

WAC 296-24-81011 Pitch. Preferred pitch.

(1) The preferred pitch of fixed ladders shall be considered to come in the range of 75 degrees and 90 degrees with the horizontal (Fig. D-11).

(2) Substandard pitch. Fixed ladders shall be considered as substandard if they are installed within the substandard pitch range of 60 and 75 degrees with the horizontal. Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range shall be considered as a critical range to be avoided, if possible.

(3) Scope of coverage in this section. This section covers only fixed ladders within the pitch range of 60 degrees and 90 degrees with the horizontal.

(4) Pitch greater than 90 degrees. Ladders having a pitch in excess of 90 degrees with the horizontal are prohibited.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-24-81011, filed 11/13/80; Order 73-5, § 296-24-81011, filed 5/9/73 and Order 73-4, § 296-24-81011, filed 5/7/73.]

WAC 296-24-81013 Maintenance and use. (1) All ladders shall be maintained in a safe condition. All ladders shall be inspected regularly, with the intervals between inspections being determined by use and exposure.

Note: For illustrations, see Figs. D-1 through D-11.

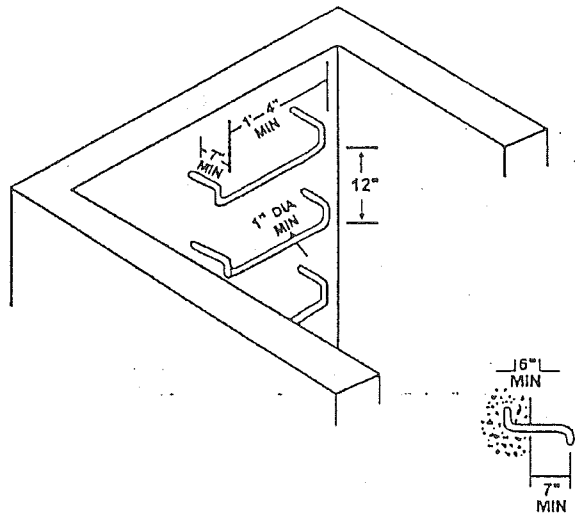
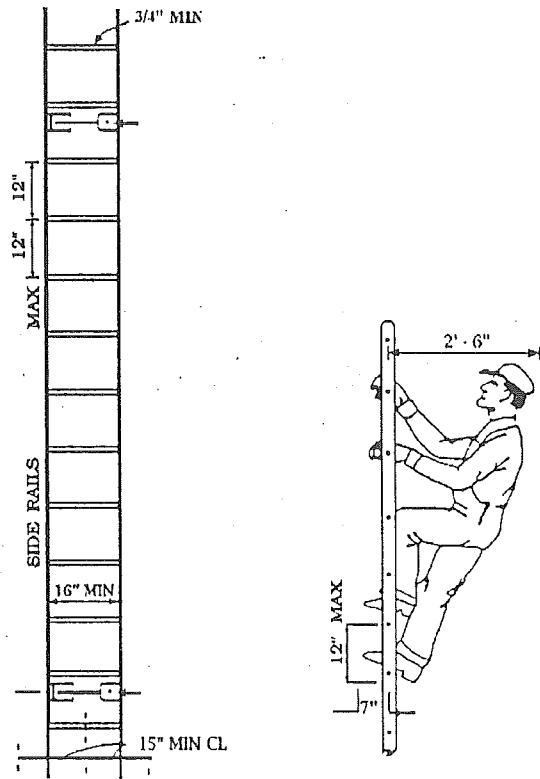


Figure D-1
Suggested design for rungs on individual-rung ladders



RAIL LADDER WITH BAR STEEL RAILS AND ROUND STEEL RUNGS

Figure D-2
Minimum Ladder Clearances

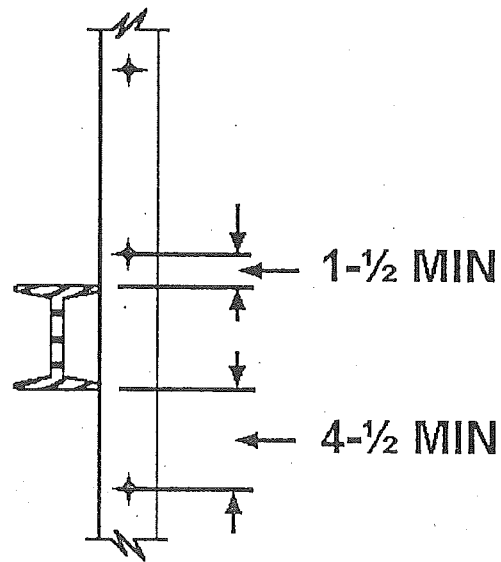


Figure D-3
Clearance for Unavoidable Obstruction at Rear of Fixed Ladder

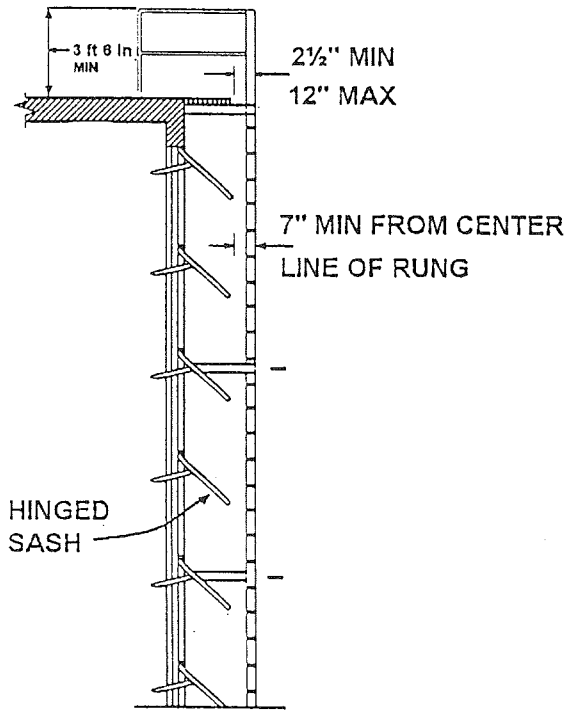


Figure D-4
Ladder Far from Wall

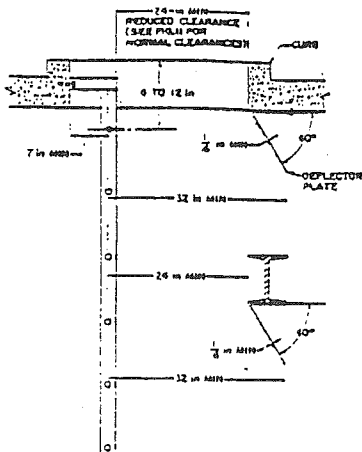


Figure D-5
Deflector Plates for Head Hazards

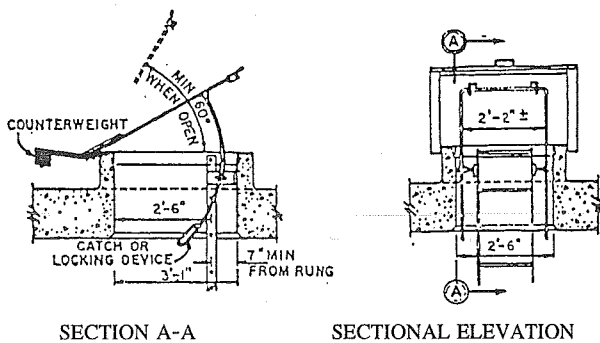


Figure D-6
Relationship of Fixed Ladder to a Safe Access Hatch

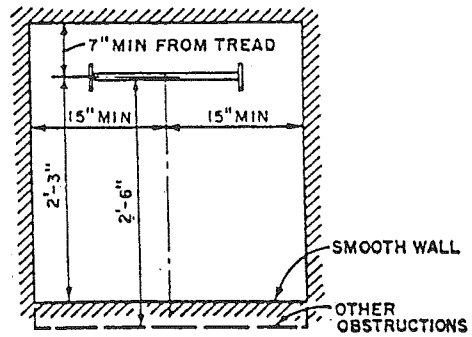
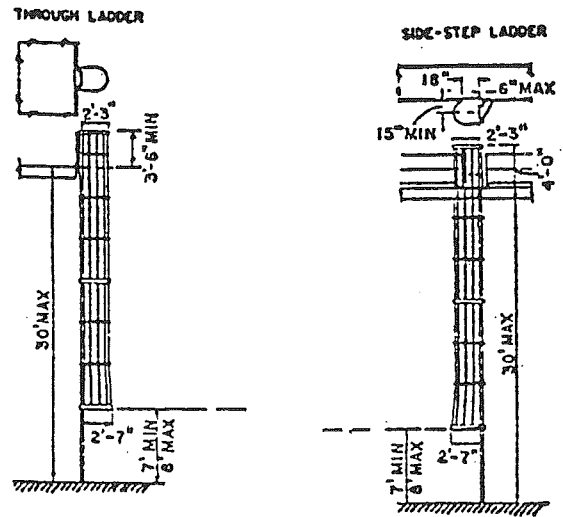


Figure D-7
Clearance Diagram for Fixed Ladder in Well



ACCESS TO LANDING
PLATFORM THROUGH
LADDER

ACCESS Laterally
FROM LADDER

Figure D-8 (Part 1)

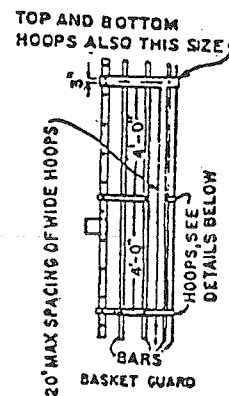


Figure D-8 (Part 2)

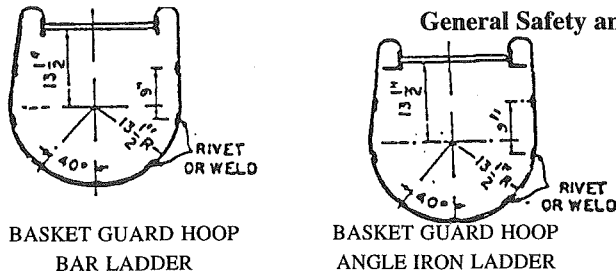


Figure D-8 (Part 3)
Cages for Ladders more than 20 Feet High

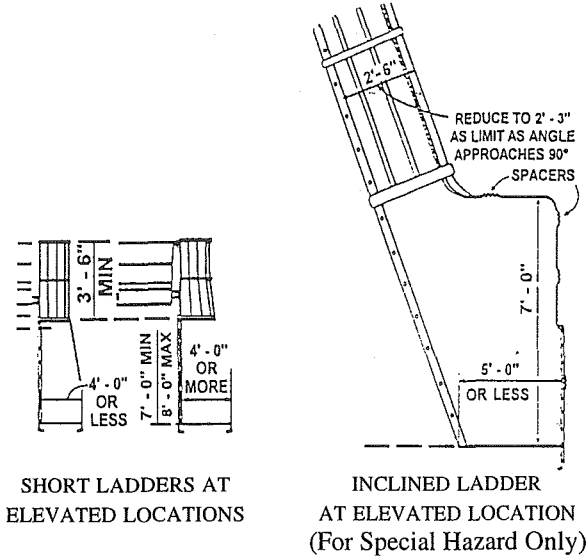


Figure D-9
Cages—Special Applications

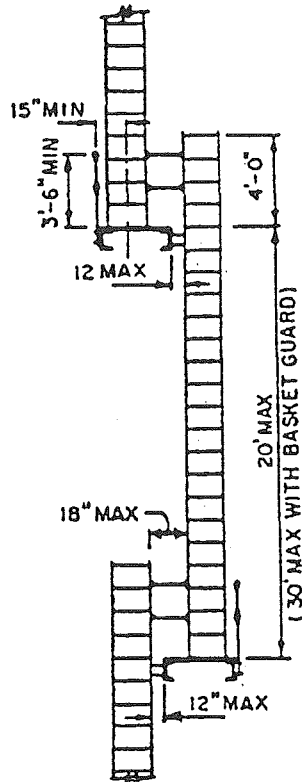


Figure D-10
Offset Fixed Ladder Sections

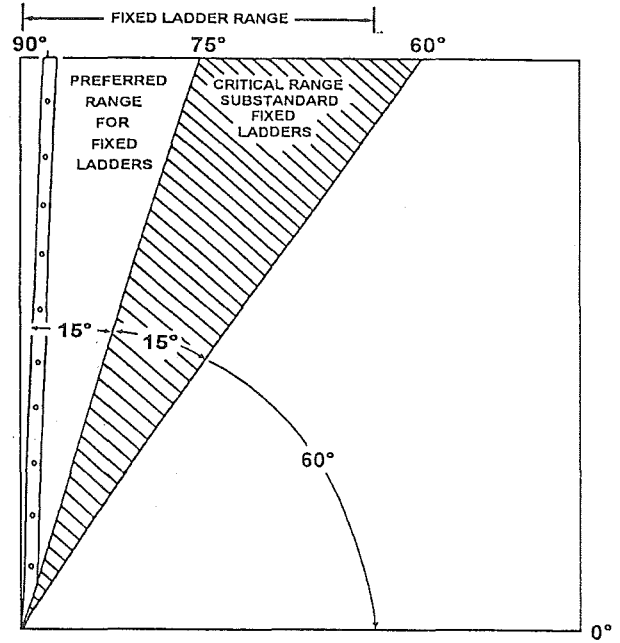


Figure D-11
Pitch of Fixed Ladders

(2) When ascending or descending, the climber must face the ladder.

(3) Workers shall not ascend or descend ladders while carrying tools or materials which will interfere with the free use of both hands.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-81013, filed 7/20/94, effective 9/20/94; Order 76-6, § 296-24-81013, filed 3/1/76; Order 73-5, § 296-24-81013, filed 5/9/73 and Order 73-4, § 296-24-81013, filed 5/7/73.]

WAC 296-24-825 Safety requirements for scaffolding.

[Order 73-5, § 296-24-825, filed 5/9/73 and Order 73-4, § 296-24-825, filed 5/7/73.]

WAC 296-24-82501 Definitions. The following terms shall have the meaning ascribed in this section when referred to in WAC 296-24-82503 through 296-24-82545 unless the context requires otherwise.

(1) Bearer. A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(2) Boatswain's chair. A seat supported by slings attached to a suspended rope, designed to accommodate one worker in a sitting position.

(3) Brace. A tie that holds one scaffold member in a fixed position with respect to another member.

(4) Bricklayer's square scaffold. A scaffold composed of framed wood squares which support a platform limited to light and medium duty.

(5) Carpenters' bracket scaffold. A scaffold consisting of wood or metal brackets supporting a platform.

(6) Coupler. A device for locking together the component parts of a tubular metal scaffold. The material used for

the couplers shall be of a structural type, such as a drop-forged steel, malleable iron, or structural grade aluminum. The use of gray cast iron is prohibited.

(7) Crawling board or chicken ladder. A plank with cleats spaced and secured at equal intervals, for use by a worker on roofs, not designed to carry any material.

(8) Double pole or independent pole scaffold. A scaffold supported from the base by a double row of uprights, independent of support from the walls and constructed of uprights, ledgers, horizontal platform bearers, and diagonal bracing.

(9) Float or ship scaffold. A scaffold hung from overhead supports by means of ropes and consisting of a substantial platform having diagonal bracing underneath, resting upon and securely fastened to two parallel plank bearers at right angles to the span.

(10) Guardrail. A rail secured to uprights and erected along the exposed sides and ends of platforms.

(11) Heavy duty scaffold. A scaffold designed and constructed to carry a working load not to exceed 75 pounds per square foot.

(12) Horse scaffold. A scaffold for light or medium duty, composed of horses supporting a work platform.

(13) Interior hung scaffold. A scaffold suspended from the ceiling or roof structure.

(14) Ladder jack scaffold. A light duty scaffold supported by brackets attached to ladders.

(15) Ledger (stringer). A horizontal scaffold member which extends from post to post and which supports the putlogs or bearer forming a tie between the posts.

(16) Light duty scaffold. A scaffold designed and constructed to carry a working load not to exceed 25 pounds per square foot.

(17) Manually propelled mobile scaffold. A portable rolling scaffold supported by casters.

(18) Mason's adjustable multiple-point suspension scaffold. A scaffold having a continuous platform supported by bearers suspended by wire rope from overhead supports, so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(19) Maximum intended load. The total of all loads including the working load, the weight of the scaffold, and such other loads as may be reasonably anticipated.

(20) Medium duty scaffold. A scaffold designed and constructed to carry a working load not to exceed 50 pounds per square foot.

(21) Mid-rail. A rail approximately midway between the guardrail and platform, used when required, and secured to the uprights erected along the exposed sides and ends of platforms.

(22) Needle beam scaffold. A light duty scaffold consisting of needle beams supporting a platform.

(23) Outrigger scaffold. A scaffold supported by outriggers or thrustouts projecting beyond the wall or face of the building or structure, the inboard ends of which are secured inside of such a building or structure.

(24) Putlog. A scaffold member upon which the platform rests.

(25) Roofing bracket. A bracket used in sloped roof construction, having provisions for fastening to the roof or sup-

ported by ropes fastened over the ridge and secured to some suitable object.

(26) Runner. The lengthwise horizontal bracing or bearing members or both.

(27) Scaffold. Any temporary elevated platform and its supporting structure used for supporting workers or materials or both.

(28) Single-point adjustable suspension scaffold. A manually or power-operated unit designed for light duty use, supported by a single wire rope from an overhead support so arranged and operated as to permit the raising or lowering of the platform to desired working positions.

(29) Single pole scaffold. Platforms resting on putlogs or crossbeams, the outside ends of which are supported on ledgers secured to a single row of posts or uprights and the inner ends of which are supported on or in a wall.

(30) Stone setters' adjustable multiple-point suspension scaffold. A swinging-type scaffold having a platform supported by hangers suspended at four points so as to permit the raising or lowering of the platform to the desired working position by the use of hoisting machines.

(31) Toeboard. A barrier secured along the sides and ends of a platform, to guard against the falling of material.

(32) Tube and coupler scaffold. An assembly consisting of tubing which serves as posts, bearers, braces, ties, and runners, a base supporting the posts, and special couplers which serve to connect the uprights and to join the various members.

(33) Tubular welded frame scaffold. A sectional, panel, or frame metal scaffold substantially built up of prefabricated welded sections which consist of posts and horizontal bearer with intermediate members. Panels or frames shall be braced with diagonal or cross braces.

(34) Two-point suspension scaffold (swinging scaffold). A scaffold, the platform of which is supported by hangers (stirrups) at two points, suspended from overhead supports so as to permit the raising or lowering of the platform to the desired working position by tackle or hoisting machines.

(35) Window jack scaffold. A scaffold, the platform of which is supported by a bracket or jack which projects through a window opening.

(36) Working load. Load imposed by people, materials, and equipment.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-82501, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-82501, filed 5/9/73 and Order 73-4, § 296-24-82501, filed 5/7/73.]

WAC 296-24-82503 General requirements for all scaffolds. (1) Scaffolds shall be furnished and erected in accordance with this standard for persons engaged in work that cannot be done safely from the ground or from solid construction, except that ladders used for such work shall conform to WAC 296-24-780 through 296-24-78009 and 296-24-795 through 296-24-79507.

(2) The footing or anchorage for scaffolds shall be sound, rigid, and capable of carrying the maximum intended load without settling or displacement. Unstable objects such as barrels, boxes, loose brick, or concrete blocks shall not be used to support scaffolds or planks.

(3) Guardrails and toeboards shall be installed on all open sides and ends of platforms more than 8 feet above the ground or floor except:

(a) Scaffolding wholly within the interior of a building and covering the entire floor area of any room therein and not having any side exposed to a hoistway, elevator shaft, stairwell, or other floor openings, and

(b) Needle-beam scaffolds and floats in use by structural iron workers.

(4) Guardrails should all be 2 x 4 inches or the equivalent, installed no less than 36 inches or not more than 42 inches high, with a midrail, when required, of 1 x 4 inch nominal lumber or equivalent. Supports should be at intervals not to exceed ten feet. Toeboards shall be a minimum of 4 inches nominal lumber in height.

(5) Factory-built (laminated) scaffold planks meeting the requirements of wood scaffold planks may be substituted for wood scaffold planks.

(6) Scaffolds and their components shall be capable of supporting without failure at least four times the maximum intended load.

(7) Scaffolds and other devices mentioned or described in these standards shall be maintained in safe condition. Scaffolds shall not be altered or moved horizontally while they are in use or occupied.

(8) Any scaffold damaged or weakened from any cause shall be immediately repaired and shall not be used until repairs have been completed.

(9) Scaffolds shall not be loaded in excess of the working load for which they are intended.

(10) All load-carrying timber members of scaffold framing shall be a minimum of 1,500 f. (stress grade) construction grade lumber. All dimensions are nominal sizes as provided in the American Lumber Standards, except that where rough sizes are noted, only rough or undressed lumber of the size specified will satisfy minimum requirements. (NOTE: Where nominal sizes of lumber are used in place of rough sizes the nominal size lumber shall be such as to provide equivalent strength to that specified in Tables D-7 through D-12 and D-16.)

(11) All planking shall be Scaffold Grade as recognized by grading rules for the species of wood used. The maximum permissible spans for 2- x 9-inch or wider planks are shown in the following table:

	Material				
	Full thickness undressed lumber		Nominal thickness lumber		
Working load (p.s.f.)	25	50	75	25	50
Permissible span (ft.)	10	8	6	8	6

The maximum permissible span for 1 1/4 x 9-inch or wider plank of full thickness is 4 feet with medium loading of 50 p.s.f.

(12) Nails or bolts used in the construction of scaffolds shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the scaffold.

Nails shall not be subjected to a straight pull and shall be driven full length.

(13) All planking or platforms shall be overlapped (minimum 12 inches) or secured from movement.

(14) An access ladder or equivalent safe access shall be provided.

(15) Scaffold planks shall extend over their end supports not less than 6 inches nor more than 18 inches.

(16) The poles, legs, or uprights of scaffolds shall be plumb, and securely and rigidly braced to prevent swaying and displacement.

TABLE D-7
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS LIGHT DUTY

	Maximum height of scaffold	
	20 feet	60 feet
Uniformly distributed load	Not to exceed 25 pounds per square foot.	
Poles or uprights	2 by 4 in.	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.	10 ft. 0 in.
Maximum width of scaffold	5 ft. 0 in.	5 ft. 0 in.
Bearers or put-logs to 3 ft. 0 in. width	2 by 4 in.	2 by 4 in.
Bearers or put-logs to 5 ft. 0 in. width	2 by 6 in. or 3 by 4 in.	2 by 6 in. or 3 by 4 in. (rough)
Ledgers	1 by 4 in.	1 1/4 by 9 in.
Planking	1 1/4 by 9 in. (rough)	2 by 9 in.
Vertical spacing of horizontal members	7 ft. 0 in.	7 ft. 0 in.
Bracing, horizontal and diagonal	1 by 4 in.	1 by 4 in.
Tie-ins	1 by 4 in.	1 by 4 in.
Toeboards	4 in. high (minimum)	4 in. high (minimum)
Guardrail	2 by 4 in.	2 by 4 in.

All members except planking are used on edge.

TABLE D-8
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS MEDIUM DUTY

Uniformly distributed load	Not to exceed 50 pounds per square foot.
Maximum height of scaffold	60 ft.
Poles or uprights	4 by 4 in.

TABLE D-8
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS MEDIUM DUTY

Pole spacing (longitudinal)	8 ft. 0 in.
Maximum width of scaffold	5 ft. 0 in.
Bearers or putlogs	2 by 9 in. or 3 by 4 in.
Spacing of bearers or putlogs	8 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members	9 ft. 0 in.
Bracing, horizontal	1 by 6 in. or 1 1/4 by 4 in.
Bracing, diagonal	1 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum)
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D-9
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF SINGLE POLE SCAFFOLDS HEAVY DUTY

Uniformly distributed load	Not to exceed 75 pounds per square foot.
Maximum height of scaffold	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.
Maximum width of scaffold	5 ft. 0 in.
Bearers or putlogs	2 by 9 in. or 3 by 5 in. (rough).
Spacing of bearers or putlogs	6 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members	6 ft. 6 in.
Bracing, horizontal and diagonal	2 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

TABLE D-10
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS LIGHT DUTY

	Maximum height of scaffold	
	20 feet	60 feet
Uniformly distributed load	Not to exceed 25 pounds per square foot.	
Poles or uprights	2 by 4 in.	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.	10 ft. 0 in.
Pole spacing (transverse)	6 ft. 0 in.	10 ft. 0 in.
Ledgers	1 1/4 by 4 in.	1 1/4 by 9 in.
Bearers to 3 ft. 0 in. span	2 by 4 in.	2 by 4 in.
Bearers to 10 ft. 0 in. span	2 by 6 in. or 3 by 4 in.	2 by 9 (rough) or 3 by 8 in.
Planking	1 1/4 by 9 in.	2 by 9 in.
Vertical spacing of horizontal members	7 ft. 0 in.	7 ft. 0 in.
Bracing, horizontal and diagonal	1 by 4 in.	1 by 4 in.
Tie-ins	1 by 4 in.	1 by 4 in.
Toeboards	4 in. high	4 in. high (minimum).
Guardrail	2 by 4 in.	2 by 4 in.

All members except planking are used on edge.

TABLE D-11
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS MEDIUM DUTY

Uniformly distributed load	Not to exceed 50 pounds per square foot.	
Maximum height of scaffold	60 ft.	
Poles or uprights	4 by 4 in.	
Pole spacing (longitudinal)	8 ft. 0 in.	
Pole spacing (transverse)	8 ft. 0 in.	
Ledgers	2 by 9 in.	
Vertical spacing of horizontal members	6 ft. 0 in.	
Spacing of bearers	8 ft. 0 in.	
Bearers	2 by 9 in. rough or 2 by 10 in.	
Bracing, horizontal	1 by 6 in. or 1 1/4 by 4 in.	
Bracing, diagonal	1 by 4 in.	
Tie-ins	1 by 4 in.	

TABLE D-11
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING
OF MEMBERS OF INDEPENDENT POLE SCAFFOLDS
MEDIUM DUTY

Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking re used on edge.

TABLE D-12
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF
MEMBERS OF INDEPENDENT POLE SCAFFOLDS HEAVY DUTY

Uniformly distributed load	Not to exceed 75 pounds per square foot.
Maximum height of scaffold	60 ft.
Poles or uprights	4 by 4 in.
Pole spacing (longitudinal)	6 ft. 0 in.
Pole spacing (transverse)	8 ft. 0 in.
Ledgers	2 by 9 in.
Vertical spacing of horizontal members	4 ft. 6 in.
Bearers	2 by 9 in. (rough).
Bracing, horizontal and diagonal	2 by 4 in.
Tie-ins	1 by 4 in.
Planking	2 by 9 in.
Toeboards	4 in. high (minimum).
Guardrail	2 by 4 in.

All members except planking are used on edge.

(17) Materials being hoisted onto a scaffold shall have a tag line.

(18) Overhead protection shall be provided for workers working on a scaffold when they are exposed to overhead hazards.

(19) Scaffolds shall be provided with a screen between the toe board and the guardrail, extending along the entire opening, consisting of No. 18 gauge U.S. Standard Wire one-half-inch mesh or the equivalent, where persons are required to work or pass under the scaffolds.

(20) Employees shall not work on scaffolds during storms or high winds.

(21) Employees shall not work on scaffolds which are covered with ice or snow.

(22) Tools, materials, and debris shall not be allowed to accumulate in quantities to cause a hazard.

(23) Only treated or protected fiber rope shall be used for or near any work involving the use of corrosive substances or chemicals.

(24) Wire or fiber rope used for scaffold suspension shall be capable of supporting at least six times the intended load.

(1999 Ed.)

(25) When acid solutions are used for cleaning buildings over 50 feet in height, wire rope supported scaffolds shall be used.

(26) The use of shore scaffolds or leanto scaffolds is prohibited.

(27) Lumber sizes, when used in WAC 296-24-82505 through 296-24-82545, refer to nominal sizes except where otherwise stated.

(28) Scaffolds shall be secured to permanent structures, through use of anchor bolts, reveal bolts, or other equivalent means. Window cleaners' anchor bolts shall not be used.

(29) Special precautions shall be taken to protect scaffold members, including any wire or fiber ropes, when using a heat-producing process.

(30) When rope falls are used to support swinging scaffolding, the rope falls shall be of sufficient length to reach the ground. Lengthening rope falls by tying on additional lengths shall be prohibited.

(31) When screw shackles are used to support staging, etc., the pin must be wired or pinned so that the shackle will not become unscrewed by strain or stress.

(32) All hooks on blocks used for raising scaffolding shall be provided with a safety latch or be "moused at the throat" to prevent the hook from becoming dislodged.

(33) Lifelines size shall be 3/4 inch manila rope or equivalent with a minimum breaking strength of 5400 pounds. Safety belt lanyards shall be a minimum of 1/2 inch nylon or equivalent with a maximum length to provide for a fall of no greater than 6 feet. This rope shall have a minimum breaking strength of 5400 pounds.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-82503, filed 7/20/94, effective 9/20/94; 90-03-029 (Order 89-20), § 296-24-82503, filed 1/11/90, effective 2/26/90; Order 74-27, § 296-24-82503, filed 5/7/74; Order 73-5, § 296-24-82503, filed 5/9/73 and Order 73-4, § 296-24-82503, filed 5/7/73.]

WAC 296-24-82505 General requirements for wood pole scaffolds. (1) Scaffold poles shall bear on a foundation of sufficient size and strength to spread the load from the poles over a sufficient area to prevent settlement. All poles shall be set plumb.

(2) Where wood poles are spliced, the ends shall be squared and the upper section shall rest squarely on the lower section. Wood splice plates shall be provided on at least two adjacent sides and shall not be less than 4 feet 0 inches in length, overlapping the abutted ends equally, and have the same width and not less than the cross-sectional area of the pole. Splice plates of other materials of equivalent strength may be used.

(3) Independent pole scaffolds shall be set as near to the wall of the building as practicable.

(4) All pole scaffolds shall be securely guyed or tied to the building or structure. Where the height or length exceeds 25 feet, the scaffold shall be secured at intervals not greater than 25 feet vertically and horizontally.

(5) Putlogs or bearers shall be set with their greater dimensions vertical, long enough to project over the ledgers of the inner and outer rows of poles at least 3 inches for proper support.

(6) Every wooden putlog on single pole scaffolds shall be reinforced with a 3/16 x 2-inch steel strip or equivalent secured to its lower edge throughout its entire length.

(7) Ledgers shall be long enough to extend over two pole spaces. Ledgers shall not be spliced between the poles. Ledgers shall be reinforced by bearing blocks securely nailed to the side of the pole to form a support for the ledger.

(8) Diagonal bracing shall be provided to prevent the poles from moving in a direction parallel with the wall of the building, or from buckling.

(9) Cross bracing shall be provided between the inner and outer sets of poles in independent pole scaffolds. The free ends of pole scaffolds shall be cross braced.

(10) Full diagonal face bracing shall be erected across the entire face of pole scaffolds in both directions. The braces shall be spliced at the poles.

(11) Platform planks shall be laid with their edges close together so the platform will be tight with no spaces through which tools or fragments of material can fall.

(12) Where planking is lapped, each plank shall lap its end supports at least 12 inches. Where the ends of planks abut each other to form a flush floor, the butt joint shall be at the centerline of a pole. The abutted ends shall rest on separate bearers. Intermediate beams shall be provided where necessary to prevent dislodgement of planks due to deflection, and the ends shall be nailed or cleated to prevent their dislodgement.

(13) When a scaffold turns a corner, the platform planks shall be laid to prevent tipping. The planks that meet the corner putlog at an angle shall be laid first, extending over the diagonally placed putlog far enough to have a good safe bearing, but not far enough to involve any danger from tipping. The planking running in the opposite direction at right angles shall be laid so as to extend over and rest on the first layer of planking.

(14) When moving platforms to the next level, the old platform shall be left undisturbed until the new putlogs or bearers have been set in place, ready to receive the platform planks.

(15) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 8 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

(16) All wood pole scaffolds 60 feet or less in height shall be constructed and erected in accordance with Tables D-7 through D-12. If they are over 60 feet in height they shall be designed by a registered professional engineer and constructed and erected in accordance with such design. A copy of the typical drawings and specifications shall be made available to the employer and for inspection purposes.

(17) Wood-pole scaffolds shall not be erected beyond the reach of effective firefighting apparatus.

[Order 73-5, § 296-24-82505, filed 5/9/73 and Order 73-4, § 296-24-82505, filed 5/7/73.]

[Title 296 WAC—p. 852]

WAC 296-24-82507 Tube and coupler scaffolds. (1) A light-duty tube and coupler scaffold shall have all posts, bearers, runners, and bracing of nominal 2-inch O.D. steel tubing. The posts shall be spaced no more than 6 feet apart by 10 feet along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load.

(2) A medium-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing. Posts spaced not more than 6 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2 1/2-inch O.D. steel tubing. Posts spaced not more than 5 feet apart by 8 feet along the length of the scaffold shall have bearers of nominal 2-inch O.D. steel tubing. Other structural metals when used must be designed to carry an equivalent load.

(3) A heavy-duty tube and coupler scaffold shall have all posts, runners, and bracing of nominal 2-inch O.D. steel tubing, with the posts spaced not more than 6 feet apart by 6 feet 6 inches along the length of the scaffold. Other structural metals when used must be designed to carry an equivalent load.

(4) Tube and coupler scaffolds shall be limited in heights and working levels to those permitted in Tables D-13, 14, and 15. Drawings and specifications of all tube and coupler scaffolds above the limitations in Tables D-13, 14, and 15 shall be designed by a registered professional engineer and copies made available to the employer and for inspection purposes.

(5) All tube and coupler scaffolds shall be constructed and erected to support four times the maximum intended loads as set forth in Tables D-13, 14, and 15, or as set forth in the specifications by a registered professional engineer, copies which shall be made available to the employer and for inspection purposes.

(6) All tube and coupler scaffolds shall be erected by competent and experienced personnel.

(7) Posts shall be accurately spaced, erected on suitable bases, and maintained plumb.

(8) Runners shall be erected along the length of the scaffold located on both the inside and the outside posts at even height. Runners shall be interlocked to form continuous lengths and coupled to each post. The bottom runners shall be located as close to the base as possible. Runners shall be placed not more than 6 feet 6 inches on centers.

(9) Bearers shall be installed transversely between posts and shall be securely coupled to the posts bearing on the runner coupler. When coupled directly to the runners, the coupler must be kept as close to the posts as possible.

(10) Bearers shall be at least 4 inches but not more than 12 inches longer than the post spacing or runner spacing. Bearers may be cantilevered for use as brackets to carry not more than two planks.

(11) Cross bracing shall be installed across the width of the scaffold at least every third set of posts horizontally and every fourth runner vertically. Such bracing shall extend diagonally from the inner and outer runners upward to the next outer and inner runners.

(12) Longitudinal diagonal bracing shall be installed at approximately a 45-degree angle from near the base of the first outer post upward to the extreme top of the scaffold. Where the longitudinal length of the scaffold permits, such

bracing shall be duplicated beginning at every fifth post. In a similar manner, longitudinal diagonal bracing shall also be installed from the last post extending back and upward toward the first post. Where conditions preclude the attachment of this bracing to the posts, it may be attached to the runners.

(13) The entire scaffold shall be tied to and securely braced against the building at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(14) Guardrails not less than 2 x 4 inches nominal lumber or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1 x 4-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17). (See Tables D-13, 14 and 15.)

TABLE D-13
TUBE AND COUPLER SCAFFOLDS
LIGHT DUTY

Uniformly distributed load Not to exceed 25 p.s.f.

Post spacing (longitudinal) 10 ft. 0 in.

Post spacing (transverse) 6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	8	125 ft.
2	4	125 ft.
3	0	91 ft. 0 in.

TABLE D-14
TUBE AND COUPLER SCAFFOLDS
MEDIUM DUTY

Uniformly distributed load Not to exceed 50 p.s.f.

Post spacing (longitudinal) 8 ft. 0 in.

Post spacing (transverse) 6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	6	125 ft.
2	0	78ft. 0 in.

TABLE D-15
TUBE AND COUPLER SCAFFOLDS
HEAVY DUTY

Uniformly distributed load Not to exceed 75 p.s.f.

Post spacing (longitudinal) 6 ft. 6 in.

Post spacing (transverse) 6 ft. 0 in.

Working levels	Additional planked levels	Maximum height
1	6	125 ft.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82507, filed 7/31/79; Order 73-5, § 296-24-82507, filed 5/9/73 and Order 73-4, § 296-24-82507, filed 5/7/73.]

WAC 296-24-82509 Tubular welded frame scaffolds.

(1) Metal tubular frame scaffolds, including accessories such as braces, brackets, trusses, screw legs, ladders, etc., shall be designed and proved to safely support four times the maximum intended load.

(2) Spacing of panels or frames shall be consistent with the loads imposed.

(3) Scaffolds shall be properly braced by cross bracing or diagonal braces, or both, for securing vertical members together laterally, and the cross braces shall be of such length as will automatically square and align vertical members so that the erected scaffold is always plumb, square, and rigid. All brace connections shall be made secure.

(4) Scaffold legs shall be set on adjustable bases or plain bases placed on mud sills or other foundations adequate to support the maximum intended load.

(5) The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

(6) Where uplift may occur, panels shall be locked together vertically by pins or other equivalent suitable means.

(7) Guardrails not less than 2 x 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- x 4-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

(8) All tubular metal scaffolds shall be constructed and erected to support four times the maximum intended loads.

(9) To prevent movement, the scaffold shall be secured to the building or structure at intervals not to exceed 30 feet horizontally and 26 feet vertically.

(10) Maximum permissible spans of planking shall be in conformity with WAC 296-24-82503(9).

(11) Drawings and specifications for all frame scaffolds over 125 feet in height above the base plates shall be designed by a registered professional engineer and copies made available to the employer and for inspection purposes.

(12) All tubular welded frame scaffolds shall be erected by competent and experienced personnel.

(13) Frames and accessories for scaffolds shall be maintained in good repair and every defect, unsafe condition, or noncompliance with this section shall be immediately corrected before further use of the scaffold. Any broken, bent, excessively rusted, altered, or otherwise structurally damaged frames or accessories shall not be used.

(14) Periodic inspections shall be made of all welded frames and accessories, and any maintenance, including painting, or minor corrections authorized by the manufacturer, shall be made before further use.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82509, filed 7/31/79; Order 73-5, § 296-24-82509, filed 5/9/73 and Order 73-4, § 296-24-82509, filed 5/7/73.]

WAC 296-24-82511 Outrigger scaffolds. (1) Outrigger beams shall extend not more than 6 feet beyond the face of the building. The inboard end of the outrigger beams, measured from the fulcrum point to the extreme point of support, shall be not less than one and one-half times the outboard end in length. The beams shall rest on edge, the sides shall be plumb and the edges shall be horizontal. The fulcrum point of the beam shall rest on a secure bearing at least 6 inches in each horizontal dimension. The beam shall be secured in place against movement and shall be securely braced at the fulcrum point against tipping.

(2) The inboard ends of outrigger beams shall be securely supported either by means of struts bearing against sills in contact with the overhead beams or ceiling, or by means of tension members secured to the floor joists underfoot, or by both if necessary. The inboard ends of outrigger beams shall be secured against tipping and the entire supporting structure shall be securely braced in both directions to prevent any horizontal movement.

(3) Unless outrigger scaffolds are designed by a licensed professional engineer, they shall be constructed and erected in accordance with Table D-16. Outrigger scaffolds designed by a registered professional engineer shall be constructed and erected in accordance with such design. A copy of the detailed drawings and specifications showing the sizes and spacing of members shall be kept on the job.

(4) Planking shall be laid tight and shall extend to within 3 inches of the building wall. Planking shall be nailed or bolted to outriggers.

(5) Where there is danger of material falling from the scaffold, a wire mesh or other enclosure shall be provided between the guardrail and the toeboard.

(6) Where additional working levels are required to be supported by the outrigger method, the plans and specifications of the outrigger and scaffolding structure shall be designed by a registered professional engineer to comply with requirements of this section.

TABLE D-16
MINIMUM NOMINAL SIZE AND MAXIMUM SPACING OF MEMBERS OF OUTRIGGER SCAFFOLDS

	Light duty	Medium duty
Maximum scaffold load	25 p.s.f.	50 p.s.f.
Outrigger size	2 x 10 in.	3 x 10 in.
Maximum outrigger spacing	10 ft. 0 in.	6 ft. 0 in.
Planking	2 x 9 in.	2 x 9 in.
Guardrail	2 x 4 in.	2 x 4 in.
Guardrail uprights	2 x 4 in.	2 x 4 in.
Toeboards	4 in. (minimum).	4 in. (minimum).

[Order 73-5, § 296-24-82511, filed 5/9/73 and Order 73-4, § 296-24-82511, filed 5/7/73.]

WAC 296-24-82513 Masons' adjustable multiple-point suspension scaffolds. (1) The scaffold shall be capable of sustaining a working load of fifty pounds per square foot and shall not be loaded in excess of that figure.

[Title 296 WAC—p. 854]

(2) The scaffold shall be provided with hoisting machines that meet the requirements of a nationally recognized testing laboratory. Refer to federal regulation 29 CFR 1910.7 for definition of a nationally recognized testing laboratory.

(3) The platform shall be supported by wire ropes in conformity with WAC 296-24-82503(24), suspended from overhead outrigger beams.

(4) The scaffold outrigger beams shall consist of structural metal securely fastened or anchored to the frame or floor system of the building or structure.

(5) Each outrigger beam shall be equivalent in strength to at least a standard seven-inch, 15.3-pound steel I-beam, be at least fifteen feet long, and shall not project more than six feet six inches beyond the bearing point.

(6) Where the overhang exceeds six feet six inches, outrigger beams shall be composed of stronger beams or multiple beams and be installed in accordance with approved designs and instructions.

(7) If channel iron outrigger beams are used in place of I-beams, they shall be securely fastened together with the flanges turned out.

(8) All outrigger beams shall be set and maintained with their webs in a vertical position.

(9) A stop bolt shall be placed at each end of every outrigger beam.

(10) The outrigger beam shall rest on suitable wood-bearing blocks.

(11) All parts of the scaffold such as bolts, nuts, fittings, clamps, wire rope, and outrigger beams and their fastenings, shall be maintained in sound and good working condition and shall be inspected before each installation and periodically thereafter.

(12) The free end of the suspension wire ropes shall be equipped with proper size thimbles and be secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall at all times remain on the drum.

(13) Where a single outrigger beam is used, the steel shackles or clevises with which the wire ropes are attached to the outrigger beams shall be placed directly over the hoisting drums.

(14) The scaffold platform shall be equivalent in strength to at least two-inch planking. (For maximum planking spans see WAC 296-24-82503(11).)

(15) Guardrails not less than two by four inches or the equivalent and not less than thirty-six inches or more than forty-two inches high, with a mid-rail, when required, of one-inch by four-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than eight feet above the ground or floor. Toeboards shall be a minimum of four inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(19).

(16) Overhead protection shall be provided on the scaffold, not more than nine feet above the platform, consisting of two-inch planking or material of equivalent strength laid tight, when employees are at work on the scaffold and an overhead hazard exists.

(1999 Ed.)

(17) Each scaffold shall be installed or relocated in accordance with designs and instructions, of a registered professional engineer, and supervised by a competent, designated person to comply with the requirements of this section.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-82513, filed 7/20/94, effective 9/20/94; 88-23-054 (Order 88-25), § 296-24-82513, filed 11/14/88; Order 73-5, § 296-24-82513, filed 5/9/73 and Order 73-4, § 296-24-82513, filed 5/7/73.]

WAC 296-24-82515 Two-point suspension scaffolds (swinging scaffolds). (1) Two-point suspension scaffold platforms shall be not less than twenty inches nor more than thirty-six inches wide overall. The platform shall be securely fastened to the hangers by U-bolts or by other equivalent means.

(2) The hangers of two-point suspension scaffolds shall be made of wrought iron, mild steel, or other equivalent material having a cross-sectional area capable of sustaining four times the maximum intended load, and shall be designed with a support for guardrail, intermediate rail, and toeboard.

(3) When hoisting machines are used on two-point suspension scaffolds, such machines shall be of a design tested and approved by a nationally recognized testing laboratory. Refer to federal regulation 29 CFR 1910.7 for definition of nationally recognized testing laboratory.

(4) The roof irons or hooks shall be of wrought iron, mild steel, or other equivalent material of proper size and design, securely installed and anchored. Tiebacks of three-fourths-inch manila rope or the equivalent shall serve as a secondary means of anchorage, installed at right angles to the face of the building whenever possible and secured to a structurally sound portion of the building.

(5) Guardrails not less than two by four inches or the equivalent and not less than thirty-six inches or more than forty-two inches high, with a mid-rail, when required, of one-inch by four-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than ten feet above the ground or floor. Toeboards shall be a minimum of four inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(19).

(6) Two-point suspension scaffolds shall be suspended by wire or fiber ropes. Wire and fiber ropes shall conform to WAC 296-24-82503(24).

(7) The blocks for fiber ropes shall be of standard six-inch size, consisting of at least one double and one single block. The sheaves of all blocks shall fit the size of rope used.

(8) All wire ropes, fiber ropes, slings, hangers, platforms, and other supporting parts shall be inspected before every installation. Periodic inspections shall be made while the scaffold is in use.

(9) On suspension scaffolds designed for a working load of five hundred pounds, no more than two persons shall be permitted to work at one time. On suspension scaffolds with a working load of seven hundred fifty pounds, no more than three persons shall be permitted to work at one time. Each worker shall be protected by a safety lifebelt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.

(10) Where acid solutions are used, fiber ropes are not permitted unless acid-proof.

(11) Two-point suspension scaffolds shall be securely lashed to the building or structure to prevent them from swaying. Window cleaners' anchors shall not be used for this purpose.

(12) The platform of every two-point suspension scaffold shall be one of the following types:

(a) The side stringer of ladder-type platforms shall be clear straight-grained spruce or materials of equivalent strength and durability. The rungs shall be of straight-grained oak, ash, or hickory, at least one and one-eighths-inch in diameter, with seven-eighths inch tenons mortised into the side stringers at least seven-eighths inch. The stringers shall be tied together with the tie rods not less than one-quarter inch in diameter, passing through the stringers and riveted up tight against washers on both ends. The flooring strips shall be spaced not more than five-eighths inch apart except at the side rails where the space may be one inch. Ladder-type platforms shall be constructed in accordance with Table D-17.

(b) Plank-type platforms shall be composed of not less than nominal two-inch by eight-inch unspliced planks, properly cleated together on the underside starting six inches from each end; intervals in between shall not exceed four feet. The plank-type platform shall not extend beyond the hangers more than eighteen inches. A bar or other effective means shall be securely fastened to the platform at each end to prevent its slipping off the hanger. The span between hangers for plank-type platforms shall not exceed ten feet.

(c) Beam platforms shall have side stringers of lumber not less than two by six inches set on edge. The span between hangers shall not exceed twelve feet when beam platforms are used. The flooring shall be supported on two-inch and six-inch crossbeams, laid flat and set into the upper edge of the stringers with a snug fit, at intervals of not more than four feet, securely nailed in place. The flooring shall be of one-inch by six-inch material properly nailed. Floorboards shall not be spaced more than one-half inch apart. (See Table D-17.)

TABLE D - 17
SCHEDULE FOR LADDER - TYPE PLATFORMS

	Length of platform (feet)				
	12	14&16	18&20	22&24	28&30
Side stringers, minimum cross section (finished sizes):					
At ends (in.)	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4
	x2 3/4	x2 3/4	x3	x3	x3 1/2
At middle (in.)	1 3/4	1 3/4	1 3/4	1 3/4	1 3/4
	x3 3/4	x3 3/4	x4	x4 1/4	x5
Reinforcing strip (minimum)	A 1/8x7/8-in. steel reinforcing strip or its equivalent shall be attached to the side or underside, full length.				
Rungs	Rungs shall be 1 1/8-in. minimum diameter with at least 7/8-in. diameter tenons, and the maximum spacing shall be 12 in. center to center.				
Tie rods:					
Number (minimum)	3	4	4	5	6
Diameter (minimum)	1/4 in.	1/4 in.	1/4 in.	1/4 in.	1/4 in.

TABLE D - 17
SCHEDULE FOR LADDER - TYPE PLATFORMS

	Length of platform (feet)				
	12	14&16	18&20	22&24	28&30
Flooring, minimum finished size (in.)	1/2 x2 3/4	1/2 x2 3/4	1/2 x2 3/4	1/2 x2 3/4	1/2 x2 3/4

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-82515, filed 7/20/94, effective 9/20/94; 88-23-054 (Order 88-25), § 296-24-82515, filed 11/14/88. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 80-11-010 (Order 80-14), § 296-24-82515, filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82515, filed 7/31/79; Order 73-5, § 296-24-82515, filed 5/9/73 and Order 73-4, § 296-24-82515, filed 5/7/73.]

WAC 296-24-82517 Stone setters' adjustable multiple-point suspension scaffolds. (1) The scaffold shall be capable of sustaining a working load of 25 pounds per square foot and shall not be overloaded. Scaffolds shall not be used for storage of stone or other heavy materials.

(2) The hoisting machine and its supports shall be of a type tested and listed by a nationally recognized testing laboratory. Refer to WAC 296-24-95601(77) for definition of listed, and 29 CFR 1910.7 for nationally recognized testing laboratory.

(3) The platform shall be securely fastened to the hangers by U-bolts or other equivalent means.

(4) The scaffold unit shall be suspended from metal outriggers, iron brackets, wire rope slings, or iron hooks which will safely support the maximum intended load.

(5) Outriggers when used shall be set with their webs in a vertical position, securely anchored to the building or structure and provided with stop bolts at each end.

(6) The scaffold shall be supported by wire rope conforming with WAC 296-24-82503(22), suspended from overhead supports.

(7) The free ends of the suspension wire ropes shall be equipped with proper size thimbles, secured by splicing or other equivalent means. The running ends shall be securely attached to the hoisting drum and at least four turns of rope shall remain on the drum at all times.

(8) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

(9) When two or more scaffolds are used on a building or structure they shall not be bridged one to the other but shall be maintained at even height with platforms butting closely.

(10) Each scaffold shall be installed or relocated in accordance with designs and instructions of a registered professional engineer, and such installation or relocation shall be supervised by a competent designated person to comply with requirements of this section.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-24-82517, filed 11/14/88. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82517, filed 7/31/79;

Order 73-5, § 296-24-82517, filed 5/9/73 and Order 73-4, § 296-24-82517, filed 5/7/73.]

WAC 296-24-82519 Single-point adjustable suspension scaffolds. (1) The scaffolding, including power units or manually operated winches, shall be of a type tested and listed by a nationally recognized testing laboratory. Refer to WAC 296-24-95601(78) for definition of listed, and 29 CFR 1910.7 for nationally recognized testing laboratory.

(2) The power units may be either electrically or air motor driven.

(3) All power-operated gears and brakes shall be enclosed.

(4) In addition to the normal operating brake, all-power driven units must have an emergency brake which engages automatically when the normal speed of descent is exceeded.

(5) Guards, mid-rails, and toeboards shall completely enclose the cage or basket. Guardrails shall be no less than 2 by 4 inches nominal lumber or the equivalent installed no less than 36 inches nor more than 42 inches above the platform. Mid-rails shall be 1 by 6 inches nominal lumber or the equivalent, installed equidistant between the guardrail and the platform. Toeboards shall be a minimum of 4 inches nominal lumber in height.

(6) The hoisting machines, cables, and equipment shall be regularly serviced and inspected after each installation and every 30 days thereafter.

(7) The units may be combined to form a two-point suspension scaffold. Such scaffold shall comply with WAC 296-24-82515.

(8) The supporting cable shall be straight for its entire length, and the operator shall not sway the basket and fix the cable to any intermediate points to change their original path of travel.

(9) Equipment shall be maintained and used in accordance with the manufacturers' instructions.

(10) Suspension methods shall conform to applicable provisions of WAC 296-24-82515 and 296-24-82517.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-82519, filed 7/20/94, effective 9/20/94; 88-23-054 (Order 88-25), § 296-24-82519, filed 11/14/88; Order 73-5, § 296-24-82519, filed 5/9/73 and Order 73-4, § 296-24-82519, filed 5/7/73.]

WAC 296-24-82521 Boatswain's chairs. (1) The chair seat shall be not less than 12 by 24 inches, and of 1-inch thickness. The seat shall be reinforced on the underside to prevent the board from splitting.

(2) The two fiber rope seat slings shall be of 5/8-inch diameter, reeved through the four seat holes so as to cross each other on the underside of the seat.

(3) Seat slings shall be of at least 3/8-inch wire rope when a worker is conducting a heat producing process such as gas or arc welding.

(4) The worker shall be protected by a safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.

(5) The tackle shall consist of correct size ball bearing or bushed blocks and properly spliced 5/8-inch diameter first-grade manila rope or equivalent strength synthetic-fiber rope.

(6) The roof irons, hooks, or the object to which the tackle is anchored shall be securely installed. Tiebacks when used shall be installed at right angles to the face of the building and securely fastened to a chimney.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-82521, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 80-11-010 (Order 80-14), § 296-24-82521, filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82521, filed 7/31/79; Order 73-5, § 296-24-82521, filed 5/9/73 and Order 73-4, § 296-24-82521, filed 5/7/73.]

WAC 296-24-82523 Carpenters' bracket scaffolds.

(1) The brackets shall consist of a triangular wood frame not less than 2 by 3 inches in cross section, or of metal of equivalent strength. Each member shall be properly fitted and securely joined.

(2) Each bracket shall be attached to the structure by means of one of the following:

- (a) A bolt no less than 5/8-inch in diameter which shall extend through the inside of the building wall.
- (b) A metal stud attachment device.
- (c) Welding to steel tanks.
- (d) Hooking over or securing through a well-secured and adequately strong supporting member.

The brackets shall be spaced no more than 10 feet apart.

(3) No more than two persons shall occupy any given 10 feet of a bracket scaffold at any one time. Tools and materials shall not exceed 75 pounds in addition to the occupancy.

(4) The platform shall consist of not less than two 2- by 10-inch nominal size planks extending not more than 10 inches or less than 6 inches beyond each end support.

(5) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82523, filed 7/31/79; Order 76-6, § 296-24-82523, filed 3/1/76; Order 73-5, § 296-24-82523, filed 5/9/73 and Order 73-4, § 296-24-82523, filed 5/7/73.]

WAC 296-24-82525 Bricklayers' square scaffolds.

(1) The squares shall not exceed 5 feet in width and 5 feet in height.

(2) Members shall be not less than those specified in Table D-18.

(3) The squares shall be reinforced on both sides of each corner with 1- by 6-inch gusset pieces. They shall also have braces 1 by 8 inches on both sides running from center to center of each member, or other means to secure equivalent strength and rigidity.

(4) The squares shall be set not more than 5 feet apart for medium duty scaffolds, and not more than 8 feet apart for light duty scaffolds. Bracing 1 x 8 inches, extending from the bottom of each square to the top of the next square, shall be provided on both front and rear sides of the scaffold.

TABLE D-18

MINIMUM DIMENSIONS FOR BRICKLAYERS' SQUARE SCAFFOLD MEMBERS

Members:	Dimensions (inches)
Bearers or horizontal members	. . . . . 2 by 6
Legs	. . . . . 2 by 6
Braces at corners	. . . . . 1 by 6
Braces diagonally from center frame	. . . . . 1 by 8

(5) Platform planks shall be at least 2-by 10-inch nominal size. The ends of the planks shall overlap the bearers of the squares and each plank shall be supported by not less than three squares.

(6) Bricklayers' square scaffolds shall not exceed three tiers in height and shall be so constructed and arranged that one square shall rest directly above the other. The upper tiers shall stand on a continuous row of planks laid across the next lower tier and be nailed down or otherwise secured to prevent displacement.

(7) Scaffolds shall be level and set upon a firm foundation.

[Order 73-5, § 296-24-82525, filed 5/9/73 and Order 73-4, § 296-24-82525, filed 5/7/73.]

WAC 296-24-82527 Horse scaffolds.

(1) Horse scaffolds shall not be constructed or arranged more than two tiers or 10 feet in height.

(2) The members of the horses shall be not less than those specified in Table D-19.

(3) Horses shall be spaced not more than 5 feet for medium duty and not more than 8 feet for light duty.

(4) When arranged in tiers, each horse shall be placed directly over the horse in the tier below.

(5) On all scaffolds arranged in tiers, the legs shall be nailed down to the planks to prevent displacement or thrust and each tier shall be substantially cross braced.

TABLE D-19
MINIMUM DIMENSIONS
FOR HORSE SCAFFOLD MEMBER

Members:	Dimensions (inches)
Horizontal members or bearers	. . . . . 3 by 4
Legs	. . . . . 1 1/4 by 4 1/2
Longitudinal brace between legs	. . . . . 1 by 6
Gusset brace at top of legs	. . . . . 1 by 8
Half diagonal braces	. . . . . 1 1/4 by 4 1/2

(6) Horses or parts which have become weak or defective shall not be used.

(7) Guardrails not less than 2 by 4 inches or the equivalent and not less than 36 inches or more than 42 inches high with a mid-rail, when required, of 1- by 4-inch lumber or equivalent and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches in height. Wire

mesh shall be installed in accordance with WAC 296-24-82503(17).

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82527, filed 7/31/79; Order 73-5, § 296-24-82527, filed 5/9/73 and Order 73-4, § 296-24-82527, filed 5/7/73.]

WAC 296-24-82529 Needle beam scaffold. (1) Wood needle beams shall be in accordance with WAC 296-24-82503 (7) and (11) and shall be not less than 4 by 6 inches in size, with the greater dimension placed in a vertical direction. Metal beams or the equivalent conforming to WAC 296-24-82503 (6) and (10) may be used.

(2) Ropes or hangers shall be provided for supports. The span between supports on the needle beam shall not exceed 10 feet for 4- by 6-inch timbers. Rope supports shall be equivalent in strength to 1-inch diameter first-grade manila rope.

(3) The ropes shall be attached to the needle beams by a scaffold hitch or a properly made eye splice. The loose end of the rope shall be tied by a bowline knot or by a round turn and one-half hitch.

(4) The platform span between the needle beams shall not exceed 8 feet when using 2-inch scaffold plank. For spans greater than 8 feet, platforms shall be designed based on design requirements for the special span. The overhang of each end of the platform planks shall be not less than 1 foot and not more than 18 inches.

(5) When one needle beam is higher than the other or when the platform is not level the platform shall be secured against slipping.

(6) All unattached tools, bolts, and nuts used on needle beam scaffolds shall be kept in suitable containers.

(7) One end of a needle beam scaffold may be supported by a permanent structural member conforming to WAC 296-24-82503 (6) and (10).

(8) Each person working on a needle beam scaffold 10 feet or more above the ground or floor, shall be protected by a safety life belt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-82529, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82529, filed 7/31/79; Order 73-5, § 296-24-82529, filed 5/9/73 and Order 73-4, § 296-24-82529, filed 5/7/73.]

WAC 296-24-82531 Plasterers', decorators', and large area scaffolds. (1) Plasterers', decorators', lathers', and ceiling workers' inside scaffolds shall be constructed in accordance with the general requirements set forth for independent wood pole scaffolds.

(2) Guardrails not less than 2 by 4 inches nominal lumber or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of 1- by 4-inch nominal lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

(3) All platform planks shall be laid with the edges close together to the point where material cannot fall through.

(4) When independent pole scaffold platforms are erected in sections such sections shall be provided with connecting runways equipped with substantial guardrails.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82531, filed 7/31/79; Order 73-5, § 296-24-82531, filed 5/9/73 and Order 73-4, § 296-24-82531, filed 5/7/73.]

WAC 296-24-82533 Interior hung scaffolds. (1) An interior hung scaffold should be hung or suspended from the roof structure or substantial ceiling beams.

(2) The suspended steel wire rope shall conform to WAC 296-24-82503(22). Wire may be used providing the strength requirements of WAC 296-24-82503(22) are met.

(3) For hanging wood scaffolds, the following minimum nominal size material is recommended:

(a) Supporting bearers 2 by 9 inches on edge.

(b) Planking 2 by 9 inches or 2 by 10 inches, with maximum span 7 feet for heavy duty and 10 feet for light duty or medium duty.

(4) Steel tube and coupler members may be used for hanging scaffolds with both types of scaffold designed to sustain a uniform distributed working load up to heavy duty scaffold loads with a safety factor of four.

(5) When a hanging scaffold is supported by means of wire rope, such wire rope shall be wrapped at least twice around the supporting members and twice around the bearers of the scaffold, with each end of the wire rope secured by at least three standard wire-rope clips.

(6) All overhead supporting members shall be inspected and checked for strength before the scaffold is erected.

(7) Guardrails not less than 2 by 4 inches nominal lumber or the equivalent and not less than 36 inches or more than 42 inches high, with a mid-rail, when required, of at least 1- by 4-inch lumber or equivalent, and toeboards, shall be installed at all open sides on all scaffolds more than 10 feet above the ground or floor. Toeboards shall be a minimum of 4 inches nominal lumber in height. Wire mesh shall be installed in accordance with WAC 296-24-82503(17).

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-82533, filed 7/31/79; Order 73-5, § 296-24-82533, filed 5/9/73 and Order 73-4, § 296-24-82533, filed 5/7/73.]

WAC 296-24-82535 Ladder-jack scaffolds. (1) All ladder-jack scaffolds shall be limited to light duty and shall not exceed a height of 20 feet above the floor or ground.

(2) All ladders used in connection with ladder-jack scaffolds shall be heavy-duty ladders and shall be designed and constructed in accordance with WAC 296-24-780 through 296-24-78009 and 296-24-795 through 296-24-79507.

(3) The ladder-jack shall be so designed and constructed that it will bear on the side rails in addition to the ladder rungs, or if bearing on rungs only, the bearing area shall be at least 10 inches on each rung.

(4) Ladders used in conjunction with ladder jacks shall be so placed, fastened, held, or equipped with devices so as to prevent slipping.

(5) The wood platform planks shall be not less than 2 inches nominal in thickness. Both metal and wood platform

planks shall overlap the bearing surface not less than 12 inches. The span between supports for wood shall not exceed 8 feet. Platform width shall be not less than 18 inches.

(6) Not more than two persons shall occupy any given 8 feet of any ladder-jack scaffold at any one time.

[Order 73-5, § 296-24-82535, filed 5/9/73 and Order 73-4, § 296-24-82535, filed 5/7/73.]

WAC 296-24-82537 Window-jack scaffolds. (1) Window-jack scaffolds shall be used only for the purpose of working at the window opening through which the jack is placed.

(2) Window jacks shall not be used to support planks placed between one window jack and another or for other elements of scaffolding.

(3) Window-jack scaffolds shall be provided with suitable guardrails unless safety belts with lifelines are attached and provided for the workers. Window-jack scaffolds shall be used by one person only.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-82537, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-82537, filed 5/9/73 and Order 73-4, § 296-24-82537, filed 5/7/73.]

WAC 296-24-82539 Roofing brackets. (1) Roofing brackets shall be constructed to fit the pitch of the roof.

(2) Brackets shall be secured in place by nailing in addition to the pointed metal projections. The nails shall be driven full length into the roof. When rope supports are used, they shall consist of first-grade manila of at least three-quarter-inch diameter, or equivalent.

(3) A substantial catch platform shall be installed below the working area of roofs more than 20 feet from the ground to eaves with a slope greater than 3 inches in 12 inches without a parapet. In width the platform shall extend 2 feet beyond the projection of the eaves and shall be provided with a safety rail, mid-rail, and toeboard. This provision shall not apply where employees engaged in work upon such roofs are protected by a safety belt attached to a lifeline.

[Order 73-5, § 296-24-82539, filed 5/9/73 and Order 73-4, § 296-24-82539, filed 5/7/73.]

WAC 296-24-82541 Crawling boards or chicken ladders.

(1) Crawling boards shall be not less than 10 inches wide and 1 inch thick, having cleats 1 x 1 1/2 inches. The cleats shall be equal in length to the width of the board and spaced at equal intervals not to exceed 24 inches. Nails shall be driven through and clinched on the underside. The crawling board shall extend from the ridge pole to the eaves when used in connection with roof construction, repair, or maintenance.

(2) A firmly fastened lifeline of at least three-quarter-inch rope shall be strung beside each crawling board for a handhold.

(3) Crawling boards shall be secured to the roof by means of adequate ridge hooks or equivalent effective means.

[Order 73-5, § 296-24-82541, filed 5/9/73 and Order 73-4, § 296-24-82541, filed 5/7/73.]

WAC 296-24-82543 Float or ship scaffolds. (1) Float or ship scaffolds shall support not more than three persons

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and a few light tools, such as those needed for riveting, bolting, and welding. They shall be constructed in accordance with WAC 296-24-82543 (2) through (6), unless substitute designs and materials provide equivalent strength, stability, and safety.

(2) The platform shall be not less than 3 feet wide and 6 feet long, made of three-quarter-inch plywood, equivalent to American Plywood Association Grade B-B, Group I, Exterior.

(3) Under the platform, there shall be two supporting bearers made from 2- x 4-inch, or 1- x 10-inch rough, selected lumber, or better. They shall be free of knots or other flaws and project 6 inches beyond the platform on both sides. The ends of the platform shall extend about 6 inches beyond the outer edges of the bearers. Each bearer shall be securely fastened to the platform.

(4) An edging of wood not less than 3/4 x 1 1/2 inches, or equivalent, shall be placed around all sides of the platform to prevent tools from rolling off.

(5) Supporting ropes shall be 1-inch diameter manila rope or equivalent, free from deterioration, chemical damage, flaws, or other imperfections. Rope connections shall be such that the platform cannot shift or slip. If two ropes are used with each float, they should be arranged so as to provide four ends which are to be securely fastened to an overhead support. Each of the two supporting ropes shall be hitched around one end of a bearer and pass under the platforms to the other end of the bearer where it is hitched again, leaving sufficient rope at each end for the supporting ties.

(6) Each worker shall be protected by a safety lifebelt attached to a lifeline. The lifeline shall be securely attached to substantial members of the structure (not scaffold), or to securely rigged lines, which will safely suspend the worker in case of a fall.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-82543, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-82543, filed 5/9/73 and Order 73-4, § 296-24-82543, filed 5/7/73.]

WAC 296-24-82545 Scope. WAC 296-24-82501 through 296-24-82543 establish safety requirements for the construction, operation, maintenance, and use of scaffolds used in the construction, alteration, demolition, and maintenance of buildings and structures.

[Order 73-5, § 296-24-82545, filed 5/9/73 and Order 73-4, § 296-24-82545, filed 5/7/73.]

WAC 296-24-840 Manually propelled mobile ladder stands and scaffolds (towers).

[Order 73-5, § 296-24-840, filed 5/9/73 and Order 73-4, § 296-24-840, filed 5/7/73.]

WAC 296-24-84001 Definitions. The following terms shall have the meaning ascribed in this section when referred to in WAC 296-24-84003 through 296-24-84013 unless the context requires otherwise.

(1) Bearer. A horizontal member of a scaffold upon which the platform rests and which may be supported by ledgers.

(2) Brace. A tie that holds one scaffold member in a fixed position with respect to another member.

[Title 296 WAC—p. 859]

(3) Climbing ladder. A separate ladder with equally spaced rungs usually attached to the scaffold structure for climbing and descending.

(4) Coupler. A device for locking together the components of a tubular metal scaffold which shall be designed and used to safely support the maximum intended loads.

(5) Design working load. The maximum intended load, being the total of all loads including the weight of the people, materials, equipment, and platform.

(6) Equivalent. Alternative design or features, which will provide an equal degree or factor of safety.

(7) Guardrail. A barrier secured to uprights and erected along the exposed sides and ends of platforms to prevent falls of persons.

(8) Handrail. A rail connected to a ladder stand running parallel to the slope and/or top step.

(9) Ladder stand. A mobile fixed size self-supporting ladder consisting of a wide flat tread ladder in the form of stairs. The assembly may include handrails.

(10) Ledger (stringer). A horizontal scaffold member which extends from post to post and which supports the bearer forming a tie between the posts.

(11) Mobile scaffold (tower). A light, medium, or heavy duty scaffold mounted on casters or wheels.

(12) Mobile. "Manually propelled."

(13) Mobile work platform. Generally a fixed work level one frame high on casters or wheels, with bracing diagonally from platform to vertical frame.

(14) Runner. The lengthwise horizontal bracing and/or bearing members.

(15) Scaffold. Any temporary elevated platform and its necessary vertical, diagonal, and horizontal members used for supporting workers and materials. (Also known as a scaffold tower.)

(16) Toeboard. A barrier at platform level erected along the exposed sides and ends of a scaffold platform to prevent falls of materials.

(17) Tube and coupler scaffold. An assembly consisting of tubing which serves as posts, bearers, braces, ties, and runners, a base supporting the posts, and uprights, and serves to join the various members, usually used in fixed locations.

(18) Tubular welded frame scaffold. A sectional, panel, or frame metal scaffold substantially built up of prefabricated welded sections, which consist of posts and bearers with intermediate connecting members and braced with diagonal or cross braces.

(19) Tubular welded sectional folding scaffold. A sectional, folding metal scaffold either of ladder frame or inside stairway design, substantially built of prefabricated welded sections, which consist of end frames, platform frame, inside inclined stairway frame and braces, or hinged connected diagonal and horizontal braces, capable of being folded into a flat package when the scaffold is not in use.

(20) Work level. The elevated platform, used for supporting workers and their materials, comprising the necessary vertical, horizontal, and diagonal braces, guardrails, and ladder for access to the work platform.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-84001, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-84001, filed 5/9/73 and Order 73-4, § 296-24-84001, filed 5/7/73.]

[Title 296 WAC—p. 860]

WAC 296-24-84003 General requirements. (1) Application. This section is intended to prescribe rules and requirements for the design, construction, and use of mobile work platforms (including ladder stands but not including aerial ladders) and rolling (mobile) scaffolds (towers). This standard is promulgated to aid in providing for the safety of life, limb, and property, by establishing minimum standards for structural design requirements and for the use of mobile work platforms and towers.

(2) Working loads.

(a) Work platforms and scaffolds shall be capable of carrying the design load under varying circumstances depending upon the conditions of use. Therefore, all parts and appurtenances necessary for their safe and efficient utilization must be integral parts of the design.

(b) Specific design and construction requirements are not a part of this section because of the wide variety of materials and design possibilities. However, the design shall be such as to produce a mobile ladder stand or scaffold that will safely sustain the specified loads. The material selected shall be of sufficient strength to meet the test requirements and shall be protected against corrosion or deterioration.

(i) The design working load of ladder stands shall be calculated on the basis of one or more 200-pound persons together with 50 pounds of equipment each.

(ii) The design load of all scaffolds shall be calculated on the basis of:

Light—Designed and constructed to carry a working load of 25 pounds per square foot.

Medium—Designed and constructed to carry a working load of 50 pounds per square foot.

Heavy—Designed and constructed to carry a working load of 75 pounds per square foot.

All ladder stands and scaffolds shall be capable of supporting at least four times the design working load.

(c) Materials used in mobile ladder stands and scaffolds shall be of standard manufacture and conform to specifications of this section for strength, dimensions, and weights, and shall be selected to safely support the design working load.

(d) Nails, bolts, or other fasteners used in the construction of ladders, scaffolds, and towers shall be of adequate size and in sufficient numbers at each connection to develop the designed strength of the unit. Nails shall be driven full length. (All nails should be immediately withdrawn from dismantled lumber.)

(e) All exposed surfaces shall be free from sharp edges, burrs or other safety hazards.

(3) Work levels.

(a) The maximum work level height shall not exceed four times the minimum or least base dimension of any mobile ladder stand or scaffold. Where the basic mobile unit does not meet this requirement, suitable outrigger frames shall be employed to achieve this least base dimension, or provisions shall be made to guy or brace the unit against tipping.

(b) The minimum platform width for any work level shall not be less than 20 inches for mobile scaffolds (towers). Ladder stands shall have a minimum step width of 16 inches.

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(c) The supporting structure for the work level shall be rigidly braced, using adequate cross bracing or diagonal bracing with rigid platforms at each work level.

(d) The steps of ladder stands shall be fabricated from slip resistant treads.

(e) The work level platform of scaffolds (towers) shall be of wood, aluminum, or plywood planking, steel or expanded metal, for the full width of the scaffold, except for necessary openings. Work platforms shall be secured in place. All planking shall be 2-inch (nominal) scaffold grade minimum 1,500 f. (stress grade) construction grade lumber or equivalent.

(f) All scaffold work levels 10 feet or higher above the ground or floor shall have a standard (4-inch nominal) toe-board.

(g) All work levels 10 feet or higher above the ground or floor shall have a guardrail of 2- by 4-inch nominal lumber or the equivalent installed no less than 36 inches or more than 42 inches high, with a mid-rail, when required, of at least 1- by 4-inch nominal lumber or equivalent.

(h) A climbing ladder, stairway, or equivalent shall be provided for proper access and egress, and shall be affixed or built into the scaffold and so located that its use will not have a tendency to tip the scaffold. A landing platform shall be provided at intervals not to exceed 30 feet.

(4) Wheels or casters.

(a) Wheels or casters shall be properly designed for strength and dimensions to support four times the design working load.

(b) All scaffold casters shall be provided with a positive wheel and/or swivel lock to prevent movement. Ladder stands shall have at least two of the four casters and shall be of the swivel type.

(c) Where leveling of the elevated work platform is required, screw jacks or other suitable means for adjusting the height shall be provided in the base section of each mobile unit.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-84003, filed 7/31/79; Order 73-5, § 296-24-84003, filed 5/9/73 and Order 73-4, § 296-24-84003, filed 5/7/73.]

WAC 296-24-84005 Mobile tubular welded frame scaffolds. (1) General. Units shall be designed to comply with the requirements of WAC 296-24-84003.

(2) Bracing. Scaffolds shall be properly braced by cross braces and/or diagonal braces for securing vertical members together laterally. The cross braces shall be of a length that will automatically square and align vertical members so the erected scaffold is always plumb, square, and rigid.

(3) Spacing. Spacing of panels or frames shall be consistent with the loads imposed. The frames shall be placed one on top of the other with coupling or stacking pins to provide proper vertical alignment of the legs.

(4) Locking. Where uplift may occur, panels shall be locked together vertically by pins or other equivalent means.

(5) Erection. Only the manufacturer of a scaffold or the manufacturers qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a registered professional engineer or

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erected in accordance with instructions furnished by the manufacturer.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-84005, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-84005, filed 5/9/73 and Order 73-4, § 296-24-84005, filed 5/7/73.]

WAC 296-24-84007 Mobile tubular welded sectional folding scaffolds. (1) General. Units including sectional stairway and sectional ladder scaffolds shall be designed to comply with the requirements of WAC 296-24-84003.

(2) Stairway. An integral stairway and work platform shall be incorporated into the structure of each sectional folding stairway scaffold.

(3) Bracing. An integral set of pivoting and hinged folding diagonal and horizontal braces and a detachable work platform shall be incorporated into the structure of each sectional folding ladder scaffold.

(4) Sectional folding stairway scaffolds. Sectional folding stairway scaffolds shall be designed as medium duty scaffolds except for high clearance. These special base sections shall be designed as light duty scaffolds. When upper sectional folding stairway scaffolds are used with a special high clearance base, the load capacity of the entire scaffold shall be reduced accordingly. The width of a sectional folding stairway scaffold shall not exceed 4 1/2 feet. The maximum length of a sectional folding stairway scaffold shall not exceed 6 feet.

(5) Sectional folding ladder scaffolds. Sectional folding ladder scaffolds shall be designed as light duty scaffolds including special base (open end) sections which are designed for high clearance. For certain special applications the six-foot folding ladder scaffolds, except for special high clearance base sections, shall be designed for use as medium duty scaffolds. The width of a sectional folding ladder scaffold shall not exceed 4 1/2 feet. The maximum length of a sectional folding ladder scaffold shall not exceed 6 feet 6 inches for a six-foot long unit, 8 feet 6 inches for an eight-foot unit or 10 feet 6 inches for a ten-foot long unit.

(6) End frames. The end frames of sectional ladder and stairway scaffolds shall be designed so that the horizontal bearers provide supports for multiple planking levels.

(7) Erection. Only the manufacturer of the scaffold or the manufacturers qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a licensed professional engineer, or erected in accordance with instructions furnished by the manufacturer to comply with requirements in this section.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-84007, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-84007, filed 5/9/73 and Order 73-4, § 296-24-84007, filed 5/7/73.]

WAC 296-24-84009 Mobile tube and coupler scaffolds. (1) Design. Units shall be designed to comply with the applicable requirements of WAC 296-24-84003.

(2) Material. The material used for the couplers shall be of a structural type, such as a drop-forged steel, malleable iron or structural grade aluminum. The use of gray cast iron is prohibited.

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(3) Erection. Only the manufacturer of the scaffold or their qualified designated agent shall be permitted to erect or supervise the erection of scaffolds exceeding 50 feet in height above the base, unless such structure is approved in writing by a licensed professional engineer, or erected in accordance with instructions furnished by the manufacturer to comply with requirements in this section.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-84009, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-84009, filed 5/9/73 and Order 73-4, § 296-24-84009, filed 5/7/73.]

WAC 296-24-84011 Mobile work platforms. (1) Design. Units shall be designed for the use intended and shall comply with the requirements of WAC 296-24-84003.

(2) Base width. The minimum width of the base of mobile work platforms shall not be less than 20 inches.

(3) Bracing. Adequate rigid diagonal bracing to vertical members shall be provided.

[Order 73-5, § 296-24-84011, filed 5/9/73 and Order 73-4, § 296-24-84011, filed 5/7/73.]

WAC 296-24-84013 Mobile ladder stands. (1) Design. Units shall comply with applicable requirements of WAC 296-24-84003.

(2) Base width. The minimum base width shall conform to WAC 296-24-84003 (3) and (a). The maximum length of the base section shall be the total length of combined steps and top assembly, measured horizontally, plus five-eighths inch per step of rise.

(3) Steps. Steps shall be uniformly spaced, and sloped, with a rise of not less than nine inches, nor more than ten inches, and a depth of not less than seven inches. The slope of the steps section shall be a minimum of fifty-five degrees and a maximum of sixty degrees measured from the horizontal.

(4) Handrails.

(a) Units having more than five steps or 60 inches vertical height to the top step shall be equipped with handrails.

(b) Handrails shall be a minimum of 29 inches high. Measurements shall be taken vertically from the center of the step.

(5) Loading. The load (see WAC 296-24-84003 (2)(b)(ii)) shall be applied uniformly to a 3 1/2 inches wide area front to back at the center of the width span with a safety factor of four.

[Order 73-5, § 296-24-84013, filed 5/9/73 and Order 73-4, § 296-24-84013, filed 5/7/73.]

WAC 296-24-855 Other working surfaces.

[Order 73-5, § 296-24-855, filed 5/9/73 and Order 73-4, § 296-24-855, filed 5/7/73.]

WAC 296-24-85501 Dockboards (bridge plates). (1) Portable and powered dockboards shall be strong enough to carry the load imposed on them.

(2) Portable dockboards shall be secured in position, either by being anchored or equipped with devices which will prevent their slipping.

(3) Powered dockboards shall be designed and constructed in accordance with Commercial Standard CS202-56

[Title 296 WAC—p. 862]

(1961) "Industrial Lifts and Hinged Loading Ramps" published by the U.S. Department of Commerce.

(4) Handholds, or other effective means, shall be provided on portable dockboards to permit safe handling.

(5) Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.

[Order 73-5, § 296-24-85501, filed 5/9/73 and Order 73-4, § 296-24-85501, filed 5/7/73.]

WAC 296-24-85503 Forging machine area. (1) Machines shall be so located as to give (a) enough clearance between machines so that the movement of one operator will not interfere with the work of another, (b) ample room for cleaning machines and handling the work, including material and scrap. The arrangement of machines shall be such that operators will not stand in aisles.

(2) Aisles shall be provided of sufficient width to permit the free movement of employees bringing and removing material. This aisle space is to be independent of working and storage space and should be defined by marking.

(3) Wood platforms used on the floor in front of machines shall be substantially constructed with nonslip surfaces.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-24-85503, filed 7/31/79; Order 73-5, § 296-24-85503, filed 5/9/73 and Order 73-4, § 296-24-85503, filed 5/7/73.]

WAC 296-24-85505 Veneer machinery. (1) Sides of steam vats shall extend to a height of not less than 36 inches above the floor, working platform, or ground.

(2) Large steam vats divided into sections shall be provided with substantial walkways between sections. Each walkway shall be provided with a standard handrail on each exposed side. These handrails may be removable, if necessary.

(3) Covers shall be removed only from that portion of steaming vats on which people are working and a portable railing shall be placed at this point to protect the operators.

(4) Workers shall not ride or step on logs in steam vats.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-85505, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-85505, filed 5/9/73 and Order 73-4, § 296-24-85505, filed 5/7/73.]

**PART J-2
POWERED PLATFORMS, ETC.**

WAC 296-24-870 Power platforms for exterior building maintenance. (1) Scope. This section covers powered platform installations permanently dedicated to interior or exterior building maintenance of a specific structure or group of structures. This section does not apply to suspended scaffolds (swinging scaffolds) used to service buildings on a temporary basis and covered under Part J-1 of this chapter, nor to suspended scaffolds used for construction work and covered under Part J of chapter 296-155 WAC. Building maintenance includes, but is not limited to, such tasks as window cleaning, caulking, metal polishing, and reglazing.

(2) Application.

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(a) New installations. This section applies to all permanent installations completed after July 23, 1990. Major modifications to existing installations completed after that date are also considered new installations under this section.

(b) Existing installations.

(i) Permanent installations in existence and/or completed before July 23, 1990, shall comply with WAC 296-24-87009, 296-24-87015, 296-24-87017, 296-24-87019, and 296-24-87035.

(ii) In addition, permanent installations completed after August 27, 1971, and in existence and/or completed before July 23, 1990, shall comply with WAC 296-24-87037.

(3) Assurance.

(a) Building owners of new installations shall inform the employer before each use in writing that the installation meets the requirements of WAC 296-24-87011(1) and 296-24-87013(1) and the additional design criteria contained in other provisions of WAC 296-24-87011 and 296-24-87013 relating to: Required load sustaining capabilities of platforms, building components, hoisting and supporting equipment; stability factors for carriages, platforms and supporting equipment; maximum horizontal force for movement of carriages and davits; design of carriages, hoisting machines, wire rope and stabilization systems; and design criteria for electrical wiring and equipment.

(b) Building owners shall base the information required in (a) of this subsection on the results of a field test of the installation before being placed into service and following any major alteration to an existing installation, as required in WAC 296-24-87009(1). The assurance shall also be based on all other relevant available information, including, but not limited to, test data, equipment specifications and verification by a registered professional engineer.

(c) Building owners of all installations, new and existing, shall inform the employer in writing that the installation has been inspected, tested and maintained in compliance with the requirements of WAC 296-24-87009 and 296-24-87015 and that all protection anchorages meet the requirements of WAC 296-24-87035 (3)(j), Appendix C.

(d) The employer shall not permit employees to use the installation prior to receiving assurance from the building owner that the installation meets the requirements contained in (a) and (c) of this subsection.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-870, filed 4/10/90, effective 5/25/90; Order 73-5, § 296-24-870, filed 5/9/73 and Order 73-4, § 296-24-870, filed 5/7/73.]

WAC 296-24-87001 Definitions. (1) Anemometer. An instrument for measuring wind velocity.

(2) Angulated roping. A system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building during its vertical travel.

(3) ANSI. American National Standards Institute.

(4) Babbitted fastenings. The method of providing wire rope attachments in which the ends of the wire strands are bent back and are held in a tapered socket by means of poured molten babbitt metal.

(5) Brake-disc type. A brake in which the holding effect is obtained by frictional resistance between one or more faces of discs keyed to the rotating member to be held and fixed discs keyed to the stationary or housing member (pressure between the discs being applied axially).

(6) Brake-self-energizing band type. An essentially unidirectional brake in which the holding effect is obtained by the snubbing action of a flexible band wrapped about a cylindrical wheel or drum affixed to the rotating member to be held, the connections and linkages being so arranged that the motion of the brake wheel or drum will act to increase the tension or holding force of the band.

(7) Brake-shoe type. A brake in which the holding effect is obtained by applying the direct pressure of two or more segmental friction elements held to a stationary member against a cylindrical wheel or drum affixed to the rotating member to be held.

(8) Building face rollers. A specialized form of guide roller designed to contact a portion of the outer face or wall structure of the building, and to assist in stabilizing the operators' platform during vertical travel.

(9) Building maintenance. Operations such as window cleaning, caulking, metal polishing, reglazing, and general maintenance on building surfaces.

(10) Cable. A conductor, or group of conductors, enclosed in a weatherproof sheath, that may be used to supply electrical power and/or control current for equipment or to provide voice communication circuits.

(11) Carriage. A wheeled vehicle used for the horizontal movement and support of other equipment.

(12) Certification. A written, signed, and dated statement confirming the performance of a requirement of this section.

(13) Combination cable. A cable having both steel structural members capable of supporting the platform, and copper or other electrical conductors insulated from each other and the structural members by nonconductive barriers.

(14) Competent person. A person who, because of training and experience, is capable of identifying hazardous or dangerous conditions in powered platform installations and of training employees to identify such conditions.

(15) Continuous pressure. Operation by means of buttons or switches, any one of which may be used to control the movement of the working platform or roof car, only as long as the button or switch is manually maintained in the actuating position.

(16) Control. A system governing starting, stopping, direction, acceleration, speed, and retardation of moving members.

(17) Controller. A device or group of devices, usually contained in a single enclosure, which serves to control in some predetermined manner the apparatus to which it is connected.

(18) Davit. A device, used singly or in pairs, for suspending a powered platform from work, storage and rigging locations on the building being serviced. Unlike outriggers, a davit reacts its operating load into a single roof socket or carriage attachment.

(19) Electrical ground. A conducting connection between an electrical circuit or equipment and the earth, or some conducting body which serves in place of the earth.

(20) Equivalent. Alternative designs, materials or methods which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

(21) Ground rigging. A method of suspending a working platform starting from a safe surface to a point of suspension above the safe surface.

(22) Ground rigged davit. A davit which cannot be used to raise a suspended working platform above the building face being serviced.

(23) Guide button. A building face anchor designed to engage a guide track mounted on a platform.

(24) Guide roller. A rotating, bearing-mounted, generally cylindrical member, operating separately or as part of a guide shoe assembly, attached to the platform, and providing rolling contact with building guideways, or other building contact members.

(25) Guide shoe. An assembly of rollers, slide members, or the equivalent, attached as a unit to the operators' platform, and designed to engage with the building members provided for the vertical guidance of the operators' platform.

(26) Hoisting machine. A device intended to raise and lower a suspended or supported unit.

(27) Hoist rated load. The hoist manufacturer's maximum allowable operating load.

(28) Installation. All the equipment and all affected parts of a building which are associated with the performance of building maintenance using powered platforms.

(29) Interlock. A device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices.

(30) Intermittent stabilization. A method of platform stabilization in which the angulated suspension wire rope(s) are secured to regularly spaced building anchors.

(31) Lanyard. A flexible line of rope, wire rope or strap which is used to secure the body harness to a deceleration device, lifeline or anchorage.

(32) Lifeline. A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

(33) Live load. The total static weight of workers, tools, parts, and supplies that the equipment is designed to support.

(34) Obstruction detector. A control that will stop the suspended or supported unit in the direction of travel if an obstruction is encountered, and will allow the unit to move only in a direction away from the obstruction.

(35) Operating control. A mechanism regulating or guiding the operation of equipment that ensures a specific operating mode.

(36) Operating device. A pushbutton, lever, or other manual device used to actuate a control.

(37) Outrigger. A device, used singly or in pairs, for suspending a working platform from work, storage, and rigging locations on the building being serviced. Unlike davits, an outrigger reacts its operating moment load as at least two opposing vertical components acting into two or more distinct roof points and/or attachments.

(38) Platform rated load. The combined weight of workers, tools, equipment and other material which is permitted to be carried by the working platform at the installation, as stated on the load rating plate.

(39) Poured socket. The method of providing wire rope terminations in which the ends of the rope are held in a tapered socket by means of poured spelter or resins.

(40) Powered platform. Equipment to provide access to the exterior of a building for maintenance, consisting of a suspended power-operated working platform, a roof car, or other suspension means, and the requisite operating and control devices.

(41) Primary brake. A brake designed to be applied automatically whenever power to the prime mover is interrupted or discontinued.

(42) Prime mover. The source of mechanical power for a machine.

(43) Rated load. The manufacturer's recommended maximum load.

(44) Rated strength. The strength of wire rope, as designated by its manufacturer or vendor, based on standard testing procedures or acceptable engineering design practices.

(45) Rated working load. The combined static weight of workers, materials, and suspended or supported equipment.

(46) Registered professional engineer. A person who has been duly and currently registered and licensed by an authority within the United States or its territories to practice the profession of engineering.

(47) Relay, direction. An electrically energized contactor responsive to an initiating control circuit, which in turn causes a moving member to travel in a particular direction.

(48) Relay, potential for vertical travel. An electrically energized contactor responsive to initiating control circuit, which in turn controls the operation of a moving member in both directions. This relay usually operates in conjunction with direction relays, as covered under the definition "relay direction."

(49) Roof car. A structure for the suspension of a working platform, providing for its horizontal movement to working positions.

(50) Roof-powered platform. A powered platform having the raising and lowering mechanism located on a roof car.

(51) Roof rigged davit. A davit used to raise the suspended working platform above the building face being serviced. This type of davit can also be used to raise a suspended working platform which has been ground-rigged.

(52) Rope. The equipment used to suspend a component of an equipment installation, i.e., wire rope.

(53) Safe surface. A horizontal surface intended to be occupied by personnel, which is so protected by a fall protection system that it can be reasonably assured that said occupants will be protected against falls.

(54) Secondary brake. A brake designed to arrest the descent of the suspended or supported equipment in the event of an overspeed condition.

(55) Self-powered platform. A powered platform having the raising and lowering mechanism located on the working platform.

(56) Speed reducer. A positive type speed reducing machine.

(57) Stability factor. The ratio of the stabilizing moment to the overturning moment.

(58) Stabilizer tie. A flexible line connecting the building anchor and the suspension wire rope supporting the platform.

(59) Supported equipment. Building maintenance equipment that is held or moved to its working position by means of attachment directly to the building or extensions of the building being maintained.

(60) Suspended equipment. Building maintenance equipment that is suspended and raised or lowered to its working position by means of ropes or combination cables attached to some anchorage above the equipment.

(61) Suspended scaffold (swinging scaffold). A scaffold supported on wire or other ropes, used for work on, or for providing access to, vertical sides of structures on a temporary basis. Such scaffold is not designed for use on a specific structure or group of structures.

(62) Tail line. The nonsupporting end of the wire rope used to suspend the platform.

(63) Tie-in guides. The portion of a building that provides continuous positive engagement between the building and a suspended or supported unit during its vertical travel on the face of the building.

(64) Traction hoist. A type of hoisting machine that does not accumulate the suspension wire rope on the hoisting drum or sheave, and is designed to raise and lower a suspended load by the application of friction forces between the suspension wire rope and the drum or sheave.

(65) Transportable outriggers. Outriggers designed to be moved from one work location to another.

(66) Traveling cable. A cable made up of electrical or communication conductors or both, and providing electrical connection between the working platform and the roof car or other fixed point.

(67) Trolley carriage. A carriage suspended from an overhead track structure.

(68) Verified. Accepted by design, evaluation, or inspection by a registered professional engineer.

(69) Weatherproof. Equipment so constructed or protected that exposure to the weather will not interfere with its proper operation.

(70) Winding drum hoist. A type of hoisting machine that accumulates the suspension wire rope on the hoisting drum.

(71) Working platform. The suspended or supported equipment intended to provide access to the face of the building and manned by persons engaged in building maintenance.

(72) Wrap. One complete turn of the suspension wire rope around the surface of a hoist drum.

(73) Yield point. The stress at which the material exhibits a permanent set of 0.2 percent.

(74) Zinced fastenings. The method of providing wire rope attachments in which the splayed or fanned wire ends are held in a tapered socket by means of poured molten zinc.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-87001, filed 7/20/94, effective 9/20/94; 90-09-026 (Order 90-01), § 296-24-87001, filed 4/10/90, effective 5/25/90; Order 73-5, § 296-24-87001, filed 5/9/73 and Order 73-4, § 296-24-87001, filed 5/7/73.]

(1999 Ed.)

WAC 296-24-87009 Inspections and tests. (1) Installations and alterations. All completed building maintenance equipment installations shall be inspected and tested in the field before being placed in initial service to determine that all parts of the installation conform to applicable requirements of this standard, and that all safety and operating equipment is functioning as required. A similar inspection and test shall be made following any major alteration to an existing installation. No hoist in an installation shall be subjected to a load in excess of 125 percent of its rated load.

(2) Periodic inspections and tests.

(a) Related building supporting structures shall undergo periodic inspection by a competent person at intervals not exceeding 12 months.

(b) All parts of the equipment including control systems shall be inspected, and, where necessary, tested by a competent person at intervals specified by the manufacturer/supplier, but not to exceed 12 months, to determine that they are in safe operating condition. Parts subject to wear, such as wire ropes, bearings, gears, and governors shall be inspected and/or tested to determine that they have not worn to such an extent as to affect the safe operation of the installation.

(c) The building owner shall keep a certification record of each inspection and test required under (a) and (b) of this subsection. The certification record shall include the date of the inspection, the signature of the person who performed the inspection, and the number, or other identifier, of the building support structure and equipment which was inspected. This certification record shall be kept readily available for review by the director or an authorized representative and by the employer.

(d) Working platforms and their components shall be inspected by the employer for visible defects before every use and after each occurrence which could affect the platform's structural integrity.

(3) Maintenance, inspections and tests.

(a) A maintenance inspection and, where necessary, a test shall be made of each platform installation every 30 days, or where the work cycle is less than 30 days such inspection and/or test shall be made prior to each work cycle. This inspection and test shall follow procedures recommended by the manufacturer, and shall be made by a competent person.

(b) The building owner shall keep a certification record of each inspection and test performed under (a) of this subsection. The certification record shall include the date of the inspection and test, the signature of the person who performed the inspection and/or test, and an identifier for the platform installation which was inspected. The certification record shall be kept readily available for review by the director or an authorized representative and by the employer.

(4) Special inspection of governors and secondary brakes.

(a) Governors and secondary brakes shall be inspected and tested at intervals specified by the manufacturer/supplier but not to exceed every 12 months.

(b) The results of the inspection and test shall confirm that the initiating device for the secondary braking system operates at the proper overspeed.

(c) The results of the inspection and test shall confirm that the secondary brake is functioning properly.

(d) If any hoisting machine or initiating device for the secondary brake system is removed from the equipment for testing, all reinstalled and directly related components shall be reinspected prior to returning the equipment installation to service.

(e) Inspection of governors and secondary brakes shall be performed by a competent person.

(f) The secondary brake governor and actuation device shall be tested before each day's use. Where testing is not feasible, a visual inspection of the brake shall be made instead to ensure that it is free to operate.

(5) Adverse weather. The operation of powered platforms during severe adverse weather conditions is prohibited.

(6) Suspension wire rope maintenance, inspection and replacement.

(a) Suspension wire rope shall be maintained and used in accordance with procedures recommended by the wire rope manufacturer.

(b) Suspension wire rope shall be inspected by a competent person for visible defects and gross damage to the rope before every use and after each occurrence which might affect the wire rope's integrity.

(c) A thorough inspection of suspension wire ropes in service shall be made once a month. Suspension wire ropes that have been inactive for 30 days or longer shall have a thorough inspection before they are placed into service. These thorough inspections of suspension wire ropes shall be performed by a competent person.

(d) The need for replacement of a suspension wire rope shall be determined by inspection and shall be based on the condition of the wire rope. Any of the following conditions or combination of conditions will be cause for removal of the wire rope:

(i) Broken wires exceeding three wires in one strand or six wires in one rope lay;

(ii) Distortion of rope structure such as would result from crushing or kinking;

(iii) Evidence of heat damage;

(iv) Evidence of rope deterioration from corrosion;

(v) A broken wire within 18 inches (460.8 mm) of the end attachments;

(vi) Noticeable rusting and pitting;

(vii) Evidence of core failure (a lengthening of rope lay, protrusion of the rope core and a reduction in rope diameter suggests core failure); or

(viii) More than one valley break (broken wire);

(ix) Outer wire wear exceeds one-third of the original outer wire diameter;

(x) Any other condition which the competent person determines has significantly affected the integrity of the rope.

(e) The building owner shall keep a certification record of each monthly inspection of a suspension wire rope as required in subdivision (c) of this subsection. The record shall include the date of the inspection, the signature of the person who performed the inspection, and a number, or other identifier, of the wire rope which was inspected. This record of inspection shall be made available for review by the director or an authorized representative and by the employer.

(7) Hoist inspection. Before lowering personnel below the top elevation of the building, the hoist shall be tested each day in the lifting direction with the intended load to make certain it has sufficient capacity to raise the personnel back to the boarding level.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-87009, filed 4/10/90, effective 5/25/90; Order 73-5, § 296-24-87009, filed 5/9/73 and Order 73-4, § 296-24-87009, filed 5/7/73.]

WAC 296-24-87011 Powered platform installations—Affected parts of buildings. (1) General requirements. The following requirements apply to affected parts of buildings which utilize working platforms for building maintenance.

(a) Structural supports, tie-downs, tie-in guides, anchoring devices and any affected parts of the building included in the installation shall be designed by or under the direction of a registered professional engineer experienced in such design;

(b) Exterior installations shall be capable of withstanding prevailing climatic conditions;

(c) The building installation shall provide safe access to, and egress from, the equipment and sufficient space to conduct necessary maintenance of the equipment;

(d) The affected parts of the building shall have the capability of sustaining all the loads imposed by the equipment; and

(e) The affected parts of the building shall be designed so as to allow the equipment to be used without exposing employees to a hazardous condition.

(2) Tie-in guides.

(a) The exterior of each building shall be provided with tie-in guides unless the conditions in (b) or (c) of this subsection are met.

Note: See Figure 1 in Appendix B of this section for a description of a typical continuous stabilization system utilizing tie-in guides.

(b) If angulated roping is employed, tie-in guides required in (a) of this subsection may be eliminated for not more than 75 feet (22.9 m) of the uppermost elevation of the building, if infeasible due to exterior building design, provided an angulation force of at least 10 pounds (44.4 n) is maintained under all conditions of loading.

(c) Tie-in guides required in (a) of this subsection may be eliminated if one of the guide systems in items (i), (ii), or (iii) of this subdivision is provided, or an equivalent.

(i) Intermittent stabilization system. The system shall keep the equipment in continuous contact with the building facade, and shall prevent sudden horizontal movement of the platform. The system may be used together with continuous positive building guide systems using tie-in guides on the same building, provided the requirements for each system are met.

(A) The maximum vertical interval between building anchors shall be 3 floors or 50 feet (15.3 m), whichever is less.

(B) Building anchors shall be located vertically so that attachment of the stabilizer ties will not cause the platform suspension ropes to angulate the platform horizontally across the face of the building. The anchors shall be positioned hor-

izontally on the building face so as to be symmetrical about the platform suspension ropes.

(C) Building anchors shall be easily visible to employees and shall allow a stabilizer tie attachment for each of the platform suspension ropes at each vertical interval. If more than two suspension ropes are used on a platform, only the two building-side suspension ropes at the platform ends shall require a stabilizer attachment.

(D) Building anchors which extend beyond the face of the building shall be free of sharp edges or points. Where cables, suspension wire ropes and lifelines may be in contact with the building face, external building anchors shall not interfere with their handling or operation.

(E) The intermittent stabilization system building anchors and components shall be capable of sustaining without failure at least 4 times the maximum anticipated load applied or transmitted to the components and anchors. The minimum design wind load for each anchor shall be 300 (1334 n) pounds, if 2 anchors share the wind load.

(F) The building anchors and stabilizer ties shall be capable of sustaining anticipated horizontal and vertical loads from winds specified for roof storage design which may act on the platform and wire ropes if the platform is stranded on a building face. If the building anchors have different spacing than the suspension wire rope or if the building requires different suspension spacings on one platform, one building anchor and stabilizer tie shall be capable of sustaining the wind loads.

Note: See Figure 2 in Appendix B of this section for a description of a typical intermittent stabilization system.

(ii) Button guide stabilization system.

(A) Guide buttons shall be coordinated with platform mounted equipment of WAC 296-24-87013 (5)(f).

(B) Guide buttons shall be located horizontally on the building face so as to allow engagement of each of the guide tracks mounted on the platform.

(C) Guide buttons shall be located in vertical rows on the building face for proper engagement of the guide tracks mounted on the platform.

(D) Two guide buttons shall engage each guide track at all times except for the initial engagement.

(E) Guide buttons which extend beyond the face of the building shall be free of sharp edges or points. Where cables, ropes and lifelines may be in contact with the building face, guide buttons shall not interfere with their handling or operation.

(F) Guide buttons, connections and seals shall be capable of sustaining without damage at least the weight of the platform, or provision shall be made in the guide tracks or guide track connectors to prevent the platform and its attachments from transmitting the weight of the platform to the guide buttons, connections and seals. In either case, the minimum design load shall be 300 pounds (1334 n) per building anchor

Note: See WAC 296-24-87013 (5)(f) for relevant equipment provisions.

Note: See Figure 3 in Appendix B of this section for a description of a typical button guide stabilization system.

(iii) System utilizing angulated roping and building face rollers. The system shall keep the equipment in continuous contact with the building facade, and shall prevent sudden

horizontal movement of the platform. This system is acceptable only where the suspended portion of the equipment in use does not exceed 130 feet (39.6 m) above a safe surface or ground level, and where the platform maintains no less than 10 pounds (44.4 n) angulation force on the building facade.

(d) Tie-in guides for building interiors (atriums) may be eliminated when a registered professional engineer determines that an alternative stabilization system, including systems in (c)(i), (ii), and (iii) of this subsection, or a platform tie-off at each work station will provide equivalent safety.

(3) Roof guarding.

(a) Employees working on roofs while performing building maintenance shall be protected by a perimeter guarding system which meets the requirements of WAC 296-24-75007(1).

(b) The perimeter guard shall not be more than 6 inches (152 mm) inboard of the inside face of a barrier, i.e. the parapet wall, or roof edge curb of the building being serviced; however, the perimeter guard location shall not exceed an 18 inch (457 mm) setback from the exterior building face.

(4) Equipment stops. Operational areas for trackless type equipment shall be provided with structural stops, such as curbs, to prevent equipment from traveling outside its intended travel areas and to prevent a crushing or shearing hazard.

(5) Maintenance access. Means shall be provided to traverse all carriages and their suspended equipment to a safe area for maintenance and storage.

(6) Elevated track.

(a) An elevated track system which is located 4 feet (1.2 m) or more above a safe surface, and traversed by carriage supported equipment, shall be provided with a walkway and guardrail system; or

(b) The working platform shall be capable of being lowered, as part of its normal operation, to the lower safe surface for access and egress of the personnel and shall be provided with a safe means of access and egress to the lower safe surface.

(7) Tie-down anchors. Imbedded tie-down anchors, fasteners, and affected structures shall be resistant to corrosion.

(8) Cable stabilization.

(a) Hanging lifelines and all cables not in tension shall be stabilized at each 200 foot (61 m) interval of vertical travel of the working platform beyond an initial 200 foot (61 m) distance.

(b) Hanging cables, other than suspended wire ropes, which are in constant tension shall be stabilized when the vertical travel exceeds an initial 600 foot (183 m) distance, and at further intervals of 600 feet (183 m) or less.

(9) Emergency planning. A written emergency action plan shall be developed and implemented for each kind of working platform operation. This plan shall explain the emergency procedures which are to be followed in the event of a power failure, equipment failure or other emergencies which may be encountered. The plan shall also include that employees be informed about the building emergency escape routes, procedures and alarm systems before operating a platform. Upon initial assignment and whenever the plan is changed the employer shall review with each employee those parts of

the plan which the employee must know to protect himself or herself in the event of an emergency.

(10) Building maintenance. Repairs or major maintenance of those building portions that provide primary support for the suspended equipment shall not affect the capability of the building to meet the requirements of this standard.

(11) Electrical requirements. The following electrical requirements apply to buildings which utilize working platforms for building maintenance.

(a) General building electrical installations shall comply with chapter 296-24 WAC Part L, unless otherwise specified in this section;

(b) Building electrical wiring shall be of such capacity that when full load is applied to the equipment power circuit not more than a five percent drop from building service vault voltage shall occur at any power circuit outlet used by equipment regulated by this section;

(c) The equipment power circuit shall be an independent electrical circuit that shall remain separate from all other equipment within or on the building, other than power circuits used for hand tools that will be used in conjunction with the equipment. If the building is provided with an emergency power system, the equipment power circuit may also be connected to this system;

(d) The power circuit shall be provided with a disconnect switch that can be locked in the "off" and "on" positions. The switch shall be conveniently located with respect to the primary operating area of the equipment to allow the operators of the equipment access to the switch;

(e) The disconnect switch for the power circuit shall be locked in the "on" position when the equipment is in use; and

(f) An effective two-way voice communication system shall be provided between the equipment operators and persons stationed within the building being serviced. The communications facility shall be operable and shall be manned at all times by persons stationed within the building whenever the platform is being used.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-87011, filed 11/22/91, effective 12/24/91; 90-09-026 (Order 90-01), § 296-24-87011, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87013 Powered platform installations—Equipment. (1) General requirements. The following requirements apply to equipment which are part of a powered platform installation, such as platforms, stabilizing components, carriages, outriggers, davits, hoisting machines, wire ropes and electrical components.

(a) Equipment installations shall be designed by or under the direction of a registered professional engineer experienced in such design;

(b) The design shall provide for a minimum live load of 250 pounds (113.6 kg) for each occupant of a suspended or supported platform;

(c) Equipment that is exposed to wind when not in service shall be designed to withstand forces generated by winds of at least 100 miles per hour (44.7 m/s) at 30 feet (9.2 m) above grade; and

(d) Equipment that is exposed to wind when in service shall be designed to withstand forces generated by winds of at least 50 miles per hour (22.4 m/s) for all elevations.

(2) Construction requirements. Bolted connections shall be self-locking or shall otherwise be secured to prevent loss of the connections by vibration.

(3) Suspension methods. Elevated building maintenance equipment shall be suspended by a carriage, outriggers, davits or an equivalent method.

(a) Carriages. Carriages used for suspension of elevated building maintenance equipment shall comply with the following:

(i) The horizontal movement of a carriage shall be controlled so as to ensure its safe movement and allow accurate positioning of the platform for vertical travel or storage;

(ii) Powered carriages shall not exceed a traversing speed of 50 feet per minute (0.3 m/s);

(iii) The initiation of a traversing movement for a manually propelled carriage on a smooth level surface shall not require a person to exert a horizontal force greater than 40 pounds (44.8 n);

(iv) Structural stops and curbs shall be provided to prevent the traversing of the carriage beyond its designed limits of travel;

(v) Traversing controls for a powered carriage shall be of a continuous pressure weatherproof type. Multiple controls when provided shall be arranged to permit operation from only one control station at a time. An emergency stop device shall be provided on each end of a powered carriage for interrupting power to the carriage drive motors;

(vi) The operating control(s) shall be so connected that in the case of suspended equipment, traversing of a carriage is not possible until the suspended portion of the equipment is located at its uppermost designed position for traversing; and is free of contact with the face of the building or building guides. In addition, all protective devices and interlocks are to be in the proper position to allow traversing of the carriage;

(vii) Stability for underfoot supported carriages shall be obtained by gravity, by an attachment to a structural support, or by a combination of gravity and a structural support. The use of flowing counterweights to achieve stability is prohibited.

(A) The stability factor against overturning shall not be less than 2 for horizontal traversing of the carriage, including the effects of impact and wind.

(B) The carriages and their anchorages shall be capable of resisting accidental over-tensioning of the wire ropes suspending the working platform, and this calculated value shall include the effect of one and one-half times the stall capacity of the hoist motor. All parts of the installation shall be capable of withstanding without damage to any part of the installation the forces resulting from the stall load of the hoist and one-half the wind load.

(C) Roof carriages which rely on having tie-down devices secured to the building to develop the required stability against overturning shall be provided with an interlock which will prevent vertical platform movement unless the tie-down is engaged;

(viii) An automatically applied braking or locking system, or equivalent, shall be provided that will prevent unintentional traversing of power-traversed or power assisted carriages;

(ix) A manual or automatic braking or locking system or equivalent, shall be provided that will prevent unintentional traversing of manually propelled carriages;

(x) A means to lock out the power supply for the carriage shall be provided;

(xi) Safe access to and egress from the carriage shall be provided from a safe surface. If the carriage traverses an elevated area, any operating area on the carriage shall be protected by a guardrail system in compliance with the provisions of subsection (5)(a)(vi) of this section. Any access gate shall be self-closing and self-latching, or provided with an interlock;

(xii) Each carriage work station position shall be identified by location markings and/or position indicators; and

(xiii) The motors shall stall if the load on the hoist motors is at any time in excess of three times that necessary for lifting the working platform with its rated load.

(b) Transportable outriggers.

(i) Transportable outriggers may be used as a method of suspension for ground rigged working platforms where the point of suspension does not exceed 300 feet (91.5 m) above a safe surface. Tie-in guide system(s) shall be provided which meet the requirements of WAC 296-24-87011(2).

(ii) Transportable outriggers shall be used only with self-powered, ground rigged working platforms.

(iii) Each transportable outrigger shall be secured with a tie-down to a verified anchorage on the building during the entire period of its use. The anchorage shall be designed to have a stability factor of not less than 4 against overturning or upsetting of the outrigger.

(iv) Access to and egress from the working platform shall be from and to a safe surface below the point of suspension.

(v) Each transportable outrigger shall be designed for lateral stability to prevent roll-over in the event an accidental lateral load is applied to the outrigger. The accidental lateral load to be considered in this design shall be not less than 70 percent of the rated load of the hoist.

(vi) Each transportable outrigger shall be designed to support an ultimate load of not less than 4 times the rated load of the hoist.

(vii) Each transportable outrigger shall be so located that the suspension wire ropes for two point suspended working platforms are hung parallel.

(viii) A transportable outrigger shall be tied-back to a verified anchorage on the building with a rope equivalent in strength to the suspension rope.

(ix) The tie-back rope shall be installed parallel to the centerline of the outrigger.

(c) Davits.

(i) Every davit installation, fixed or transportable, rotatable or nonrotatable shall be designed and installed to insure that it has a stability factor against overturning of not less than 4.

(ii) The following requirements apply to roof rigged davit systems:

(A) Access to and egress from the working platform shall be from a safe surface. Access or egress shall not require persons to climb over a building's parapet or guard railing; and

(B) The working platform shall be provided with wheels, casters or a carriage for traversing horizontally.

(iii) The following requirements apply to ground rigged davit systems:

(A) The point of suspension shall not exceed 300 feet (91.5 m) above a safe surface. Guide system(s) shall be provided which meet the requirements of WAC 296-24-87011(2);

(B) Access and egress to and from the working platform shall only be from a safe surface below the point of suspension.

(iv) A rotating davit shall not require a horizontal force in excess of 40 pounds (177.9 n) per person to initiate a rotating movement.

(v) The following requirements shall apply to transportable davits:

(A) A davit or part of a davit weighing more than 80 pounds (36 kg) shall be provided with a means for its transport, which shall keep the center of gravity of the davit at or below 36 inches (914 mm) above the safe surface during transport;

(B) A davit shall be provided with a pivoting socket or with a base that will allow the insertion or removal of a davit at a position of not more than 35 degrees above the horizontal, with the complete davit inboard of the building face being serviced; and

(C) Means shall be provided to lock the davit to its socket or base before it is used to suspend the platform.

(4) Hoisting machines.

(a) Raising and lowering of suspended or supported equipment shall be performed only by a hoisting machine.

(b) Each hoisting machine shall be capable of arresting any overspeed descent of the load.

(c) Each hoisting machine shall be powered only by air, electric or hydraulic sources.

(d) Flammable liquids shall not be carried on the working platform.

(e) Each hoisting machine shall be capable of raising or lowering 125 percent of the rated load of the hoist.

(f) Moving parts of a hoisting machine shall be enclosed or guarded in compliance with Part C of chapter 296-24 WAC.

(g) Winding drums, traction drums and sheaves and directional sheaves used in conjunction with hoisting machines shall be compatible with, and sized for, the wire rope used.

(h) Each winding drum shall be provided with a positive means of attaching the wire rope to the drum. The attachment shall be capable of developing at least 4 times the rated load of the hoist.

(i) Each hoisting machine shall be provided with a primary brake and at least one independent secondary brake, each capable of stopping and holding not less than 125 percent of the lifting capacity of the hoist.

(i) The primary brake shall be directly connected to the drive train of the hoisting machine, and shall not be connected through belts, chains, clutches, or set screw type devices. The brake shall automatically set when power to the prime mover is interrupted.

(ii) The secondary brake shall be an automatic emergency type of brake that, if actuated during each stopping cycle, shall not engage before the hoist is stopped by the primary brake.

(iii) When a secondary brake is actuated, it shall stop and hold the platform within a vertical distance of 24 inches (609.6 mm).

(j) Any component of a hoisting machine which requires lubrication for its protection and proper functioning shall be provided with a means for that lubrication to be applied.

(5) Suspended equipment.

(a) General requirements.

(i) Each suspended unit component, except suspension ropes and guardrail systems, shall be capable of supporting, without failure, at least 4 times the maximum intended live load applied or transmitted to that component.

(ii) Each suspended unit component shall be constructed of materials that will withstand anticipated weather conditions.

(iii) Each suspended unit shall be provided with a load rating plate, conspicuously located, stating the unit weight and rated load of the suspended unit.

(iv) When the suspension points on a suspended unit are not at the unit ends, the unit shall be capable of remaining continuously stable under all conditions of use and position of the live load, and shall maintain at least a 1.5 to 1 stability factor against unit upset.

(v) Guide rollers, guide shoes or building face rollers shall be provided, and shall compensate for variations in building dimensions and for minor horizontal out-of-level variations of each suspended unit.

(vi) Each working platform of a suspended unit shall be secured to the building facade by one or more of the following methods, or by an equivalent method:

(A) Continuous engagement to building anchors as provided in WAC 296-24-87011 (2)(a);

(B) Intermittent engagement to building anchors as provided in WAC 296-24-87011 (2)(c)(i);

(C) Button guide engagement as provided in WAC 296-24-87011 (2)(c)(ii);

(D) Angulated roping and building face rollers as provided in WAC 296-24-87011 (2)(c)(iii).

(vii) Each working platform of a suspended unit shall be provided with a guardrail system on all sides which shall meet the following requirements:

(A) The system shall consist of a top guardrail, midrail, and a toeboard;

(B) The top guardrail shall not be less than 36 inches (914 mm) high and shall be able to withstand at least a 200-pound (890 n) force in any downward or outward direction;

(C) The midrail shall be able to withstand at least a 75-pound (333 n) force in any downward or outward direction; and

(D) The areas between the guardrail and toeboard on the ends and outboard side, and the area between the midrail and toeboard on the inboard side, shall be closed with a material that is capable of withstanding a load of 100 pounds (45.4 KG.) applied horizontally over any area of one square foot (.09 m²). The material shall have all openings small enough to

reject passage of life lines and potential falling objects which may be hazardous to persons below.

(E) Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 n) applied in any downward or horizontal direction at any point along the toeboard.

(F) Toeboards shall be 4 inches (9 cm) minimum in length from their top edge to the level of the platform floor.

(G) Toeboards shall be securely fastened in place at the outermost edge of the platform and have no more than one-half inch (1.3 cm) clearance above the platform floor.

(H) Toeboards shall be solid or with an opening not over one inch (2.5 cm) in the greatest dimension.

(b) Two and four-point suspended working platforms.

(i) The working platform shall be not less than 24 inches (610 mm) wide and shall be provided with a minimum of a 12 inch (305 mm) wide passage at or past any obstruction on the platform.

(ii) The flooring shall be of a slip-resistant type and shall contain no opening that would allow the passage of life lines, cables and other potential falling objects. If a larger opening is provided, it shall be protected by placing a material under the opening which shall prevent the passage of life lines, cables and potential falling objects.

(iii) The working platform shall be provided with a means of suspension that will restrict the platform's inboard to outboard roll about its longitudinal axis to a maximum of 15 degrees from a horizontal plane when moving the live load from the inboard to the outboard side of the platform.

(iv) Any cable suspended from above the platform shall be provided with a means for storage to prevent accumulation of the cable on the floor of the platform.

(v) All operating controls for the vertical travel of the platform shall be of the continuous-pressure type, and shall be located on the platform.

(vi) Each operating station of every working platform shall be provided with a means of interrupting the power supply to all hoist motors to stop any further powered ascent or descent of the platform.

(vii) The maximum rated speed of the platform shall not exceed 50 feet per minute (0.3 ms) with single speed hoists, nor 75 feet per minute (0.4 ms) with multispeed hoists.

(viii) Provisions shall be made for securing all tools, water tanks, and other accessories to prevent their movement or accumulation on the floor of the platform.

(ix) Portable fire extinguishers conforming to the provisions of WAC 296-24-585 and 296-24-592 shall be provided and securely attached on all working platforms.

(x) Access to and egress from a working platform, except for those that land directly on a safe surface, shall be provided by stairs, ladders, platforms and runways conforming to the provisions of Part J-1 of chapter 296-24 WAC. Access gates shall be self-closing and self-latching.

(xi) Means of access to or egress from a working platform which is 48 inches (1.2 m) or more above a safe surface shall be provided with a guardrail system or ladder handrails that conform to the provisions of Part J-1 of chapter 296-24 WAC.

(xii) The platform shall be provided with a secondary wire rope suspension system if the platform contains over-

head structures which restrict the emergency egress of employees. A horizontal lifeline or a direct connection anchorage shall be provided, as part of a fall arrest system which meets the requirements of Appendix C, for each employee on such a platform.

(xiii) A vertical lifeline shall be provided as part of a fall arrest system which meets the requirements of Appendix C, for each employee on a working platform suspended by 2 or more wire ropes, if the failure of one wire rope or suspension attachment will cause the platform to upset. If a secondary wire rope suspension is used, vertical lifelines are not required for the fall arrest system, provided that each employee is attached to a horizontal lifeline anchored to the platform.

(xiv) An emergency electric operating device shall be provided on roof powered platforms near the hoisting machine for use in the event of failure of the normal operating device located on the working platform, or failure of the cable connected to the platform. The emergency electric operating device shall be mounted in a secured compartment, and the compartment shall be labeled with instructions for use. A means for opening the compartment shall be mounted in a break-glass receptacle located near the emergency electric operating device or in an equipment secure and accessible location.

(c) Single point suspended working platforms.

(i) The requirements of (b)(i) through (xi) of this subsection shall also apply to a single point working platform.

(ii) Each single point suspended working platform shall be provided with a secondary wire rope suspension system, which will prevent the working platform from falling should there be a failure of the primary means of support, or if the platform contains overhead structures which restrict the egress of the employees. A horizontal life line or a direct connection anchorage shall be provided, as part of a fall arrest system which meets the requirements of Appendix C, for each employee on the platform.

(d) Ground-rigged working platforms.

(i) Ground-rigged working platforms shall comply with all the requirements of (b)(i) through (xiii) of this subsection.

(ii) After each day's use, the power supply within the building shall be disconnected from a ground-rigged working platform, and the platform shall be either disengaged from its suspension points or secured and stored at grade.

(e) Intermittently stabilized platforms.

(i) The platform shall comply with (b)(i) through (xiii) of this subsection.

(ii) Each stabilizer tie shall be equipped with a "quick connect-quick disconnect" device which cannot be accidentally disengaged, for attachment to the building anchor, and shall be resistant to adverse environmental conditions.

(iii) The platform shall be provided with a stopping device that will interrupt the hoist power supply in the event the platform contacts a stabilizer tie during its ascent.

(iv) Building face rollers shall not be placed at the anchor setting if exterior anchors are used on the building face.

(v) Stabilizer ties used on intermittently stabilized platforms shall allow for the specific attachment length needed to effect the predetermined angulation of the suspended wire

rope. The specific attachment length shall be maintained at all building anchor locations.

(vi) The platform shall be in continuous contact with the face of the building during ascent and descent.

(vii) The attachment and removal of stabilizer ties shall not require the horizontal movement of the platform.

(viii) The platform-mounted equipment and its suspension wire ropes shall not be physically damaged by the loads from the stabilizer tie or its building anchor. The platform, platform-mounted equipment and wire ropes shall be able to withstand a load that is at least twice the ultimate strength of the stabilizer tie.

Note: See Figure 2 in Appendix B of this section for a description of a typical intermittent stabilization system.

(f) Button-guide stabilized platforms.

(i) The platform shall comply with (b)(i) through (xiii) of this subsection.

(ii) Each guide track on the platform shall engage a minimum of two guide buttons during any vertical travel of the platform following the initial button engagement.

(iii) Each guide track on a platform that is part of a roof rigged system shall be provided with a storage position on the platform.

(iv) Each guide track on the platform shall be sufficiently maneuverable by platform occupants to permit easy engagement of the guide buttons, and easy movement into and out of its storage position on the platform.

(v) Two guide tracks shall be mounted on the platform and shall provide continuous contact with the building face.

(vi) The load carrying components of the button guide stabilization system which transmit the load into the platform shall be capable of supporting the weight of the platform, or provision shall be made in the guide track connectors or platform attachments to prevent the weight of the platform from being transmitted to the platform attachments.

Note: See Figure 3 in Appendix B of this section for a description of a typical button guide stabilization system.

(6) Supported equipment.

(a) Supported equipment shall maintain a vertical position in respect to the face of the building by means other than friction.

(b) Cog wheels or equivalent means shall be incorporated to provide climbing traction between the supported equipment and the building guides. Additional guide wheels or shoes shall be incorporated as may be necessary to ensure that the drive wheels are continuously held in positive engagement with the building guides.

(c) Launch guide mullions indexed to the building guides and retained in alignment with the building guides shall be used to align drive wheels entering the building guides.

(d) Manned platforms used on supported equipment shall comply with the requirements of (b)(i), (ii), and (iv) through (xi) of this subsection, covering suspended equipment.

(7) Suspension wire ropes and rope connections.

(a) Each specific installation shall use suspension wire ropes or combination cable and connections meeting the specification recommended by the manufacturer of the hoisting machine used. Connections shall be capable of develop-

ing at least 80 percent of the rated breaking strength of the wire rope.

(b) Each suspension rope shall have a "Design Factor" of at least 10. The "Design Factor" is the ratio of the rated strength of the suspension wire rope to the rated working load, and shall be calculated using the following formula:

$$F = \frac{S(N)}{W}$$

Where:

F= Design factor

S= Manufacturer's rated strength of one suspension rope

N= Number of suspension ropes under load

W= Rated working load on all ropes at any point of travel

(c) Suspension wire rope grade shall be at least improved plow steel or equivalent.

(d) Suspension wire ropes shall be sized to conform with the required design factor, but shall not be less than 5/16 inch (7.94 mm) in diameter.

(e) No more than one reverse bend in 6 wire rope lays shall be permitted.

(f) A corrosion-resistant tag shall be securely attached to one of the wire rope fastenings when a suspension wire rope is to be used at a specific location and will remain in that location. This tag shall bear the following wire rope data:

(i) The diameter (inches and/or mm);

(ii) Construction classification;

(iii) Whether nonpreformed or preformed;

(iv) The grade of material;

(v) The manufacturer's rated strength;

(vi) The manufacturer's name;

(vii) The month and year the ropes were installed; and

(viii) The name of the person or company which installed the ropes.

(g) A new tag shall be installed at each rope renewal.

(h) The original tag shall be stamped with the date of the resocketing, or the original tag shall be retained and a supplemental tag shall be provided when ropes are resocketed. The supplemental tag shall show the date of resocketing and the name of the person or company that resocketed the rope.

(i) Winding drum type hoists shall contain at least 3 wraps of the suspension wire rope on the drum when the suspended unit has reached the lowest possible point of its vertical travel.

(j) Traction drum and sheave type hoists shall be provided with a wire rope of sufficient length to reach the lowest possible point of vertical travel of the suspended unit, and an additional length of the wire rope of at least 4 feet (1.2 m).

(k) The lengthening or repairing of suspension wire ropes is prohibited.

(l) Babbitted fastenings for suspension wire rope are prohibited.

(8) Control circuits, power circuits and their components.

(a) Electrical wiring and equipment shall comply with Part L of chapter 296-24 WAC, except as otherwise required by this section.

(b) Electrical runway conductor systems shall be of a type designed for use in exterior locations, and shall be

located so that they do not come into contact with accumulated snow or water.

(c) Cables shall be protected against damage resulting from over-tensioning or from other causes.

(d) Devices shall be included in the control system for the equipment which will provide protection against electrical overloads, three phase reversal and phase failure. The control system shall have a separate method, independent of the direction control circuit, for breaking the power circuit in case of an emergency or malfunction.

(e) Suspended or supported equipment shall have a control system which will require the operator of the equipment to follow predetermined procedures.

(f) The following requirements shall apply to electrical protection devices:

(i) On installations where the carriage does not have a stability factor of at least 4 against overturning, electrical contract(s) shall be provided and so connected that the operating devices for the suspended or supported equipment shall be operative only when the carriage is located and mechanically retained at an established operating point.

(ii) Overload protection shall be provided in the hoisting or suspension system to protect against the equipment operating in the "up" direction with a load in excess of 125 percent of the rated load of the platform; and

(iii) An automatic detector shall be provided for each suspension point that will interrupt power to all hoisting motors for travel in the "down" direction, and apply the primary brakes if any suspension wire rope becomes slack. A continuous-pressure rigging-bypass switch designed for use during rigging is permitted. This switch shall only be used during rigging.

(g) Upper and lower directional switches designed to prevent the travel of suspended units beyond safe upward and downward levels shall be provided.

(h) Emergency stop switches shall be provided on remote controlled, roof-powered manned platforms adjacent to each control station on the platform.

(i) Cables which are in constant tension shall have overload devices which will prevent the tension in the cable from interfering with the load limiting device required in (f)(ii) of this subsection, or with the platform roll limiting device required in subsection (5)(b)(iii) of this section. The setting of these devices shall be coordinated with other overload settings at the time of design of the system, and shall be clearly indicated on or near the device. The device shall interrupt the equipment travel in the "down" direction.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-87013, filed 7/20/94, effective 9/20/94; 90-09-026 (Order 90-01), § 296-24-87013, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87015 Maintenance. (1) General maintenance. All parts of the equipment affecting safe operation shall be maintained in proper working order so that they may perform the functions for which they were intended. The equipment shall be taken out of service when it is not in proper working order.

(2) Cleaning.

(a) Control or power contactors and relays shall be kept clean.

(b) All other parts shall be kept clean if their proper functioning would be affected by the presence of dirt or other contaminants.

(3) Periodic resocketing of wire rope fastenings.

(a) Hoisting ropes utilizing poured socket fastenings shall be resocketed at the nondrum ends at intervals not exceeding 24 months. In resocketing the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(b) Resocketed ropes shall conform to the requirements of WAC 296-24-87013(7).

(c) Limit switches affected by the resocketed ropes shall be reset, if necessary.

(4) Periodic reshackling of suspension wire ropes. The hoisting ropes shall be reshackled at the nondrum ends at intervals not exceeding 24 months. When reshackling the ropes, a sufficient length shall be cut from the end of the rope to remove damaged or fatigued portions.

(5) Roof systems. Roof track systems, tie-downs, or similar equipment shall be maintained in proper working order so that they perform the function for which they were intended.

(6) Building face guiding members. T-rails, indented mullions, or equivalent guides located in the face of a building shall be maintained in proper working order so that they perform the functions for which they were intended. Brackets for cable stabilizers shall similarly be maintained in proper working order.

(7) Inoperative safety devices. No person shall render a required safety device or electrical protective device inoperative, except as necessary for tests, inspections, and maintenance. Immediately upon completion of such tests, inspections, and maintenance, the device shall be restored to its normal operating condition.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-87015, filed 7/20/94, effective 9/20/94; 90-09-026 (Order 90-01), § 296-24-87015, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87017 Operations. (1) Training.

(a) Working platforms shall be operated only by persons who are proficient in the operation, safe use and inspection of the particular working platform to be operated.

(b) All employees who operate working platforms shall be trained in the following:

(i) Recognition of, and preventive measures for, the safety hazards associated with their individual work tasks.

(ii) General recognition and prevention of safety hazards associated with the use of working platforms, including the provisions in the section relating to the particular working platform to be operated.

(iii) Emergency action plan procedures required in WAC 296-24-87011(9).

(iv) Work procedures required in (d) of this subsection.

(v) Personal fall arrest system inspection, care, use and system performance.

(c) Training of employees in the operation and inspection of working platforms shall be done by a competent person.

(d) Written work procedures for the operation, safe use and inspection of working platforms shall be provided for

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employee training. Pictorial methods of instruction, may be used, in lieu of written work procedures, if employee communication is improved using this method. The operating manuals supplied by manufacturers for platform system components can serve as the basis for these procedures.

(e) The employer shall certify that employees have been trained in operating and inspecting a working platform by preparing a certification record which includes the identity of the person trained, the signature of the employer or the person who conducted the training and the date that training was completed. The certification record shall be prepared at the completion of the training required in (b) of this subsection, and shall be maintained in a file for the duration of the employee's employment. The certification record shall be kept readily available for review by the director or an authorized representative.

(2) Use.

(a) Working platforms shall not be loaded in excess of the rated load, as stated on the platform load rating plate.

(b) Employees shall be prohibited from working on snow, ice, or other slippery material covering platforms, except for the removal of such materials.

(c) Adequate precautions shall be taken to protect the platform, wire ropes and life lines from damage due to acids or other corrosive substances, in accordance with the recommendations of the corrosive substance producer, supplier, platform manufacturer or other equivalent information sources. Platform members which have been exposed to acids or other corrosive substances shall be washed down with a neutralizing solution, at a frequency recommended by the corrosive substance producer or supplier.

(d) Platform members, wire ropes and life lines shall be protected when using a heat producing process. Wire ropes and life lines which have been contacted by the heat producing process shall be considered to be permanently damaged and shall not be used.

(e) The platform shall not be operated in winds in excess of 25 miles per hour (40.2 km/hr) except to move it from an operating to a storage position. Wind speed shall be determined based on the best available information, which includes on-site anemometer readings and local weather forecasts which predict wind velocities for the area.

(f) On exterior installations, an anemometer shall be mounted on the platform to provide information of on-site wind velocities prior to and during the use of the platform. The anemometer may be a portable (hand held) unit which is temporarily mounted during platform use.

(g) Tools, materials and debris not related to the work in progress shall not be allowed to accumulate on platforms. Stabilizer ties shall be located so as to allow unencumbered passage along the full length of the platform and shall be of such length so as not to become entangled in rollers, hoists or other machinery.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-87017, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87019 Personal fall protection. Employees on working platforms shall be protected by a personal fall arrest system meeting the requirements of Appendix C, Part

I, WAC 296-24-87035 of this standard, and as otherwise provided by this standard.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-87019, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87031 Appendix A—Guidelines (advisory). (1) Use of the appendix. Appendix A provides examples of equipment and methods to assist the employer in meeting the requirements of the indicated provision of the standard. Employers may use other equipment or procedures which conform to the requirements of the standard. This appendix neither adds to nor detracts from the mandatory requirements set forth in WAC 296-24-870 through 296-24-87037.

(2) Assurance. WAC 296-24-870(3) requires the building owner to inform the employer in writing that the powered platform installation complies with certain requirements of the standard, since the employer may not have the necessary information to make these determinations. The employer, however, remains responsible for meeting these requirements which have not been set off in WAC 296-24-870 (3)(a).

(3) Design requirements. The design requirements for each installation should be based on the limitations (stresses, deflections, etc.), established by nationally recognized standards as promulgated by the following organizations, or to equivalent standards:

AA—The Aluminum Association, 900 19th Street Northwest, Suite 300, Washington, D.C. 20006
Aluminum Construction Manual
Specifications for Aluminum Structures
Aluminum Standards and Data

AGMA—American Gear Manufacturers Association, 1500 King Street, Suite 201, Alexandria, VA 22314

AISC—American Institute of Steel Construction, 1 East Wacker Drive, Suite 3100, Chicago, IL 60601-2001

ANSI—American National Standards Institute, Inc., 11 West 42nd Street, New York, NY 10036

ASCE—American Society of Civil Engineers, 345 East 47th Street, New York, NY 10017

ASME—American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017

ASTM—American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103-1187

AWS—American Welding Society, Inc., Box 351040, 550 N.W. LeJeune Road, Miami, FL 33126

NEMA—National Electric Manufacturers Association, 2101 L Street N.W., Washington, D.C. 20037

(4) Tie-in guides. Indented mullions, T-rails or other equivalent guides are acceptable as tie-in guides in a building face for a continuous stabilization system. Internal guides are embedded in other building members with only the opening exposed (see Figure 1 of Appendix B). External guides, however, are installed external to the other building members and so are fully exposed. The minimum opening for tie-in guides is three-quarters of an inch (19 mm), and the minimum inside dimensions are one-inch (25 mm) deep and two inches (50 mm) wide.

Employers should be aware of the hazards associated with tie-in guides in a continuous stabilization system which was not designed properly. For example, joints in these track systems may become extended or discontinuous due to installation or building settlement. If this alignment problem is not corrected, the system could jam when a guide roller or guide shoe strikes a joint and this would cause a hazardous situation for employees. In another instance, faulty design will result in guide rollers being mounted in a line so they will jam in the track at the slightest misalignment.

(5) Building anchors (intermittent stabilization system). In the selection of the vertical distance between building anchors, certain factors should be given consideration. These factors include building height and architectural design, platform length and weight, wire rope angulation, and the wind velocities in the building area. Another factor to consider is the material of the building face, since this material may be adversely affected by the building rollers.

External or indented type building anchors are acceptable. Receptacles in the building facade used for the indented type should be kept clear of extraneous materials which will hinder their use. During the inspection of the platform installation, evidence of a failure or abuse of the anchors should be brought to the attention of the employer.

(6) Stabilizer tie length. A stabilizer tie should be long enough to provide for the planned angulation of the suspension cables. However, the length of the tie should not be excessive and become a problem by possibly becoming entangled in the building face rollers or parts of the platform machinery.

The attachment length may vary due to material elongation and this should be considered when selecting the material to be used. Consideration should also be given to the use of ties which are easily installed by employees, since this will encourage their use.

(7) Intermittent stabilization system. Intermittent stabilization systems may use different equipment, tie-in devices and methods to restrict the horizontal movement of a powered platform with respect to the face of the building. One acceptable method employs corrosion-resistant building anchors secured in the face of the building in vertical rows every third floor or 50 feet (15.3 m), whichever is less. The anchors are spaced horizontally to allow a stabilization attachment (stabilizer tie) for each of the two platform suspension wire ropes. The stabilizer tie consists of two parts. One part is a quick connect-quick disconnect device which utilizes a corrosion-resistant yoke and retainer spring that is designed to fit over the building anchors. The second part of the stabilizer tie is a lanyard which is used to maintain a fixed distance between the suspension wire rope and the face of the building.

In this method, as the suspended powered platform descends past the elevation of each anchor, the descent is halted and each of the platform occupants secures a stabilizer tie between a suspension wire rope and a building anchor. The procedure is repeated as each elevation of a building anchor is reached during the descent of the powered platform.

As the platform ascends, the procedure is reversed; that is, the stabilizer ties are removed as each elevation of a building anchor is reached. The removal of each stabilizer tie is

assured since the platform is provided with stopping devices which will interrupt power to its hoist(s) in the event either stopping device contacts a stabilizer during the ascent of the platform.

Figure 2 of Appendix B illustrates another type of acceptable intermittent stabilization system which utilizes retaining pins as the quick connect-quick disconnect device in the stabilizer tie.

(8) Wire rope inspection. The inspection of the suspension wire rope is important since the rope gradually loses strength during its useful life. The purpose of the inspection is to determine whether the wire rope has sufficient integrity to support a platform with the required design factor.

If there is any doubt concerning the condition of a wire rope or its ability to perform the required work, the rope should be replaced. The cost of wire rope replacement is quite small if compared to the cost in terms of human injuries, equipment down time and replacement.

No listing of critical inspection factors, which serve as a basis for wire rope replacement in the standard, can be a substitute for an experienced inspector of wire rope. The listing serves as a user's guide to the accepted standards by which ropes must be judged.

Rope life can be prolonged if preventive maintenance is performed regularly. Cutting off an appropriate length of rope at the end termination before the core degrades and valley brakes appear minimizes degradation at these sections.

(9) General maintenance. In meeting the general maintenance requirement in WAC 296-24-87015(1), the employer should undertake the prompt replacement of broken, worn and damaged parts, switch contacts, brushes, and short flexible conductors of electrical devices. The components of the electrical service system and traveling cables should be replaced when damaged or significantly abraded. In addition, gears, shafts, bearings, brakes and hoisting drums should be kept in proper alignment.

(10) Training. In meeting the training requirement of WAC 296-24-87017(1), employers should use both on the job training and formal classroom training. The written work procedures used for this training should be obtained from the manufacturer, if possible, or prepared as necessary for the employee's information and use.

Employees who will operate powered platforms with intermittent stabilization systems should receive instruction in the specific ascent and descent procedures involving the assembly and disassembly of the stabilizer ties.

An acceptable training program should also include employee instruction in basic inspection procedures for the purpose of determining the need for repair and replacement of platform equipment. In addition, the program should cover the inspection, care and use of the personal fall protection equipment required in Appendix C, Part I, subsections (5) and (6).

In addition, the training program should also include emergency action plan elements. OSHA brochure #3088 (Rev.) 1985, "How to Prepare for Workplace Emergencies," details the basic steps needed to prepare to handle emergencies in the workplace.

Following the completion of a training program, the employee should be required to demonstrate competency in

operating the equipment safely. Supplemental training of the employee should be provided by the employer, as necessary, if the equipment used or other working conditions should change.

An employee who is required to work with chemical products on a platform should receive training in proper cleaning procedures, and in the hazards, care and handling of these products. In addition, the employee should be supplied with the appropriate personal protective equipment, such as gloves and eye and face protection.

(11) Suspension and securing of powered platforms (equivalency). One acceptable method of demonstrating the equivalency of a method of suspending or securing a powered platform, as required in WAC 296-24-87011 (2)(c), 296-24-87013(3), and (5)(a)(vi), is to provide an engineering analysis by a registered professional engineer. The analysis should demonstrate that the proposed method will provide an equal or greater degree of safety for employees than any one of the methods specified in the standard.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-87031, filed 7/20/94, effective 9/20/94; 90-09-026 (Order 90-01), § 296-24-87031, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87033 Appendix B—Exhibits (advisory).

The three drawings in Appendix B illustrate typical platform stabilization systems which are addressed in the standard. The drawings are to be used for reference purposes only, and do not illustrate all the mandatory requirements for each system.

Figure 1. Typical Self-Powered Platform—Continuous External or Indented Mullion Guide System

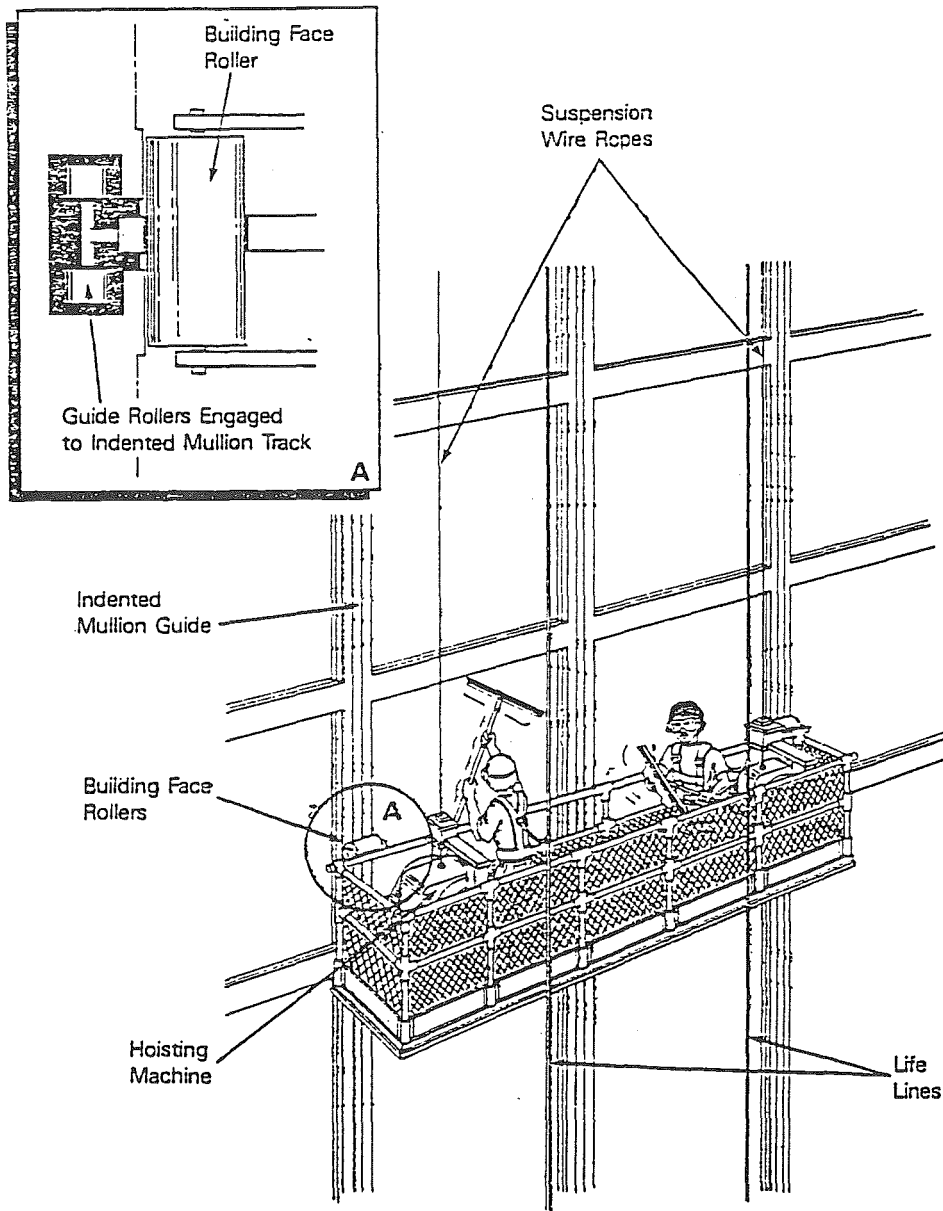


Figure 2. Typical Self-Powered Platform—Intermittent Tie-In System

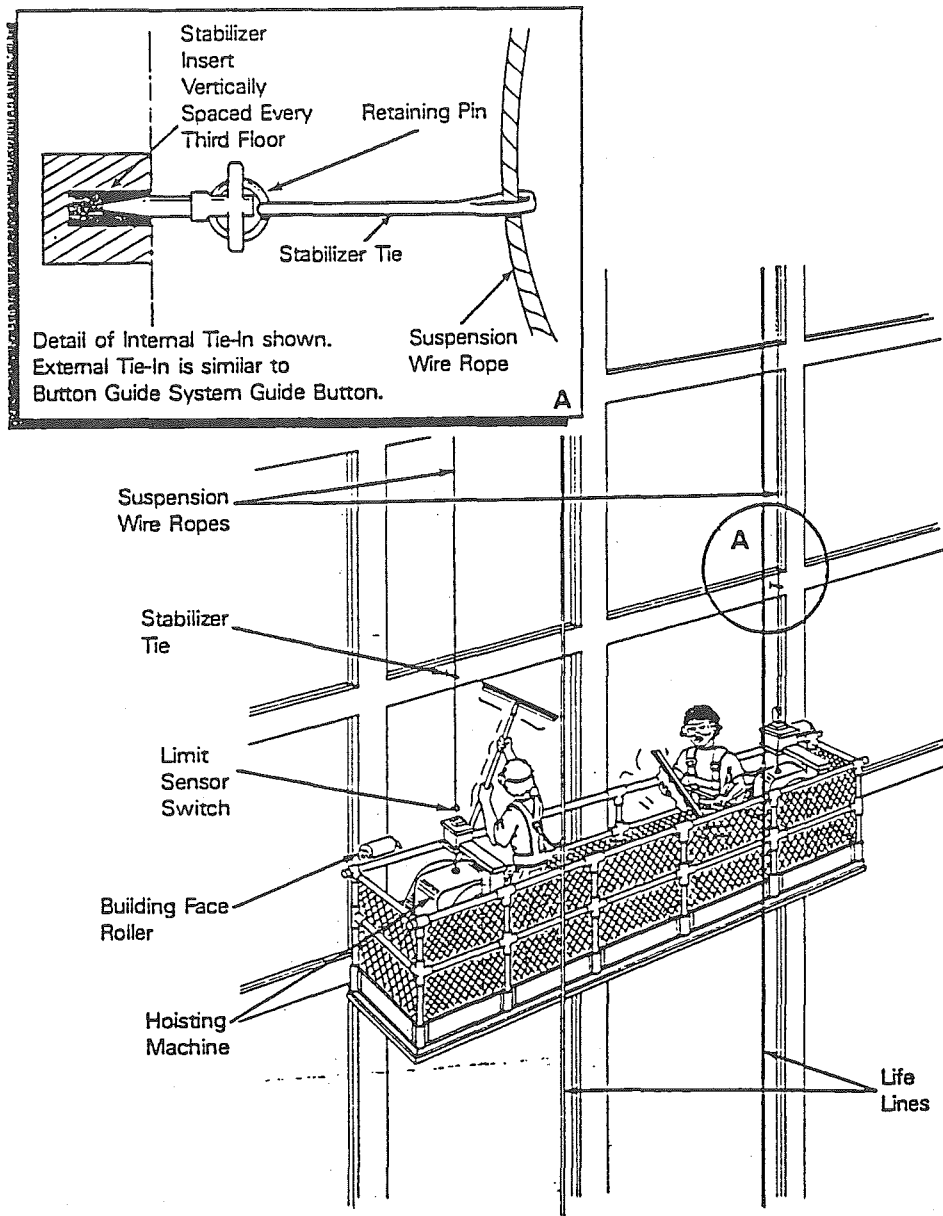
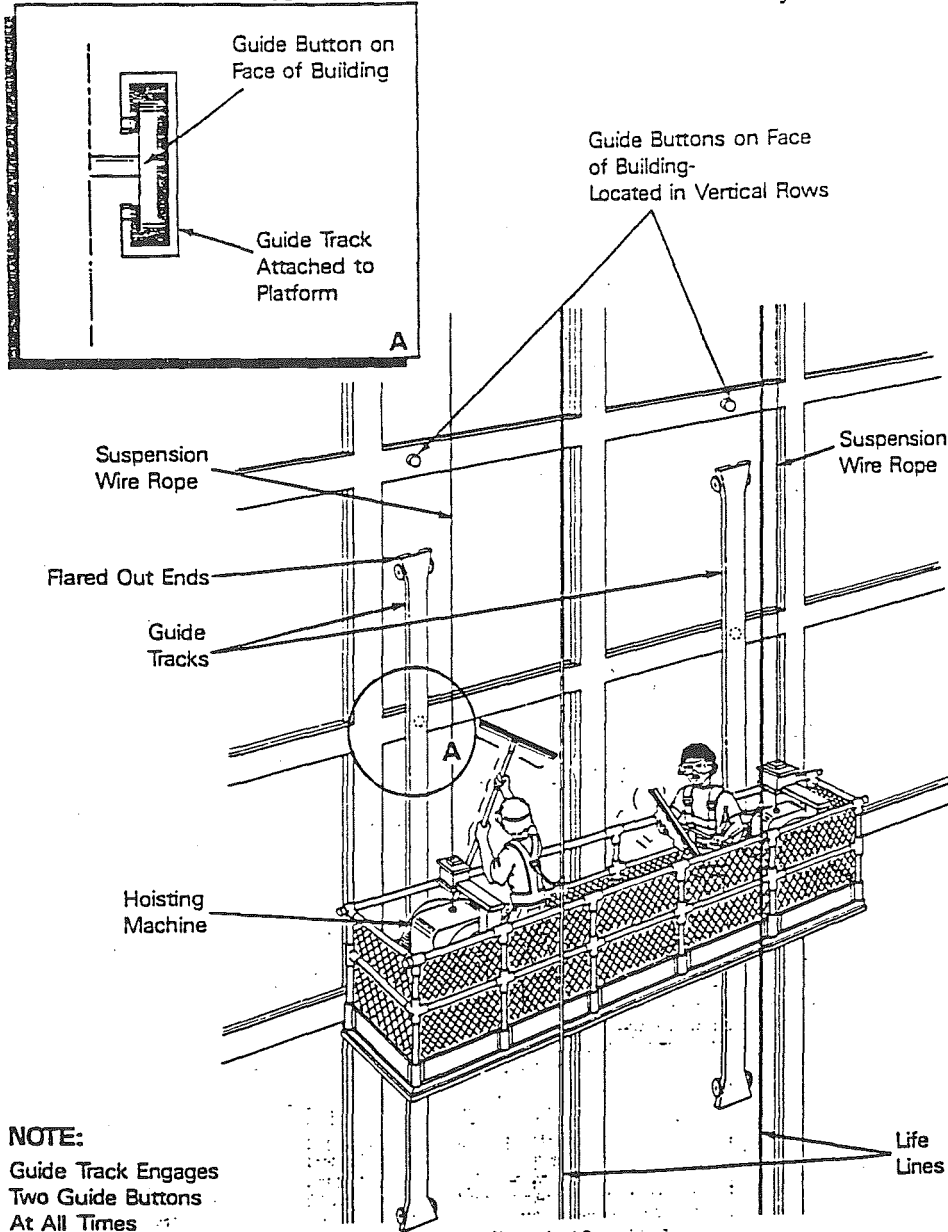


Figure 3. Typical Self-Powered Platform—Button Guide System



NOTE:
 Guide Track Engages
 Two Guide Buttons
 At All Times

BILLING CODE 4510-26-C

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-87033, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87035 Appendix C—Personal fall arrest system (Part I—Mandatory; Parts II and III—Nonmandatory). (1) Use of the appendix.

Part I of Appendix C sets out the mandatory criteria for personal fall arrest systems used by all employees using powered platforms. Part II sets out nonmandatory test procedures which may be used to determine compliance with applicable requirements contained in Part I of this appendix. Part III provides nonmandatory guidelines which are intended to assist employers in complying with these provisions.

PART I

Personal fall arrest systems (mandatory)—(1) Scope and application. This section establishes the application of and performance criteria for personal fall arrest systems which are required for use by all employees using powered platforms under WAC 296-24-87019.

(2) Definitions.

(a) Anchorage. A secure point of attachment for lifelines, lanyards or deceleration devices, and which is independent of the means of supporting or suspending the employee.

(b) Body harness. A design of straps which may be secured about the employee in a manner to distribute the fall arrest forces over at least the thighs, pelvis, waist, chest and shoulders with means for attaching it to other components of a personal fall arrest system.

(c) Buckle. Any device for holding the body harness closed around the employee's body.

(d) **Competent person.** A person who is capable of identifying hazardous or dangerous conditions in the personal fall arrest system or any component thereof, as well as in their application and use with related equipment.

(e) **Connector.** A device which is used to couple (connect) parts of the system together. It may be an independent component of the system (such as a carabiner), or an integral component of part of the system (such as a buckle or dee-ring sewn into a body belt or body harness, or a snap-hook spliced or sewn to a lanyard or self-retracting lanyard).

(f) **Deceleration device.** Any mechanism, such as a rope grab, ripstitch lanyard, specially woven lanyard, tearing or deforming lanyard, or automatic self retracting-lifeline/lanyard, which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limits the energy imposed on an employee during fall arrest.

(g) **Deceleration distance.** The additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of an employee's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the employee comes to a full stop.

(h) **Equivalent.** Alternative designs, materials or methods which the employer can demonstrate will provide an equal or greater degree of safety for employees than the methods, materials or designs specified in the standard.

(i) **Free fall.** The act of falling before the personal fall arrest system begins to apply force to arrest the fall.

(j) **Free fall distance.** The vertical displacement of the fall arrest attachment point on the employee's body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance, lifeline and lanyard elongation but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

(k) **Lanyard.** A flexible line of rope, wire rope, or strap which is used to secure the body harness to a deceleration device, lifeline, or anchorage.

(l) **Lifeline.** A component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

(m) **Personal fall arrest system.** A system used to arrest an employee in a fall from a working level. It consists of an anchorage, connectors, body harness and may include a lanyard, deceleration device, lifeline, or suitable combinations of these.

(n) **Qualified person.** A person with a recognized degree or professional certificate and extensive knowledge and experience in the subject field who is capable of design, analysis, evaluation and specifications in the subject work, project, or product.

(o) **Rope grab.** A deceleration device which travels on a lifeline and automatically frictionally engages the lifeline and

locks so as to arrest the fall of an employee. A rope grab usually employs the principle of inertial locking, cam/lever locking, or both.

(p) **Self-retracting lifeline/lanyard.** A deceleration device which contains a drum-wound line which may be slowly extracted from, or retracted onto, the drum under slight tension during normal employee movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

(q) **Snap-hook.** A connector comprised of a hookshaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snap-hooks are generally one of two types:

(i) The locking type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection, or

(ii) The nonlocking type with a self-closing keeper which remains closed until pressed open for connection or disconnection.

(r) **Tie-off.** The act of an employee, wearing personal fall protection equipment, connecting directly or indirectly to an anchorage. It also means the condition of an employee being connected to an anchorage.

(3) **Design for system components.**

(a) Connectors shall be drop forged, pressed or formed steel, or made of equivalent materials.

(b) Connectors shall have a corrosion-resistant finish, and all surfaces and edges shall be smooth to prevent damage to interfacing parts of the system.

(c) Lanyards and vertical lifelines which tie-off one employee shall have a minimum breaking strength of 5,000 pounds (22.2 kN).

(d) Self-retracting lifelines and lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less shall have components capable of sustaining a minimum static tensile load of 3,000 pounds (13.3 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(e) Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet (0.61 m) or less, ripstitch lanyards, and tearing and deforming lanyards shall be capable of sustaining a minimum tensile load of 5,400 pounds (23.9 kN) applied to the device with the lifeline or lanyard in the fully extended position.

(f) Dee-rings and snap-hooks shall be capable of sustaining a minimum tensile load of 5000 pounds (22.2 N).

(g) Dee-rings and snap-hooks shall be 100 percent proof-tested to a minimum tensile load of 3600 pounds (16 kN) without cracking, breaking, or taking permanent deformation.

(h) Snap-hooks shall be sized to be compatible with the member to which they are connected so as to prevent unintentional disengagement of the snap-hook by depression of the snap-hook keeper by the connected member, or shall be a locking type snap-hook designed and used to prevent disengagement of the snap-hook by the contact of the snap-hook keeper by the connected member.

(i) Horizontal lifelines, where used, shall be designed, and installed as part of a complete personal fall arrest system,

which maintains a safety factor of at least 2, under the supervision of a qualified person.

(j) Anchorages to which personal fall arrest equipment is attached shall be capable of supporting at least 5,000 pounds (22.2 kN) per employee attached, or shall be designed, installed, and used as part of a complete personal fall arrest system which maintains a safety factor of at least two, under the supervision of a qualified person.

(k) Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body harnesses, shall be made from synthetic fibers or wire rope.

(4) System performance criteria.

(a) Personal fall arrest systems shall, when stopping a fall:

(i) Limit maximum arresting force on an employee to 1,800 pounds (8 kN) when used with a body harness;

(ii) Bring an employee to a complete stop and limit maximum deceleration distance an employee travels to 3.5 feet (1.07 m); and

(iii) Shall have sufficient strength to withstand twice the potential impact energy of an employee free falling a distance of 6 feet (1.8 m), or the free fall distance permitted by the system, whichever is less.

(b) (i) When used by employees having a combined person and tool weight of less than 310 pounds (140 kg), personal fall arrest systems which meet the criteria and protocols contained in subsections (2), (3), and (4) in Part II of this appendix shall be considered as complying with the provisions of (a) of this subsection.

(ii) When used by employees having a combined tool and body weight of 310 pounds (140 kg) or more, personal fall arrest systems which meet the criteria and protocols contained in subsections (2), (3), and (4) of Part II may be considered as complying with the provisions of (a) of this subsection provided that the criteria and protocols are modified appropriately to provide proper protection for such heavier weights.

(5) Care and use.

(a) Snap-hooks, unless of a locking type designed and used to prevent disengagement from the following connections, shall not be engaged:

(i) Directly to webbing, rope or wire rope;

(ii) To each other;

(iii) To a dee-ring to which another snap-hook or other connector is attached;

(iv) To a horizontal lifeline; or

(v) To any object which is incompatibly shaped or dimensioned in relation to the snap-hook such that the connected object could depress the snap-hook keeper a sufficient amount to release itself.

(b) Devices used to connect to a horizontal lifeline which may become a vertical lifeline shall be capable of locking in either direction on the lifeline.

(c) Personal fall arrest systems shall be rigged such that an employee can neither free fall more than 6 feet (1.8 m), nor contact any lower level.

(d) The attachment point of the body harness shall be located in the center of the wearer's back near shoulder level, or above the wearer's head.

(e) When vertical lifelines are used, each employee shall be provided with a separate lifeline.

(f) Personal fall arrest systems or components shall be used only for employee fall protection.

(g) Personal fall arrest systems or components subjected to impact loading shall be immediately removed from service and shall not be used again for employee protection unless inspected and determined by a competent person to be undamaged and suitable for reuse.

(h) The employer shall provide for prompt rescue of employees in the event of a fall or shall assure the self-rescue capability of employees.

(i) Before using a personal fall arrest system, and after any component or system is changed, employees shall be trained in accordance with the requirements of WAC 296-24-87017(1), in the safe use of the system.

(6) Inspections. Personal fall arrest systems shall be inspected prior to each use for mildew, wear, damage and other deterioration, and defective components shall be removed from service if their strength or function may be adversely affected.

PART II

Test methods for personal fall arrest systems (nonmandatory)

(1) General. Subsections (2), (3), (4) and (5) of this Part II set forth test procedures which may be used to determine compliance with the requirements in subsection (4) of Part I of this appendix.

(2) General conditions for all tests in Part II.

(a) Lifelines, lanyards and deceleration devices should be attached to an anchorage and connected to the body harness in the same manner as they would be when used to protect employees.

(b) The anchorage should be rigid, and should not have a deflection greater than .04 inches (1 mm) when a force of 2,250 pounds (10 kN) is applied.

(c) The frequency response of the load measuring instrumentation should be 120 Hz.

(d) The test weight used in the strength and force tests should be a rigid, metal, cylindrical or torso-shaped object with a girth of 38 inches plus or minus 4 inches (96 cm plus or minus 10 cm).

(e) The lanyard or lifeline used to create the free fall distance should be supplied with the system, or in its absence, the least elastic lanyard or lifeline available to be used with the system.

(f) The test weight for each test should be hoisted to the required level and should be quickly released without having any appreciable motion imparted to it.

(g) The system's performance should be evaluated taking into account the range of environmental conditions for which it is designed to be used.

(h) Following the test, the system need not be capable of further operation.

(3) Strength test.

(a) During the testing of all systems, a test weight of 300 pounds plus or minus 5 pounds (135 kg plus or minus 2.5 kg) should be used. (See subsection (2)(d) of this part.)

(b) The test consists of dropping the test weight once. A new unused system should be used for each test.

(c) For lanyard systems, the lanyard length should be 6 feet plus or minus 2 inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body belt or body harness.

(d) For rope-grab-type deceleration systems, the length of the lifeline above the centerline of the grabbing mechanism to the lifeline's anchorage point should not exceed 2 feet (0.61 m).

(e) For lanyard systems, for systems with deceleration devices which do not automatically limit free fall distance to 2 feet (0.61 m) or less, and for systems with deceleration devices which have a connection distance in excess of one foot (0.3 m) (measured between the centerline of the lifeline and the attachment point to the body harness), the test weight should be rigged to free fall a distance of 7.5 feet (2.3 m) from a point that is 1.5 feet (46 cm) above the anchorage point, to its hanging location (6 feet below the anchorage). The test weight should fall without interference, obstruction, or hitting the floor or ground during the test. In some cases a nonelastic wire lanyard of sufficient length may need to be added to the system (for test purposes) to create the necessary free fall distance.

(f) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should be rigged to free fall a distance of 4 feet (1.22 m).

(g) Any weight which detaches from the harness should constitute failure for the strength test.

(4) Force test.

(a) General. The test consists of dropping the respective test weight specified in (b)(i) or (c)(i) of this subsection once. A new, unused system should be used for each test.

(b) For lanyard systems.

(i) A test weight of 220 pounds plus or minus three pounds (100 kg plus or minus 1.6 kg) should be used. (See subsection (2)(d) above.)

(ii) Lanyard length should be 6 feet plus or minus 2 inches (1.83 m plus or minus 5 cm) as measured from the fixed anchorage to the attachment on the body harness.

(iii) The test weight should fall free from the anchorage level to its hanging location (a total of 6 feet (1.83 m) free fall distance) without interference, obstruction, or hitting the floor or ground during the test.

(c) For all other systems.

(i) A test weight of 220 pounds plus or minus 3 pounds (100 kg plus or minus 1.6 kg) should be used. (See subsection (2)(d) above.)

(ii) The free fall distance to be used in the test should be the maximum fall distance physically permitted by the system during normal use conditions, up to a maximum free fall distance for the test weight of 6 feet (1.83 m), except as follows:

(A) For deceleration systems which have a connection link or lanyard, the test weight should free fall a distance equal to the connection distance (measured between the centerline of the lifeline and the attachment point to the body harness).

(B) For deceleration device systems with integral lifelines or lanyards which automatically limit free fall distance to 2 feet (0.61 m) or less, the test weight should free fall a distance equal to that permitted by the system in normal use. (For example, to test a system with a self-retracting lifeline or lanyard, the test weight should be supported and the system allowed to retract the lifeline or lanyard as it would in normal use. The test weight would then be released and the force and deceleration distance measured).

(d) A system fails the force test if the recorded maximum arresting force exceeds 2,520 pounds (11.2 kN) when using a body harness.

(e) The maximum elongation and deceleration distance should be recorded during the force test.

(5) Deceleration device tests.

(a) General. The device should be evaluated or tested under the environmental conditions, (such as rain, ice, grease, dirt, type of lifeline, etc.), for which the device is designed.

(b) Rope-grab-type deceleration devices.

(i) Devices should be moved on a lifeline 1,000 times over the same length of line a distance of not less than one foot (30.5 cm), and the mechanism should lock each time.

(ii) Unless the device is permanently marked to indicate the type(s) of lifeline which must be used, several types (different diameters and different materials), of lifelines should be used to test the device.

(c) Other self-activating-type deceleration devices. The locking mechanisms of other self-activating-type deceleration devices designed for more than one arrest should lock each of 1,000 times as they would in normal service.

PART III

Additional nonmandatory guidelines for personal fall arrest systems. The following information constitutes additional guidelines for use in complying with requirements for a personal fall arrest system.

(1) Selection and use considerations. The kind of personal fall arrest system selected should match the particular work situation, and any possible free fall distance should be kept to a minimum. Consideration should be given to the particular work environment. For example, the presence of acids, dirt, moisture, oil, grease, etc., and their effect on the system, should be evaluated. Hot or cold environments may also have an adverse affect on the system. Wire rope should not be used where an electrical hazard is anticipated. As required by the standard, the employer must plan to have means available to promptly rescue an employee should a fall occur, since the suspended employee may not be able to reach a work level independently.

Where lanyards, connectors, and lifelines are subject to damage by work operations such as welding, chemical cleaning, and sandblasting, the component should be protected, or other securing systems should be used. The employer should fully evaluate the work conditions and environment (including seasonal weather changes) before selecting the appropriate personal fall protection system. Once in use, the system's effectiveness should be monitored. In some cases, a program for cleaning and maintenance of the system may be necessary.

(2) Testing considerations. Before purchasing or putting into use a personal fall arrest system, an employer should obtain from the supplier information about the system based on its performance during testing so that the employer can know if the system meets this standard. Testing should be done using recognized test methods. Part II of this Appendix C contains test methods recognized for evaluating the performance of fall arrest systems. Not all systems may need to be individually tested; the performance of some systems may be based on data and calculations derived from testing of similar systems, provided that enough information is available to demonstrate similarity of function and design.

(3) Component compatibility considerations. Ideally, a personal fall arrest system is designed, tested, and supplied as a complete system. However, it is common practice for lanyards, connectors, lifelines, deceleration devices, and body harnesses to be interchanged since some components wear out before others. The employer and employee should realize that not all components are interchangeable. For instance, a lanyard should not be connected between a body harness and a deceleration device of the self-retracting type since this can result in additional free fall for which the system was not designed. Any substitution or change to a personal fall arrest system should be fully evaluated or tested by a competent person to determine that it meets the standard, before the modified system is put in use.

(4) Employee training considerations. Thorough employee training in the selection and use of personal fall arrest systems is imperative. As stated in the standard, before the equipment is used, employees must be trained in the safe use of the system. This should include the following: Application limits; proper anchoring and tie-off techniques; estimation of free fall distance, including determination of deceleration distance, and total fall distance to prevent striking a lower level; methods of use; and inspection and storage of the system. Careless or improper use of the equipment can result in serious injury or death. Employers and employees should become familiar with the material in this Appendix, as well as manufacturer's recommendations, before a system is used. Of uppermost importance is the reduction in strength caused by certain tie-offs (such as using knots, tying around sharp edges, etc.) and maximum permitted free fall distance. Also, to be stressed are the importance of inspections prior to use, the limitations of the equipment, and unique conditions at the worksite which may be important in determining the type of system to use.

(5) Instruction considerations. Employers should obtain comprehensive instructions from the supplier as to the system's proper use and application, including, where applicable:

- (a) The force measured during the sample force test;
- (b) The maximum elongation measured for lanyards during the force test;
- (c) The deceleration distance measured for deceleration devices during the force test;
- (d) Caution statements on critical use limitations;
- (e) Application limits;
- (f) Proper hook-up, anchoring and tie-off techniques, including the proper dee-ring or other attachment point to use on the body harness for fall arrest;

- (g) Proper climbing techniques;
 - (h) Methods of inspection, use, cleaning, and storage;
- and

(i) Specific lifelines which may be used. This information should be provided to employees during training.

(6) Inspection considerations. As stated in WAC 296-24-87035(6), personal fall arrest systems must be regularly inspected. Any component with any significant defect, such as cuts, tears, abrasions, mold, or undue stretching; alterations or additions which might affect its efficiency; damage due to deterioration; contact with fire, acids, or other corrosives; distorted hooks or faulty hook springs; tongues unfitted to the shoulder of buckles; loose or damaged mountings; non-functioning parts; or wearing or internal deterioration in the ropes must be withdrawn from service immediately, and should be tagged or marked as unusable, or destroyed.

(7) Rescue considerations. As required by WAC 296-24-87035 (5)(h) when personal fall arrest systems are used, the employer must assure that employees can be promptly rescued or can rescue themselves should a fall occur. The availability of rescue personnel, ladders or other rescue equipment should be evaluated. In some situations, equipment which allows employees to rescue themselves after the fall has been arrested may be desirable, such as devices which have descent capability.

(8) Tie-off considerations.

(a) One of the most important aspects of personal fall protection systems is fully planning the system before it is put into use. Probably the most overlooked component is planning for suitable anchorage points. Such planning should ideally be done before the structure or building is constructed so that anchorage points can be incorporated during construction for use later for window cleaning or other building maintenance. If properly planned, these anchorage points may be used during construction, as well as afterwards.

(b) Employers and employees should at all times be aware that the strength of a personal fall arrest system is based on its being attached to an anchoring system which does not significantly reduce the strength of the system (such as a properly dimensioned eye-bolt/snap-hook anchorage). Therefore, if a means of attachment is used that will reduce the strength of the system, that component should be replaced by a stronger one, but one that will also maintain the appropriate maximum arrest force characteristics.

(c) Tie-off using a knot in a rope lanyard or lifeline (at any location) can reduce the lifeline or lanyard strength by 50 percent or more. Therefore, a stronger lanyard or lifeline should be used to compensate for the weakening effect of the knot, or the lanyard length should be reduced (or the tie-off location raised) to minimize free fall distance, or the lanyard or lifeline should be replaced by one which has an appropriately incorporated connector to eliminate the need for a knot.

(d) Tie-off of a rope lanyard or lifeline around an "H" or "I" beam or similar support can reduce its strength as much as 70 percent due to the cutting action of the beam edges. Therefore, use should be made of a webbing lanyard or wire core lifeline around the beam; or the lanyard or lifeline should be protected from the edge; or free fall distance should be greatly minimized.

(e) Tie-off where the line passes over or around rough or sharp surfaces reduces strength drastically. Such a tie-off should be avoided or an alternative tie-off rigging should be used. Such alternatives may include use of a snap-hook/dee-ring connection, wire rope tie-off, an effective padding of the surfaces, or an abrasion-resistance strap around or over the problem surface.

(f) Horizontal lifelines may, depending on their geometry and angle of sag, be subjected to greater loads than the impact load imposed by an attached component. When the angle of horizontal lifeline sag is less than 30 degrees, the impact force imparted to the lifeline by an attached lanyard is greatly amplified. For example, with a sag angle of 15 degrees, the force amplification is about 2:1 and at 5 degrees sag, it is about 6:1. Depending on the angle of sag, and the line's elasticity, the strength of the horizontal lifeline and the anchorages to which it is attached should be increased a number of times over that of the lanyard. Extreme care should be taken in considering a horizontal lifeline for multiple tie-offs. The reason for this is that in multiple tie-offs to a horizontal lifeline, if one employee falls, the movement of the falling employee and the horizontal lifeline during arrest of the fall may cause other employees to also fall. Horizontal lifeline and anchorage strength should be increased for each additional employee to be tied-off. For these and other reasons, the design of systems using horizontal lifelines must only be done by qualified persons. Testing of installed lifelines and anchors prior to use is recommended.

(g) The strength of an eye-bolt is rated along the axis of the bolt and its strength is greatly reduced if the force is applied at an angle to this axis (in the direction of shear). Also, care should be exercised in selecting the proper diameter of the eye to avoid accidental disengagement of snap-hooks not designed to be compatible for the connection.

(h) Due to the significant reduction in the strength of the lifeline/lanyard (in some cases, as much as a 70 percent reduction), the sliding hitch knot should not be used for lifeline/lanyard connections except in emergency situations where no other available system is practical. The "one-and-one" sliding hitch knot should never be used because it is unreliable in stopping a fall. The "two-and-two," or "three-and-three" knot (preferable), may be used in emergency situations; however, care should be taken to limit free fall distance to a minimum because of reduced lifeline/lanyard strength.

(9) Vertical lifeline considerations. As required by the standard, each employee must have a separate lifeline when the lifeline is vertical. The reason for this is that in multiple tie-offs to a single lifeline, if one employee falls, the movement of the lifeline during the arrest of the fall may pull other employees' lanyards, causing them to fall as well.

(10) Snap-hook considerations.

(a) Although not required by this standard for all connections, locking snap-hooks designed for connection to suitable objects (of sufficient strength) are highly recommended in lieu of the nonlocking type. Locking snap-hooks incorporate a positive locking mechanism in addition to the spring loaded keeper, which will not allow the keeper to open under moderate pressure without someone first releasing the mechanism.

Such a feature, properly designed, effectively prevents roll-out from occurring.

(b) As required by the standard WAC 296-24-87035 (5)(a) the following connections must be avoided (unless properly designed locking snap-hooks are used) because they are conditions which can result in roll-out when a nonlocking snap-hook is used:

- Direct connection of a snap-hook to a horizontal lifeline.
- Two (or more) snap-hooks connected to one dee-ring.
- Two snap-hooks connected to each other.
- A snap-hook connected back on its integral lanyard.
- A snap-hook connected to a webbing loop or webbing lanyard.
- Improper dimensions of the dee-ring, rebar, or other connection point in relation to the snap-hook dimensions which would allow the snap-hook keeper to be depressed by a turning motion of the snap-hook.

(11) Free fall considerations. The employer and employee should at all times be aware that a system's maximum arresting force is evaluated under normal use conditions established by the manufacturer, and in no case using a free fall distance in excess of 6 feet (1.8 m). A few extra feet of free fall can significantly increase the arresting force on the employee, possibly to the point of causing injury. Because of this, the free fall distance should be kept at a minimum, and, as required by the standard, in no case greater than 6 feet (1.8 m). To help assure this, the tie-off attachment point to the lifeline or anchor should be located at or above the connection point of the fall arrest equipment to harness. (Since otherwise additional free fall distance is added to the length of the connecting means (i.e. lanyard).) Attaching to the working surface will often result in a free fall greater than 6 feet (1.8 m). For instance, if a 6 foot (1.8 m) lanyard is used, the total free fall distance will be the distance from the working level to the body harness attachment point plus the 6 feet (1.8 m) of lanyard length. Another important consideration is that the arresting force which the fall system must withstand also goes up with greater distances of free fall, possibly exceeding the strength of the system.

(12) Elongation and deceleration distance considerations. Other factors involved in a proper tie-off are elongation and deceleration distance. During the arresting of a fall, a lanyard will experience a length of stretching or elongation, whereas activation of a deceleration device will result in a certain stopping distance. These distances should be available with the lanyard or device's instructions and must be added to the free fall distance to arrive at the total fall distance before an employee is fully stopped. The additional stopping distance may be very significant if the lanyard or deceleration device is attached near or at the end of a long lifeline, which may itself add considerable distance due to its own elongation. As required by the standard, sufficient distance to allow for all of these factors must also be maintained between the employee and obstructions below, to prevent an injury due to impact before the system fully arrests the fall. In addition, a minimum of 12 feet (3.7 m) of lifeline should be allowed below the securing point of a rope grab type deceleration device, and the end terminated to prevent the device from sliding off the lifeline. Alternatively, the lifeline should

extend to the ground or the next working level below. These measures are suggested to prevent the worker from inadvertently moving past the end of the lifeline and having the rope grab become disengaged from the lifeline.

(13) Obstruction considerations. The location of the tie-off should also consider the hazard of obstructions in the potential fall path of the employee. Tie-offs which minimize the possibilities of exaggerated swinging should be considered.

(14) Other considerations. Because of the design of some personal fall arrest systems, additional considerations may be required for proper tie-off. For example, heavy deceleration devices of the self-retracting type should be secured overhead in order to avoid the weight of the device having to be supported by the employee. Also, if self-retracting equipment is connected to a horizontal lifeline, the sag in the lifeline should be minimized to prevent the device from sliding down the lifeline to a position which creates a swing hazard during fall arrest. In all cases, manufacturer's instructions should be followed.

[Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-24-87035, filed 1/10/91, effective 2/12/91; 90-09-026 (Order 90-01), § 296-24-87035, filed 4/10/90, effective 5/25/90.]

WAC 296-24-87037 Appendix D—Existing installations (mandatory). (1) Use of the appendix.

Appendix D sets out the mandatory building and equipment requirements for applicable permanent installations completed after August 27, 1971, and no later than July 23, 1990 which are exempt from WAC 296-24-870 through 296-24-87013.

Note: All existing installations subject to this Appendix shall also comply with WAC 296-24-87009, 296-24-87015, 296-24-87017, 296-24-87019, and Appendix C.

(2) Definitions applicable to this appendix.

(a) Angulated roping. A system of platform suspension in which the upper wire rope sheaves or suspension points are closer to the plane of the building face than the corresponding attachment points on the platform, thus causing the platform to press against the face of the building during its vertical travel.

(b) ANSI. American National Standards Institute.

(c) Babbitted fastenings. The method of providing wire rope attachments in which the ends of the wire strands are bent back and are held in a tapered socket by means of poured molten babbitt metal.

(d) Brake—disc type. A brake in which the holding effect is obtained by frictional resistance between one or more faces of discs keyed to the rotating member to be held and fixed discs keyed to the stationary or housing member (pressure between the discs being applied axially).

(e) Brake—self-energizing band type. An essentially unidirectional brake in which the holding effect is obtained by the snubbing action of a flexible band wrapped about a cylindrical wheel or drum affixed to the rotating member to be held, the connections and linkages being so arranged that the motion of the brake wheel or drum will act to increase the tension or holding force of the band.

(f) Brake—shoe type. A brake in which the holding effect is obtained by applying the direct pressure of two or

more segmental friction elements held to a stationary member against a cylindrical wheel or drum affixed to the rotating member to be held.

(g) Building face rollers. A specialized form of guide roller designed to contact a portion of the outer face or wall structure of the building, and to assist in stabilizing the operators' platform during vertical travel.

(h) Continuous pressure. Operation by means of buttons or switches, any one of which may be used to control the movement of the working platform or roof car, only as long as the button or switch is manually maintained in the actuating position.

(i) Control. A system governing starting, stopping, direction, acceleration, speed, and retardation of moving members.

(j) Controller. A device or group of devices, usually contained in a single enclosure, which serves to control in some predetermined manner the apparatus to which it is connected.

(k) Electrical ground. A conducting connection between an electrical circuit or equipment and the earth, or some conducting body which serves in place of the earth.

(l) Guide roller. A rotating, bearing-mounted, generally cylindrical member, operating separately or as part of a guide shoe assembly, attached to the platform, and providing rolling contact with building guideways, or other building contact members.

(m) Guide shoe. An assembly of rollers, slide members, or the equivalent, attached as a unit to the operators' platform, and designed to engage with the building members provided for the vertical guidance of the operators' platform.

(n) Interlock. A device actuated by the operation of some other device with which it is directly associated, to govern succeeding operations of the same or allied devices.

(o) Operating device. A pushbutton, lever, or other manual device used to actuate a control.

(p) Powered platform. Equipment to provide access to the exterior of a building for maintenance, consisting of a suspended power-operated working platform, a roof car, or other suspension means, and the requisite operating and control devices.

(q) Rated load. The combined weight of employees, tools, equipment, and other material which the working platform is designed and installed to lift.

(r) Relay, direction. An electrically energized contactor responsive to an initiating control circuit, which in turn causes a moving member to travel in a particular direction.

(s) Relay, potential for vertical travel. An electrically energized contactor responsive to initiating control circuit, which in turn controls the operation of a moving member in both directions. This relay usually operates in conjunction with direction relays, as covered under the definition, "relay, direction."

(t) Roof car. A structure for the suspension of a working platform, providing for its horizontal movement to working positions.

(u) Roof-powered platform. A powered platform having the raising and lowering mechanism located on a roof car.

(v) Self-powered platform. A powered platform having the raising and lowering mechanism located on the working platform.

(w) Traveling cable. A cable made up of electrical or communication conductors or both, and providing electrical connection between the working platform and the roof car or other fixed point.

(x) Weatherproof. Equipment so constructed or protected that exposure to the weather will not interfere with its proper operation.

(y) Working platform. The suspended structure arranged for vertical travel which provides access to the exterior of the building or structure.

(z) Yield point. The stress at which the material exhibits a permanent set of 0.2 percent.

(aa) Zinced fastenings. The method of providing wire rope attachments in which the splayed or fanned wire ends are held in a tapered socket by means of poured molten zinc.

(3) General requirements.

(a) Design requirements. All powered platform installations for exterior building maintenance completed as of August 27, 1971, but no later than January 25, 1990, shall meet all of the design, construction and installation requirements of Part II and III of the "American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance ANSI A120.1-1970" and of this appendix. References shall be made to appropriate parts of ANSI A120.1-1970 for detail specifications for equipment and special installations.

(b) Limitation. The requirements of this appendix apply only to electric-powered platforms. It is not the intent of this appendix to prohibit the use of other types of power. Installation of powered platforms using other types of power is permitted, provided such platforms have adequate protective devices for the type of power used, and otherwise provide for reasonable safety of life and limb to users of equipment and to others who may be exposed.

(c) Types of powered platforms.

(i) For the purpose of applying this appendix, powered platforms are divided into two basic types, Type F and Type T.

(ii) Powered platforms designated as Type F shall meet all the requirements in Part II of ANSI A120.1-1970, American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance. A basic requirement of Type F equipment is that the work platform is suspended by at least 4 wire ropes and designed so that failure of any one wire rope will not substantially alter the normal position of the working platform. Another basic requirement of Type F equipment is that only one layer of hoisting rope is permitted on winding drums. Type F powered platforms may be either roof-powered or self-powered.

(iii) Powered platforms designated as Type T shall meet all the requirements in Part III of ANSI A120.1-1970 American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance, except for section 28, Safety Belts and Life Lines. A basic requirement of Type T equipment is that the working platform is suspended by at least 2 wire ropes. Failure of one wire rope would not permit the working platform to fall to the ground, but would upset its normal position. Type T powered platforms may be either roof-powered or self-powered.

(iv) The requirements of this section apply to powered platforms with winding drum type hoisting machines. It is not the intent of this section to prohibit powered platforms using other types of hoisting machines such as, but not limited to, traction drum hoisting machines, air powered machines, hydraulic powered machines, and internal combustion machines. Installation of powered platforms with other types of hoisting machines is permitted, provided adequate protective devices are used, and provided reasonable safety of life and limb to users of the equipment and to others who may be exposed is assured.

(v) Both Type F and Type T powered platforms shall comply with the requirements of Appendix C of this standard.

(4) Type F powered platforms.

(a) Roof car, general.

(i) A roof car shall be provided whenever it is necessary to move the working platform horizontally to working or storage positions.

(ii) The maximum rated speed at which a power traversed roof car may be moved in a horizontal direction shall be 50 feet per minute.

(b) Movement and positioning of roof car.

(i) Provision shall be made to protect against having the roof car leave the roof or enter roof areas not designed for travel.

(ii) The horizontal motion of the roof cars shall be positively controlled so as to insure proper movement and positioning of the roof car.

(iii) Roof car positioning devices shall be provided to insure that the working platform is placed and retained in proper position for vertical travel and during storage.

(iv) Mechanical stops shall be provided to prevent the traversing of the roof car beyond its normal limits of travel. Such stops shall be capable of withstanding a force equal to 100 percent of the inertial effect of the roof car in motion with traversing power applied.

(v) The operating device of a power-operated roof car for traversing shall be located on the roof car, the working platform, or both, and shall be of the continuous pressure weather-proof electric type. If more than one operating device is provided, they shall be so arranged that traversing is possible only from one operating device at a time.

(vi) The operating device shall be so connected that it is not operable until:

(A) The working platform is located at its uppermost position of travel and is not in contact with the building face or fixed vertical guides in the face of the building; and

(B) All protective devices and interlocks are in a position for traversing.

(c) Roof car stability. Roof car stability shall be determined by either items (i) or (ii), whichever is greater.

(i) The roof car shall be continuously stable, considering overturning moment as determined by 125 percent rated load, plus maximum dead load and the prescribed wind loading.

(ii) The roof car and its anchorages shall be capable of resisting accidental over-tensioning of the wire ropes suspending the working platform and this calculated value shall include the effect of one and one-half times the value. For this calculation, the simultaneous effect of one-half wind load

shall be included, and the design stresses shall not exceed those referred to in subsection (3)(a) of this Appendix.

(iii) If the load on the motors is at any time in excess of three times that required for lifting the working platform with its rated load the motor shall stall.

(d) Access to the roof car. Safe access to the roof car and from the roof car to the working platform shall be provided. If the access to the roof car at any point of its travel is not over the roof area or where otherwise necessary for safety, self-closing, self-locking gates shall be provided. Applicable provisions WAC 296-24-735 through 296-24-810 shall apply.

(e) Means for maintenance, repair, and storage. Means shall be provided to run the roof car away from the roof perimeter, where necessary, and to provide a safe area for maintenance, repairs, and storage. Provisions shall be made to secure the machine in the stored position. For stored machines subject to wind forces, see special design and anchorage requirements for "wind forces" in Part II, section 10.5.1.1 of ANSI A120.1-1970 American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance.

(f) General requirements for working platforms. The working platform shall be of girder or truss construction and shall be adequate to support its rated load under any position of loading, and comply with the provisions set forth in section 10 of ANSI A120.1-1970, American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance.

(g) Load rating plate. Each working platform shall bear a manufacturer's load rating plate, conspicuously posted; stating the maximum permissible rated load. Load rating plates shall be made of noncorrosive material and shall have letters and figures stamped, etched, or cast on the surface. The minimum height of the letters and figures shall be one-fourth inch.

(h) Minimum size. The working platform shall have a minimum net width of 24 inches.

(i) Guardrails. Working platforms shall be furnished with permanent guard rails not less than 36 inches high, and not more than 42 inches high at the front (building side). At the rear, and on the sides, the rail shall not be less than 42 inches high. An intermediate guardrail shall be provided around the entire platform between the top guardrail and the toeboard. The top rail shall withstand a minimum of 200 pounds pressure.

(j) Toeboards. A four-inch toeboard shall be provided along all sides of the working platform.

(k) Open spaces between guardrails and toeboards. The spaces between the intermediate guardrail and platform toeboard on the building side of the working platform, and between the top guardrail and the toeboard on other sides of the platform, shall be filled with metallic mesh or similar material that will reject a ball one inch in diameter. The installed mesh shall be capable of withstanding a load of 100 pounds applied horizontally over any area of 144 square inches. If the space between the platform and the building face does not exceed eight inches, and the platform is restrained by guides, the mesh may be omitted on the front side.

(l) Flooring. The platform flooring shall be of the non-skid type, and if of open construction, shall reject a 9/16-inch diameter ball, or be provided with a screen below the floor to reject a 9/16-inch diameter ball.

(m) Access gates. Where access gates are provided, they shall be self-closing and self-locking.

(n) Operating device for vertical movement of the working platform.

(i) The normal operating device for the working platform shall be located on the working platform and shall be of the continuous pressure weatherproof electric type.

(ii) The operating device shall be operable only when all electrical protective devices and interlocks on the working platform are in position for normal service and, the roof car, if provided, is at an established operating point.

(o) Emergency electric operative device.

(i) In addition, on roof-powered platforms, an emergency electric operating device shall be provided near the hoisting machine for use in the event of failure of the normal operating device for the working platform, or failure of the traveling cable system. The emergency operating device shall be mounted in a locked compartment and shall have a legend mounted thereon reading: "For Emergency Operation Only. Establish Communication With Personnel on Working Platform Before Use."

(ii) A key for unlocking the compartment housing the emergency operating device shall be mounted in a break-glass receptacle located near the emergency operating device.

(p) Manual cranking for emergency operation. Emergency operation of the main drive machine may be provided to allow manual cranking. This provision for manual operation shall be designed so that not more than two persons will be required to perform this operation. The access to this provision shall include a means to automatically make the machine inoperative electrically while under the emergency manual operation. The design shall be such that the emergency brake is operative at or below governor tripping speed during manual operation.

(q) Arrangement and guarding of hoisting equipment.

(i) Hoisting equipment shall consist of a power-driven drum or drum contained in the roof car (roof-powered platforms) or contained on the working platform (self-powered platform).

(ii) The hoisting equipment shall be power-operated in both up and down directions.

(iii) Guard or other protective devices shall be installed wherever rotating shafts or other mechanisms or gears may expose personnel to a hazard.

(iv) Friction devices or clutches shall not be used for connecting the main driving mechanism to the drum or drums. Belt or chain-driven machines are prohibited.

(r) Hoisting motors.

(i) Hoisting motors shall be electric and of weather-proof construction.

(ii) Hoisting motors shall be in conformance with applicable provisions of subdivision (v) of this subsection, Electric Wiring and Equipment.

(iii) Hoisting motors shall be directly connected to the hoisting machinery. Motor couplings, if used, shall be of steel construction.

(s) Brakes. The hoisting machine(s) shall have two independent braking means, each designed to stop and hold the working platform with 125 percent of rated load.

(t) Hoisting ropes and rope connections.

(i) Working platforms shall be suspended by wire ropes of either 6 x 19 or 6 x 37 classification, preformed or nonpreformed.

(ii) (Reserved)

(iii) The minimum factor of safety shall be 10, and shall be calculated by the following formula:

$$F = S \times N / W$$

Where

S = Manufacturer's rated breaking strength of one rope.

N = Number of ropes under load.

W = Maximum static load on all ropes with the platform and its rated load at any point of its travel.

(iv) Hoisting ropes shall be sized to conform with the required factor of safety, but in no case shall the size be less than 5/16 inch diameter.

(v) Winding drums shall have at least three turns of rope remaining when the platform has landed at the lowest possible point of its travel.

(vi) The lengthening or repairing of wire rope by the joining of two or more lengths is prohibited.

(vii) The nondrum ends of the hoisting ropes shall be provided with individual shackle rods which will permit individual adjustment of rope lengths, if required.

(viii) More than two reverse bends in each rope is prohibited.

(u) Rope tag data. A metal data tag shall be securely attached to one of the wire rope fastenings. This data tag shall bear the following wire rope data:

(i) The diameter in inches.

(ii) Construction classification.

(iii) Whether nonpreformed or preformed.

(iv) The grade of material used.

(v) The manufacturer's rated breaking strength.

(vi) Name of the manufacturer of the rope.

(vii) The month and year the ropes were installed.

(v) Electrical wiring and equipment.

(i) All electrical equipment and wiring shall conform to the requirements of the National Electrical Code, NFPA 70-1987; ANSI C1-1987, except as modified by ANSI A120.1-1970 "American National Standard Safety Requirements for Powered Platforms for Exterior Building Maintenance." For detail design specifications for electrical equipment, see Part 2, ANSI A120.1-1970.

(ii) All motors and operation and control equipment shall be supplied from a single power source.

(iii) The power supply for the powered platform shall be an independent circuit supplied through a fused disconnect switch.

(iv) Electrical conductor parts of the power supply system shall be protected against accidental contact.

(v) Electrical grounding shall be provided.

(A) Provisions for electrical grounding shall be included with the power-supply system.

(B) Controller cabinets, motor frames, hoisting machines, the working platform, roof car and roof car track

system, and noncurrent carrying parts of electrical equipment, where provided, shall be grounded.

(C) The controller, where used, shall be so designed and installed that a single ground or short circuit will not prevent both the normal and final stopping device from stopping the working platform.

(D) Means shall be provided on the roof car and working platform for grounding portable electric tools.

(E) The working platform shall be grounded through a grounding connection in a traveling cable. Electrically powered tools utilized on the working platform shall be grounded.

(vi) Electrical receptacles located on the roof or other exterior location shall be of a weatherproof type and shall be located so as not to be subject to contact with water or accumulated snow. The receptacles shall be grounded and the electric cable shall include a grounding conductor. The receptacle and plug shall be a type designed to avoid hazard to persons inserting or withdrawing the plug. Provision shall be made to prevent application of cable strain directly to the plug and receptacle.

(vii) Electric runway conductor systems shall be of the type designed for use in exterior locations and shall be located so as not to be subject to contact with water or accumulated snow. The conductors, collectors, and disconnecting means shall conform to the same requirements as those for cranes and hoists in Article 610 of the National Electrical Code, NFPA 70-1987; ANSI C1-1987. A grounded conductor shall parallel the power conductors and be so connected that it cannot be opened by the disconnecting means. The system shall be designed to avoid hazard to persons in the area.

(viii) Electrical protective devices and interlocks of the weatherproof type shall be provided.

(ix) Where the installation includes a roof car, electric contact(s) shall be provided and so connected that the operating devices for the working platform shall be operative only when the roof car is located and mechanically retained at an established operating point.

(x) Where the powered platform includes a power-operated roof car, the operating device for the roof car shall be inoperative when the roof car is mechanically retained at an established operating point.

(xi) An electric contact shall be provided and so connected that it will cause the down direction relay for vertical travel to open if the tension in the traveling cable exceeds safe limits.

(xii) An automatic overload device shall be provided to cut off the electrical power to the circuit in all hoisting motors for travel in the up direction, should the load applied to the hoisting ropes at either end of the working platform exceed 125 percent of its normal tension with rated load, as shown on the manufacturer's data plate on the working platform.

(xiii) An automatic device shall be provided for each hoisting rope which will cut off the electrical power to the hoisting motor or motors in the down direction and apply the brakes if any hoisting rope becomes slack.

(xiv) Upper and lower directional limit devices shall be provided to prevent the travel of the working platform beyond the normal upper and lower limits of travel.

(xv) Operation of a directional limit device shall prevent further motion in the appropriate direction, if the normal limit of travel has been reached.

(xvi) Directional limit devices, if driven from the hoisting machine by chains, tapes, or cables, shall incorporate a device to disconnect the electric power from the hoisting machine and apply both the primary and secondary brakes in the event of failure of the driving means.

(xvii) Final terminal stopping devices of the working platform:

(A) Final terminal stopping devices for the working platform shall be provided as a secondary means of preventing the working platform from over-traveling at the terminals.

(B) The device shall be set to function as close to each terminal landing as practical, but in such a way that under normal operating conditions it will not function when the working platform is stopped by the normal terminal stopping device.

(C) Operation of the final terminal stopping device shall open the potential relay for vertical travel, thereby disconnecting the electric power from the hoisting machine, and applying both the primary and secondary brakes.

(D) The final terminal stopping device for the upper limit of travel shall be mounted so that it is operated directly by the motion of the working platform itself.

(xviii) Emergency stop switches shall be provided in or adjacent to each operating device.

(xix) Emergency stop switches shall:

(A) Have red operating buttons or handles.

(B) Be conspicuously and permanently marked "Stop."

(C) Be the manually opened and manually closed type.

(D) Be positively opened with the opening not solely dependent on springs.

(xx) The manual operation of an emergency stop switch associated with an operating device for the working platform shall open the potential relay for vertical travel, thereby disconnecting the electric power from the hoisting machine and applying both the primary and secondary brakes.

(xxi) The manual operation of the emergency stop switch associated with the operating device for a power-driven roof car shall cause the electrical power to the traverse machine to be interrupted, and the traverse machine brake to apply.

(w) Requirements for emergency communications.

(i) Communication equipment shall be provided for each powered platform for use in an emergency.

(ii) Two-way communication shall be established between personnel on the roof and personnel on the stalled working platform before any emergency operation of the working platform is undertaken by personnel on the roof.

(iii) The equipment shall permit two-way voice communication between the working platform; and

(A) Designated personnel continuously available while the powered platform is in use; and

(B) Designated personnel on roof-powered platforms, undertaking emergency operation of the working platform by means of the emergency operating device located near the hoisting machine.

(iv) The emergency communication equipment shall be one of the following types:

(A) Telephone connected to the central telephone exchange system; or

(B) Telephones on a limited system or an approved two-way radio system, provided designated personnel are available to receive a message during the time the powered platform is in use.

(5) Type T powered platforms.

(a) Roof car. The requirements of subsection (4)(a) through (4)(e) of this Appendix shall apply to Type T powered platforms.

(b) Working platform. The requirements of subsection (4)(f) through (4)(p) of this Appendix apply to Type T powered platforms.

(i) The working platform shall be suspended by at least two wire ropes.

(ii) The maximum rated speed at which the working platform of self-powered platforms may be moved in a vertical direction shall not exceed 35 feet per minute.

(c) Hoisting equipment. The requirements of subsection (4)(q) and (r) of this Appendix shall apply to Type T powered platforms.

(d) Brakes. Brakes requirements of subsection (4)(s) of this Appendix shall apply.

(e) Hoisting ropes and rope connections.

(i) Subsection (4)(t)(i) through (vi) and (viii) of this Appendix shall apply to Type T powered platforms.

(ii) Adjustable shackle rods in subsection (4)(t)(vii) of this Appendix shall apply to Type T powered platforms, if the working platform is suspended by more than two wire ropes.

(f) Electrical wiring and equipment.

(i) The requirements of subsection (4)(v)(i) through (vi) of this Appendix shall apply to Type T powered platforms. "Circuit protection limitation," "powered platform electrical service system," all operating services and control equipment shall comply with the specifications contained in Part 2, section 26, ANSI A120.1-1970.

(ii) For electrical protective devices the requirements of subsection (4)(v)(i) through (viii) of this Appendix shall apply to Type T powered platforms. Requirements for the "circuit potential limitation" shall be in accordance with specifications contained in Part 2, section 26, of ANSI A120.1-1970.

(g) Emergency communications. All the requirements of subsection (4)(w) of this Appendix shall apply to Type T powered platforms.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-24-87037, filed 4/10/90, effective 5/25/90.]

WAC 296-24-885 Vehicle-mounted elevating and rotating work platforms.

[Order 76-6, § 296-24-885, filed 3/1/76; Order 73-5, § 296-24-885, filed 5/9/73 and Order 73-4, § 296-24-885, filed 5/7/73.]

WAC 296-24-88501 Definitions. (1) Aerial device. Any vehicle-mounted device, telescoping or articulating or both, which is used to position workers and/or materials.

(2) Aerial ladder. An aerial device consisting of a single- or multiple-section extensible ladder.

(3) Articulating boom platform. An aerial device with two or more hinged boom sections.

(4) Extensible boom platform. An aerial device (except ladders) with a telescopic or extensible boom. Telescopic derricks with personnel platform attachments shall be considered to be extensible boom platforms when used with a personnel platform.

(5) Electric line truck. A truck used to transport people, tools and material, and to serve as a traveling workshop for electric power line construction and maintenance work. It is sometimes equipped with a boom and auxiliary equipment for setting poles, digging holes and elevating material and/or people.

(6) Mobile unit. A combination of an aerial device, its vehicle, and related equipment.

(7) Platform. Any personnel-carrying device (basket or bucket) which is a component of an aerial device.

(8) Vehicle. Any carrier that is not manually propelled.

(9) Vertical tower. An aerial device designed to elevate a platform in a substantially vertical axis.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-88501, filed 7/20/94, effective 9/20/94; Order 76-6, § 296-24-88501, filed 3/1/76; Order 73-5, § 296-24-88501, filed 5/9/73 and Order 73-4, § 296-24-88501, filed 5/7/73.]

WAC 296-24-88503 General requirements. (1) Unless otherwise provided in this section, aerial devices (aerial lifts) acquired on or after July 1, 1975, shall be designed and constructed in conformance with the applicable requirements of the American National Standard for "Vehicle Mounted Elevating and Rotating Work Platforms," ANSI A92.2-1969, including appendix. Aerial lifts acquired for use before July 1, 1975 which do not meet the requirements of ANSI A92.2-1969, may not be used after July 1, 1976, unless they shall have been modified so as to conform with the applicable design and construction requirements of ANSI A92.2-1969. Aerial devices include the following types of vehicle-mounted aerial devices used to elevate personnel and/or material to jobsites above ground:

- (a) Extensible boom platforms;
- (b) Aerial ladders;
- (c) Articulating boom platforms;
- (d) Vertical towers, and
- (e) A combination of any of the above.

(f) Aerial equipment may be made of metal, wood, fiberglass reinforced plastic (FRP), or other material; may be powered or manually operated; and are deemed to be aerial lifts whether or not they are capable of rotating about a substantially vertical axis.

(2) Aerial lifts may be "field modified" for uses other than those intended by the manufacturer, provided the modification has been certified in writing by the manufacturer or by any other equivalent entity, such as a nationally recognized testing laboratory, to be in conformity with all applicable provisions of ANSI A92.2-1969 and this section, and to be at least as safe as the equipment was before modification.

(3) The requirements of this section do not apply to fire-fighting equipment or electric line trucks used in the construction and maintenance of power distribution lines by telecommunications employees, line clearance tree trimming employees, electric contractor employees and electric utility

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employees, except with the requirement that a vehicle be a stable support for the aerial device.

(4) For operations near overhead electrical lines see chapter 296-24 WAC Part L.

[Statutory Authority: Chapter 49.17 RCW, 91-24-017 (Order 91-07), § 296-24-88503, filed 11/22/91, effective 12/24/91; Order 76-6, § 296-24-88503, filed 3/1/76; Order 73-5, § 296-24-88503, filed 5/9/73 and Order 73-4, § 296-24-88503, filed 5/7/73.]

WAC 296-24-88505 Specific requirements. (1) Ladder trucks and tower trucks. Before the truck is moved for highway travel, aerial ladders shall be secured in the lower traveling position by the locking device above the truck cab, and the manually operated device at the base of the ladder, or by other equally effective means (e.g., cradles which prevent rotation of the ladder in combination with positive acting linear actuators).

(2) Extensible and articulating boom platforms.

(a) Lift controls shall be tested each day prior to use to determine that such controls are in safe working condition.

(b) Only trained persons shall operate an aerial lift.

(c) Belting off to an adjacent pole, structure, or equipment while working from an aerial lift shall not be permitted.

(d) Employees shall always stand firmly on the floor of the basket, and shall not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position.

(e) A body belt shall be worn and a lanyard attached to the boom or basket when working from an aerial lift.

(f) Boom and basket load limits specified by the manufacturer shall not be exceeded.

(g) The brakes shall be set and outriggers, when used, shall be positioned on pads or a solid surface. Wheel chocks shall be installed before using an aerial lift on an incline.

(h) An aerial lift truck may not be moved when the boom is elevated in a working position with workers in the basket, except for equipment which is specifically designed for this type of operation in accordance with the provisions of WAC 296-24-88503 (1)(2).

(i) Articulating boom and extensible boom platforms, primarily designed as personnel carriers, shall have both platform (upper) and lower controls. Upper controls shall be in or beside the platform within easy reach of the operator. Lower controls shall provide for overriding the upper controls. Controls shall be plainly marked as to their function. Lower level controls shall not be operated unless permission has been obtained from the employee in the lift, except in case of emergency.

(j) Climbers shall not be worn while performing work from an aerial lift.

(k) Before moving an aerial lift for travel, the boom(s) shall be inspected to see that it is properly cradled and outriggers are in stowed position, except as provided in subdivision (h).

(3) Bursting safety factor. All critical hydraulic and pneumatic components shall comply with the provisions of the American National Standards Institute Standard, ANSI A92.2-1969, Section 4.9 Bursting Safety Factor. Critical components are those in which a failure would result in a free fall or free rotation of the boom. All noncritical components shall have a bursting safety factor of at least two to one.

[Title 296 WAC—p. 889]

(4) Welding standards. All welding shall conform to the following American Welding Society (AWS) Standards, as applicable:

- (a) Standard Qualification Procedure, AWS B3.0-41.
- (b) Recommended Practices for Automotive Welding Design, AWS D8.4-61.
- (c) Standard Qualification of Welding Procedures and Welders for Piping and Tubing, AWS D10.9-69.
- (d) Specifications for Welding Highway and Railway Bridges, AWS D2.0-69. (Rev. 2-5-76.)

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-88505, filed 7/20/94, effective 9/20/94; Order 76-6, § 296-24-88505, filed 3/1/76.]

WAC 296-24-900 Manlifts.

[Order 73-5, § 296-24-900, filed 5/9/73 and Order 73-4, § 296-24-900, filed 5/7/73.]

WAC 296-24-90001 Definitions. (1) Handhold (hand-grip). A handhold is a device attached to the belt which can be grasped by the passenger to provide a means of maintaining balance.

(2) Open type. One which has a handgrip surface fully exposed and capable of being encircled by the passenger's fingers.

(3) Closed type. A cup-shaped device, open at the top in the direction of travel of the step for which it is to be used, and closed at the bottom into which the passenger may place fingers.

(4) Limit switch. A device, the purpose of which is to cut off the power to the motor and apply the brakes to stop the carrier in the event that a loaded step passes the terminal landing.

(5) Manlift. A device consisting of a power-driven endless belt moving in one direction only, and provided with steps or platforms and handholds attached to it for the transportation of personnel from floor to floor.

(6) Rated speed. Rated speed is the speed for which the device is designed and installed.

(7) Split-rail switch. An electric limit switch operated mechanically by the rollers on the manlift steps. It consists of an additional hinged or "split" rail, mounted on the regular guiderail, over which the step rollers pass. It is spring-loaded in the "split" position. If the step supports no load, the rollers will "bump" over the switch; if a loaded step should pass over the section, the split rail will be forced straight, tripping the switch and opening the electrical circuit.

(8) Step (platform). A step is a passenger carrying unit.

(9) Travel. The travel is the distance between the centers of the top and bottom pulleys.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-90001, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-90001, filed 5/9/73 and Order 73-4, § 296-24-90001, filed 5/7/73.]

WAC 296-24-90003 General requirements. (1) Application. These standards apply to the construction, maintenance, inspection, and operation of manlifts in relation to accident causing hazards. Manlifts covered by these standards consist of platforms or brackets and accompanying handholds mounted on, or attached to an endless belt, operat-

ing vertically in one direction only and being supported by, and driven through pulleys, at the top and bottom. These manlifts are intended for conveyance of persons only. It is not intended that these standards cover moving stairways, elevators with enclosed platforms ("Paternoster" elevators), gravity lifts, nor conveyors used only for conveying material. These standards apply to manlifts used to carry only personnel trained and authorized by the employer in their use.

(2) Exceptions for new and existing equipment. The purpose of these standards is to provide reasonable safety for life and limb.

(3) Design requirements. All new manlift installations and equipment installed after the effective date of these standards shall meet the design requirements of the "American National Safety Standard for Manlifts ANSI A90.1-1969," and the requirements of this section.

(4) Reference to other codes. The following codes are applicable to this section. Safety Code for Mechanical Power Transmission Apparatus ANSI B15.1-1953 (R 1958) and chapter 296-24 WAC Part C; chapter 296-24 WAC Part L; Safety Code for Fixed Ladders, ANSI A14.3-1956 and Safety Requirements for Floor and Wall Openings, Railings and Toeboards, ANSI A12.1-1967 and chapter 296-24 WAC Part J-1.

(5) Floor openings.

(a) Allowable size. Floor openings for both the "up" and "down" runs shall be not less than 28 inches nor more than 36 inches in width for a 12-inch belt not less than 34 inches nor more than 38 inches for a 14-inch belt; and not less than 36 inches nor more than 40 inches for a 16-inch belt and shall extend not less than 24 inches, nor more than 28 inches from the face of the belt.

(b) Uniformity. All floor openings for a given manlift shall be uniform in size and shall be approximately circular, and each shall be located vertically above the opening below it.

(6) Landing.

(a) Vertical clearance. The clearance between the floor or mounting platform and the lower edge for the conical guard above it required by WAC 296-24-90003(7) shall not be less than 7 feet 6 inches. Where this clearance cannot be obtained no access to the manlift shall be provided and the manlift runway shall be enclosed where it passes through such floor.

(b) Clear landing space. The landing space adjacent to the floor openings shall be free from obstruction and kept clear at all times. This landing space shall be at least 2 feet in width from the edge of the floor opening used for mounting and dismounting.

(c) Lighting and landing. Adequate lighting not less than 5-foot candles, shall be provided at each floor landing at all times when the lift is in operation.

(d) Landing surface. The landing surfaces at the entrances and exits to the manlift shall be constructed and maintained as to provide safe footing at all times.

(e) Emergency landings. Where there is a travel of 50 feet or more between floor landings, one or more emergency landings shall be provided so that there will be a landing (either floor or emergency) for every 25 feet or less of manlift travel.

(i) Emergency landings shall be accessible from both the "up" and "down" rungs of the manlift and shall give access to the ladder required in WAC 296-24-90003(12).

(ii) Emergency landings shall be completely enclosed with a standard railing and toeboard.

(iii) Platforms constructed to give access to bucket elevators or other equipment for the purpose of inspection, lubrication, and repair may also serve as emergency landings under this rule. All such platforms will then be considered part of the emergency landing and shall be provided with standard railings and toeboards.

(7) Guards on underside of floor openings.

(a) Fixed type. On the ascending side of the manlift floor openings shall be provided with a bevel guard or cone meeting the following requirements:

(i) The cone shall make an angle of not less than 45° with the horizontal. An angle of 60° or greater shall be used where ceiling heights permit.

(ii) The lower edge of this guard shall extend at least 42 inches outward from any handhold on the belt. It shall not extend beyond the upper surface of the floor above.

(iii) The cone shall be made of not less than No. 18 U.S. gauge sheet steel or material of equivalent strength or stiffness. The lower edge shall be rolled to a minimum diameter of one-half inch and the interior shall be smooth with no rivets, bolts or screws protruding.

(b) Floating type. In lieu of the fixed guards specified in WAC 296-24-90003 (7)(a) a floating type safety cone may be used, such floating cones to be mounted on hinges at least 6 inches below the under side of the floor and so constructed as to actuate a limit switch should a force of 2 pounds be applied on the edge of the cone closest to the hinge. The depth of this floating cone need not exceed 12 inches.

(8) Protection of entrances and exits.

(a) Guardrail requirement. The entrances and exits at all floor landings affording access to the manlift shall be guarded by a maze (staggered railing) or a handrail equipped with self-closing gates.

(b) Construction. The rails shall be standard guardrails with toeboards meeting the provisions of the Safety Requirements for Floor and Wall Openings, Railings and Toeboards, ANSI A12.1-1967 and WAC 296-24-750 through 296-24-75011.

(c) Gates. Gates, if used, shall open outward and shall be self-closing. Corners of gates shall be rounded.

(d) Maze. Maze or staggered openings shall offer no direct passage between enclosure and outer floor space.

(e) Except where building layout prevents, entrances at all landings shall be in the same relative position.

(f) If located in buildings to which the public has access, such manlift or manlifts shall be located in an enclosure protected by self-closing spring-locked doors. Keys to such doors shall be limited to authorized personnel.

(9) Guards for openings.

(a) Construction. The floor opening at each landing shall be guarded on sides not used for entrance or exit by a standard railing and toeboard or by panels or wire mesh of not less than Number 10 U.S. gage, expanded metal of not less than Number 13 U.S. gage or sheet metal of equivalent strength.

(1999 Ed.)

(b) Guardrails in stairwells. When belt manlift is installed in a stairwell a standard guardrail shall be placed between the floor openings of the manlift and the stairways.

(c) Height and location. Such rails or guards shall be at least forty-two inches in height on the "up" running side and sixty-six inches on the "down" running side. If a guardrail is used the section of the guard above the rail may be of the construction specified in WAC 296-24-90003 (9)(a) or may consist of vertical or horizontal bars which will reject a ball six inches in diameter. Rails or guards shall be located not more than one foot from the edge of the floor opening.

(d) Safeguards required. Expanded metal, sheet metal or wood guards must be installed to cover the area from the floor to seven feet above the floor on each exposed side of the belt manlift at each floor landing, so persons cannot place their hands in the area where the step rollers travel.

(10) Bottom arrangement.

(a) Bottom landing. At the bottom landing the clear area shall be not smaller than the area enclosed by the guardrails on the floors above, and any wall in front of the down-running side of the belt shall be not less than 48 inches from the face of the belt. This space shall not be encroached upon by stairs or ladders.

(b) Location of lower pulley. The lower (boot) pulley shall be installed so that it is supported by the lowest landing served. The sides of the pulley support shall be guarded to prevent contact with the pulley or the steps.

(c) Mounting platform. A mounting platform shall be provided in front or to one side of the uprun at the lowest landing, unless the floor level is such that the following requirement can be met: The floor or platform shall be at or above the point at which the upper surface of the ascending step completes its turn and assumes a horizontal position.

(d) Guardrails. To guard against persons walking under a descending step, the area on the downside of the manlift shall be guarded in accordance with WAC 296-24-90003(8). To guard against a person getting between the mounting platform and an ascending step, the area between the belt and the platform shall be protected by a guardrail.

(11) Top arrangements.

(a) Clearance from floor. A top clearance shall be provided of at least 11 feet above the top terminal landing. This clearance shall be maintained from a plane through each face of the belt to a vertical cylindrical plane having a diameter 2 feet greater than the diameter of the floor opening, extending upward from the top floor to the ceiling on the up-running side of the belt. No encroachment of structural or machine supporting members within this space will be permitted.

(b) Pulley clearance.

(i) There shall be a clearance of at least 5 feet between the center of the head pulley shaft and any ceiling obstruction.

(ii) The center of the head pulley shaft shall be not less than 6 feet above the top terminal landing.

(c) Emergency grab rail. An emergency grab bar or rail and platform shall be provided at the head pulley when the distance to the head pulley is over 6 feet above the top landing, otherwise only a grab bar or rail is to be provided to permit the rider to swing free should the emergency stops become inoperative.

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(12) Emergency exit ladder. A fixed metal ladder accessible from both the "up" and "down" run of the manlift shall be provided for the entire travel of the manlift. Such ladder shall be in accordance with ANSI A14.3-1956, Safety Code for Fixed Ladders and WAC 296-24-810 through 296-24-81013.

(13) Superstructure bracing. Manlift rails shall be secured in such a manner as to avoid spreading, vibration, and misalignment.

(14) Illumination.

(a) General. Both runs of the manlift shall be illuminated at all times when the lift is in operation. An intensity of not less than 1-foot candle shall be maintained at all points. (However, see WAC 296-24-90003 (6)(c) for illumination requirements at landings.)

(b) Control of illumination. Lighting of manlift runways shall be by means of circuits permanently tied into the building circuits (no switches), or shall be controlled by switches at each landing. Where separate switches are provided at each landing, any switch shall turn on all lights necessary to illuminate the entire runway.

(15) Weather protection. The entire manlift and its driving mechanism shall be protected from the weather at all times.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-90003, filed 11/22/91, effective 12/24/91; Order 76-6, § 296-24-90003, filed 3/1/76; Order 73-5, § 296-24-90003, filed 5/9/73 and Order 73-4, § 296-24-90003, filed 5/7/73.]

WAC 296-24-90005 Mechanical requirements. (1) Machines, general.

(a) Brakes. Brakes provided for stopping and holding a manlift shall be inherently self-engaging, by requiring power or force from an external source to cause disengagement. The brake shall be electrically released, and shall be applied to the motor shaft for direct-connected units or to the input shaft for belt-driven units. The brake shall be capable of stopping and holding the manlift when the descending side is loaded with 250 lb on each step.

(b) Belt.

(i) The belts shall be of hard-woven canvas, rubber-coated canvas, leather, or other material meeting the strength requirements of WAC 296-24-90003(3) and having a coefficient of friction such that when used in conjunction with an adequate tension device it will meet the brake test specified in WAC 296-24-90005 (1)(a).

(ii) The width of the belt shall be not less than 12 inches for a travel not exceeding 100 feet, not less than 14 inches for a travel greater than 100 feet but not exceeding 150 feet and 16 inches for a travel exceeding 150 feet.

(iii) A belt that has become torn while in use on a manlift shall not be spliced and put back in service.

(iv) Belt fastenings. Belts shall be fastened by a lapped splice or shall be butt spliced with a strap on the side of the belt away from the pulley. For lapped splices, the overlap of the belt at the splice shall be not less than three feet where the total travel of the manlift does not exceed one hundred feet and not less than four feet, if the travel exceeds one hundred feet.

Where butt splices are used the straps shall extend not less than three feet on one side of the butt for a travel not in excess of one hundred feet, and four feet for a travel in excess of one hundred feet.

For twelve inch belts, the joint shall be fastened with not less than twenty special elevator bolts, each of a minimum diameter of one-quarter inch. These bolts shall be arranged symmetrically in five rows so arranged as to cover the area of the joint effectively. The minimum number of bolts for a belt width of fourteen inches shall be not less than twenty-three and for belt widths of sixteen inches, the number of bolts shall be not less than twenty-seven.

(v) Pulleys. Drive pulleys and idler (boot) pulleys shall have a diameter not less than given in Table 1.

Belt Construction	TABLE 1 Minimum Strength (lb. per inch of width)	Minimum Pulley (diameter inches)
5 ply	1500	20
6 ply	1800	20
7 ply	2100	22

Note: Table No. 1 is included solely for the purpose of determining the minimum diameter of pulley required for the listed number of plies of belt construction.

(vi) Pulley protection. The machine shall be so designed and constructed as to catch and hold the driving pulley in event of shaft failure.

(2) Speed. Maximum speed. No manlift designed for a speed in excess of 80 feet per minute shall be installed.

(3) Platforms or steps.

(a) Minimum depth. Steps or platforms shall be not less than 12 inches nor more than 14 inches deep, measured from the belt to the edge of the step or platform.

(b) Width. The width of the step or platform shall be not less than the width of the belt to which it is attached.

(c) Distance between steps. The distance between steps shall be equally spaced and not less than 16 feet measured from the upper surface of one step to the upper surface of the next step above it.

(d) Angle of step. The surface of the step shall make approximately a right angle with the "up" and "down" run of the belt, and shall travel in the approximate horizontal position with the "up" and "down" run of the belt.

(e) Surfaces. The upper or working surfaces of the step shall be of a material having inherent nonslip characteristics (coefficient of friction not less than 0.5) or shall be covered completely by a nonslip tread securely fastened to it.

(f) Strength of step supports. When subjected to a load of 400 pounds applied at the approximate center of the step, step frames, or supports and their guides shall be of adequate strength to:

(i) Prevent the disengagement of any step roller.

(ii) Prevent any appreciable misalignment.

(iii) Prevent any visible deformation of the steps or its support.

(g) Prohibition of steps without handholds. No steps shall be provided unless there is a corresponding handhold above or below it meeting the requirements of WAC 296-24-

90005(4). If a step is removed for repairs or permanently, the handholds immediately above and below it shall be removed before the lift is again placed in service.

(4) Handholds.

(a) Location. Handholds attached to the belt shall be provided and installed so that they are not less than 4 feet nor more than 4 feet 8 inches above the step tread. These shall be so located as to be available on the both "up" and "down" run of the belt.

(b) Size. The grab surface of the handhold shall be not less than 4 1/2 inches in width, not less than 3 inches in depth, and shall provide 2 inches of clearance from the belt. Fastenings for handholds shall be located not less than 1 inch from the edge of the belt.

(c) Strength. The handhold shall be capable of withstanding, without damage, a load of 300 pounds applied parallel to the run of the belt.

(d) Prohibition of handhold without steps. No handhold shall be provided without a corresponding step. If a handhold is removed permanently or temporarily, the corresponding step and handhold for the opposite direction of travel shall also be removed before the lift is again placed in service.

(e) Type. All handholds shall be of the closed type.

(5) Up limit stops.

(a) Requirements. Two separate automatic stop devices shall be provided to cut off the power and apply the brake when a loaded step passes the upper terminal landing. One of these shall consist of a split-rail switch mechanically operated by the step roller and located not more than 6 inches above the top terminal landing. The second automatic stop device may consist of any of the following:

(i) Any split-rail switch placed 6 inches above and on the side opposite the first limit switch.

(ii) An electronic device.

(iii) A switch actuated by a lever, rod, or plate, the latter to be placed on the "up" side of the head pulley so as to just clear a passing step.

(b) Emergency stop switch, treadle type in pit on down side. An emergency stop treadle switch shall be placed in the area below the lowest landing on the "down" side. This switch must stop the mechanism if a person should fail to get off at the lowest landing and be ejected from the step as it approaches its position to travel around the boot pulley.

(c) Manual reset location. After the manlift has been stopped by a stop device it shall be necessary to reset the automatic stop manually. The device shall be so located that a person resetting it shall have a clear view of both the "up" and "down" runs of the manlift. It shall not be possible to reset the device from any step or platform.

(d) Cut-off point. The initial limit stop device shall function so that the manlift will be stopped before the loaded step has reached a point of 24 inches above the top terminal landing.

(e) Electrical requirements.

(i) Where such switches open the main motor circuit directly they shall be of the multipole type.

(ii) Where electronic devices are used they shall be so designed and installed that failure will result in shutting off the power to the driving motor.

(iii) Where flammable vapors or dusts may be present all electrical installations shall be according to chapter 296-24 WAC Part L.

(iv) Unless of the oil-immersed type controller contacts carrying the main motor current shall be copper to carbon or equal, except where the circuit is broken at two or more points simultaneously.

(6) Emergency stop.

(a) General. An emergency stop means shall be provided.

(b) Location. This stop means shall be within easy reach of the ascending and descending runs of the belt.

(c) Operation. This stop means shall be so connected with the control lever or operating mechanism that it will cut off the power and apply the brake when pulled in the direction of travel.

(d) Rope. If rope is used, it shall be not less than three-eighths inch in diameter. Wire rope, unless marlin-covered, shall not be used.

(7) Instruction and warning signs.

(a) Instruction signs at landings or belts. Signs of conspicuous and easily read style giving instructions for the use of the manlift shall be posted at each landing or stenciled on the belt.

(i) Such signs shall be of letters not less than 1 inch in height and of a color having high contrast with the surface on which it is stenciled or painted (white or yellow on black or black on white or gray).

(ii) The instructions shall read approximately as follows:

Face the belt.

Use the handholds.

To stop-pull rope.

(b) Top floor warning sign and light.

(i) At the top floor an illuminated sign shall be displayed bearing the following wording:

"TOP FLOOR-GET OFF"

Signs shall be in block letters not less than 2 inches in height. This sign shall be located within easy view of an ascending passenger and not more than 2 feet above the top terminal landing.

(ii) In addition to the sign required by WAC 296-24-90005(7), a red warning light of not less than 40-watt rating shall be provided immediately below the upper landing terminal and so located as to shine in the passenger's face.

(c) Bottom of manlift warning signs, light and buzzer.

(i) Sign or light. A sign or light warning any passengers they are approaching the bottom landing shall be posted above bottom landing in a conspicuous place. Sign or light to be similar in size to top warning light and sign noted above.

(ii) An electric buzzer. An electric buzzer shall be installed five feet above the bottom landing on the down side to warn any riders they are approaching the bottom landing and the buzzer shall be activated automatically by the weight of a load on a step.

(d) Visitor warning. A conspicuous sign having the following legend-AUTHORIZED PERSONNEL ONLY-shall be displayed at each landing. The sign shall be of block letters not less than 2 inches in height and shall be of a color offering high contrast with the background color.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-90005, filed 7/20/94, effective 9/20/94; 91-24-017 (Order 91-07), § 296-24-90005, filed 11/22/91, effective 12/24/91; Order 74-27, § 296-24-90005, filed 5/7/74; Order 73-5, § 296-24-90005, filed 5/9/73 and Order 73-4, § 296-24-90005, filed 5/7/73.]

WAC 296-24-90007 Operating rules. (1) Proper use of manlifts. No freight, packaged goods, pipe, lumber, or construction materials of any kind shall be handled on any manlift.

[Order 73-5, § 296-24-90007, filed 5/9/73 and Order 73-4, § 296-24-90007, filed 5/7/73.]

WAC 296-24-90009 Periodic inspection. (1) Frequency. All manlifts shall be inspected by a competent designated person at intervals of not more than 30 days. Limit switches shall be checked weekly. Manlifts found to be unsafe shall not be operated until properly repaired.

(2) Items covered. This periodic inspection shall cover but is not limited to the following items:

- Steps.
- Step fastenings.
- Rails.
- Rail supports and fastenings.
- Rollers and slides.
- Belt and belt tension.
- Handholds and fastenings.
- Floor landings.
- Guardrails.
- Lubrication.
- Limit switches.
- Warning signs and lights.
- Illumination.
- Drive pulley.
- Bottom (boot) pulley and clearance.
- Pulley supports.
- Motor.
- Driving mechanism.
- Brake.
- Electrical switches.
- Vibration and misalignment.
- "Skip" on up or down run when mounting step (indicating worn gears).

(3) Inspection log. A written record shall be kept of findings at each inspection. Records of inspection shall be made available to the director of labor and industries or his/her duly authorized representative.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-90009, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-90009, filed 5/9/73 and Order 73-4, § 296-24-90009, filed 5/7/73.]

PART K COMPRESSED GAS AND COMPRESSED GAS EQUIPMENT

WAC 296-24-920 Inspection of compressed gas cylinders.

[Order 73-5, § 296-24-920, filed 5/9/73 and Order 73-4, § 296-24-920, filed 5/7/73.]

[Title 296 WAC—p. 894]

WAC 296-24-92001 Definitions. (1) High- and low-pressure cylinders. High-pressure cylinders means those cylinders with a marked service pressure of 900 p.s.i. or greater; low-pressure cylinders are those with a marked service pressure less than 900 p.s.i.

(2) Minimum allowable wall thickness. The minimum allowable wall thickness means the minimum wall thickness required by the specification under which the cylinder was manufactured.

(3) Dents. Dents (in cylinders) means deformations caused by the cylinder coming in contact with a blunt object in such a way that the thickness of metal is not materially impaired.

(4) Cuts, gouges, or digs. Cuts, gouges, or digs (in cylinders) means deformations caused by contact with a sharp object in such a way as to cut into or upset the metal of the cylinder, decreasing the wall thickness at that point.

(5) Corrosion or pitting. Means corrosion or pitting in cylinders involving the loss of wall thickness by corrosive media.

Note: There are several kinds of pitting or corrosion to be considered.

(6) Isolated pitting. Means isolated pits of small cross-section which do not effectively weaken the cylinder wall but are indicative of possible complete penetration and leakage.

Note: Since the pitting is isolated the original wall is essentially intact.

(7) Line corrosion. Means pits which are not isolated but are connected or nearly connected to others in a narrow band or line.

Note: This condition is more serious than isolated pitting. Line corrosion frequently occurs in the area of intersection of the footing and bottom of a cylinder. This is sometimes referred to as "crevice corrosion."

(8) General corrosion. Means corrosion which covers considerable surface areas of the cylinder.

Note: It reduces the structural strength. It is often difficult to measure or estimate the depth of general corrosion because direct comparison with the original wall cannot always be made. General corrosion is often accompanied by pitting.

(9) "DOT" means the U.S. Department of Transportation.

[Order 73-5, § 296-24-92001, filed 5/9/73 and Order 73-4, § 296-24-92001, filed 5/7/73.]

WAC 296-24-92003 General requirements. (1) Application.

(a) Each employer shall determine that compressed gas cylinders under the employers control are in a safe condition to the extent that this can be determined by visual, and other inspection required by WAC 296-24-920 through 296-24-92011.

(b) The requirements contained in these standards are not intended to apply to cylinders manufactured under specification DOT (ICC)-3HT (49 CFR Ch.1). Separate requirements covering service life and standards for visual inspection of these cylinders are contained in Compressed Gas Association Pamphlet C-8, "Standard for Requalification of ICC-3HT Cylinders."

(2) Quality of inspection. Experience in the inspection of cylinders is an important factor in determining the acceptability of a given cylinder for continued service.

Note: Users lacking this experience and having doubtful cylinders should return them to a manufacturer of the same type of cylinders for reinspection.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-92003, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-92003, filed 5/9/73 and Order 73-4, § 296-24-92003, filed 5/7/73.]

WAC 296-24-92005 Inspection of low-pressure cylinders exempt from the hydrostatic test including acetylene cylinders.

(1) Application. This section covers cylinders of the type that are exempt from the hydrostatic retest requirements of the DOT by virtue of their exclusive use in certain noncorrosive gas service. They are not subject to internal corrosion and do not require internal shell inspection.

(2) Preparation for inspection. Rust, scale, caked paint, etc., shall be removed from the exterior surface so that the surface can be adequately observed. Facilities shall be provided for inverting the cylinder to facilitate inspection of the bottom. This is important because experience has shown this area to be the most susceptible to corrosion.

(3) Exterior inspection. Cylinders shall be checked as outlined below for corrosion, general distortion, or any other defect that might indicate a weakness which would render it unfit for service.

(a) To fix corrosion limits for all types, designs, and sizes of cylinders, and include them in this section is not practicable. Cylinders categorized by this section and subsection (1) of this section shall meet the following requirements. Failure to meet any of these requirements is of itself cause for rejection of a cylinder. Rejected cylinders shall be removed from the work place. Rejected cylinders may be returned to the manufacturer for reinspection.

(i) A cylinder shall be rejected when the tare weight is less than ninety-five percent of the original tare weight marked on the cylinder. When determining tare weight, be sure that the cylinder is empty.

(ii) A cylinder shall be rejected when the remaining wall in an area having isolated pitting only is less than one-third of the minimum allowable wall thickness as determined under (b) and (d) of this subsection.

(iii) A cylinder shall be rejected when line corrosion on the cylinder is three inches in length or over and the remaining wall is less than three-fourths of the minimum allowable wall thickness or when line corrosion is less than three inches in length and the remaining wall thickness is less than one-half the minimum allowable wall thickness as determined under (b) through (d) of this subsection.

(iv) A cylinder shall be rejected when the remaining wall in an area of general corrosion is less than one-half of the minimum allowable wall thickness as determined under (b) through (d) of this subsection.

(b) To use the criteria in (a) of this subsection, it is necessary to know the original wall thickness of the cylinder or the minimum allowable wall thickness. Table M-1 lists the minimum allowable wall thickness under DOT specifications (49 CFR Ch. 1) for a number of common size low-pressure cylinders.

(1999 Ed.)

TABLE M - 1

Cylinder size O.D. x length (inches)	DOT Specification marking	Nominal water capacity (pounds)	Minimum allowable wall thickness (inches)
15 x 46	4B240 ¹	239	0.128
14 13/16 x 47	4E240	239	.140
14 15/16 x 46	4BA240	239	.086
14 11/16 x 28 3/8	4BA240	143	.086
11 29/32 x 32 11/16	4BA240	95	.078
11 29/32 x 18 11/32	4BA240	48	.078

¹Without longitudinal seam.

(c) When the wall thickness of the cylinder at manufacture is not known, and the actual wall thickness cannot be measured, this cylinder shall be rejected when the inspection reveals that the deepest pit in a general corrosion area exceeds three sixty-fourths inch. This is arrived at by considering that in no case shall the pitting exceed one-half the minimum allowable wall thickness which is 0.064 inch. When a pit measures 0.043 inch (approximately three sixty-fourths inch) in a corrosion area, general corrosion will already have removed 0.021 inch of the original wall and the total pit depth as compared to the initial wall will be 0.064 inch.

(d) When the original wall thickness at manufacture is known, or the actual wall thickness is measured, this thickness less one and one-half times the maximum measured pit depth shall be 0.064 inch or greater. If it is less, the cylinder shall be rejected.

(e) Dents are of concern where the metal deformation is sharp and confined, or where they are near a weld. Where metal deformation is not sharp, dents of larger magnitude can be tolerated.

(f) Where denting occurs so that any part of the deformation includes a weld, the maximum allowable dent depth shall be one-fourth inch.

(g) When denting occurs so that no part of the deformation includes a weld, the cylinder shall be rejected if the depth of the dent is greater than one-tenth of the mean diameter of the dent.

(h) Cuts, gouges, or digs reduce the wall thickness of the cylinder and in addition are considered to be stress raisers. Depth limits are set in these standards; however, cylinders shall be rejected at one-half of the limit set whenever the length of the defect is three inches or more.

(i) When the original wall thickness at manufacture is not known, and the actual wall thickness cannot be measured a cylinder shall be rejected if the cut, gouge, or dig exceeds one-half of the minimum allowable wall thickness as determined under (b) through (d) of this subsection.

(ii) When the original wall thickness at manufacture is known, or the actual wall thickness is measured, a cylinder shall be rejected if the original wall thickness minus the depth of the defect is less than one-half of the minimum allowable wall thickness as determined under (b) through (d) of this subsection.

(i) Leaks can originate from a number of sources, such as defects in a welded or brazed seam, defects at the threaded opening, or from sharp dents, digs, gouges, or pits.

(i) To check for leaks, the cylinder shall be charged and carefully examined. All seams and pressure openings shall be coated with a soap or other suitable solution to detect the escape of gas. Any leakage is cause for rejection.

(ii) Safety relief devices as defined in WAC 296-24-93001(1) shall be tested for leaks before a charged cylinder is shipped from the cylinder filling plant.

(j) After fire damage, cylinders shall be carefully inspected for evidence of exposure to fire.

(i) Common evidences of exposure to fire are:

(A) Charring or burning of the paint or other protective coat.

(B) Burning or sintering of the metal.

(C) Distortion of the cylinder.

(D) Melted out fuse plugs.

(E) Burning or melting of valve.

(ii) The evaluation of fire damage by DOT regulations state that, "a cylinder which has been subjected to the action of fire must not again be placed in service until it has been properly reconditioned," in accordance with 49 CFR 173.34(f). The general intent of this requirement is to remove from service cylinders which have been subject to the action of fire which has changed the metallurgical structure or the strength properties of the steel, or in the case of acetylene cylinders caused breakdown of porous filler. This is normally determined by visual examination as covered above with particular emphasis to the condition of the protective coating. If the protective coating has been burnt off or if the cylinder body is burnt, warped, or distorted, it is assumed that the cylinder has been overheated and 49 CFR 173.34(f) shall be complied with. If, however, the protective coating is only dirtied from smoke or other debris, and is found by examination to be intact underneath, the cylinder shall not be considered affected within the scope of this requirement.

(k) Cylinders are manufactured with a reasonably symmetrical shape. Cylinders which have definite visible bulges shall be removed from service and evaluated. Cylinders shall be rejected when a variation of one percent or more is found in the measured circumferences or in peripheral distances measured from the valve spud to the center seam (of equivalent fixed point).

(l) Cylinder necks shall be examined for serious cracks, folds, and flaws. Neck cracks are normally detected by testing the neck during charging operations with a soap solution.

(m) Cylinder neck threads shall be examined whenever the valve is removed from the cylinder. Cylinders shall be rejected if the required number of effective threads are materially reduced, or if a gas tight seal cannot be obtained by reasonable valving methods. Gages shall be used to measure the number of effective threads.

(n) If the valve is noticeably tilted the cylinder shall be rejected.

(o) The footing and heading of cylinders may become so distorted through service abuse that they no longer perform their functions:

(i) To cause the cylinder to remain stable and upright.

(ii) To protect the valve. Rings shall be examined for distortion; for looseness, and for failure of welds. Appearances may often warrant rejection of the cylinder.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-24-92005, filed 5/15/89, effective 6/30/89; Order 73-5, § 296-24-92005, filed 5/9/73 and Order 73-4, § 296-24-92005, filed 5/7/73.]

WAC 296-24-92007 Low-pressure cylinders subject to hydrostatic testing. (1) Application. Cylinders covered in this section are low-pressure cylinders other than those covered in WAC 296-24-92005 through 296-24-92005 (3)(o)(ii). They differ essentially from such cylinders in that they require a periodic hydrostatic retest which includes an internal and external examination. Defect limits for the external examination are prescribed in WAC 296-24-92005 through 296-24-92005 (3)(o)(ii), with exceptions for aluminum cylinders shown in WAC 296-24-92007(4).

(2) Preparation for inspection. Flammable gas cylinders shall be purged before being examined with a light. Lamps used for flammable gas cylinder inspection shall be explosion proof.

(3) Internal inspection. Cylinders shall be inspected internally at least every time the cylinder is periodically retested. The examination shall be made with a light of sufficient intensity to clearly illuminate the interior walls.

(4) External inspection of aluminum cylinders. The inspection requirements of WAC 296-24-92005 through 296-24-92005 (3)(o)(ii) shall be met, except as follows:

(a) Aluminum cylinders shall be rejected when impairment to the surface (corrosion or mechanical defect) exceeds a depth where the remaining wall is less than three-fourths of the minimum allowable wall thickness required by the specification under which the cylinder was manufactured.

(b) Aluminum cylinders subjected to the action of fire shall be removed from service.

[Order 73-5, § 296-24-92007, filed 5/9/73 and Order 73-4, § 296-24-92007, filed 5/7/73.]

WAC 296-24-92009 High-pressure cylinders. (1) Application. High-pressure cylinders are those with a marked service pressure of 900 p.s.i. or higher. They are seamless; no welding is permitted. The great bulk of such cylinders are of the 3A or 3AA types under DOT specifications (49 CFR Ch. 1).

(2) Preparation for inspection.

(a) Cylinders shall be cleaned for inspection so that the inside and outside surfaces and all conditions can be observed. This shall include removal of scale and caked paint from the exterior and the thorough removal of internal scale. Cylinders with interior coating shall be examined for defects in the coating. If the coating is defective, it shall be removed.

(b) A good inspection light of sufficient intensity to clearly illuminate the interior wall is mandatory for internal inspection. Flammable gas cylinders shall be purged before being examined with a light. Lamps for flammable gas cylinder inspection shall be explosion proof.

(3) Exterior inspection.

(a) To fix corrosion limits for all types, designs, and sizes of cylinders, and include them in this section, is not practicable. Considerable judgment is required in evaluating cylinders fit for service. Experience is a major factor, aside from strength considerations for high pressure cylinders.

(b) When the original wall thickness of the cylinder is not known, and the actual wall thickness cannot be measured,

the cylinder shall be rejected if corrosion exceeds one thirty-second inch in depth. This is arrived at by subtracting from the minimum allowable wall at manufacture (0.221 inch), the limiting wall in service (0.195 inch), to give the maximum allowable corrosion limit of 0.026 inch, the equivalent of one thirty-second inch.

(c) When the wall thickness is known, or the actual wall thickness is measured, the difference between this known wall and the limiting value establishes the maximum corrosion figure. The normal hot forged cylinder of this size will have a measured wall of about 0.250 inch. Comparison of this with the limiting wall thickness shows that defects up to about one-sixteenth inch are allowable provided, of course, that the actual wall is measured or is known.

(d) Cylinders with general corrosion are evaluated by subjecting them to a hydrostatic test. Thus, a cylinder with an elastic expansion of 227 cc. or greater shall be rejected. If areas of pronounced pitting are included within the general corrosion, the depth of such pitting should also be measured (with the high spots of the actual surface as a reference plane) and the criteria established in the first example apply. Thus, the maximum corrosion limit would be one thirty-second inch when the wall was not known.

(e) Any defect of appreciable depth having a sharp bottom is a stress raiser and even though a cylinder may be acceptable from a stress standpoint, it is common practice to remove such defects. After any such repair operation, verification of the cylinder strength and structure shall be made by a hydrostatic test of other suitable means.

(f) Dents can be tolerated when the cylinder wall is not deformed excessively or abruptly. Generally speaking, dents are accepted up to a depth of about one-sixteenth inch when the major diameter of the dent is equal to or greater than 32 times the depth of the dent. Sharper dents than this are considered too abrupt and shall require rejection of the cylinder. On small diameter cylinders these general rules may have to be adjusted. Considerations of appearance play a major factor in the evaluation of dents.

(g) Cylinders with arc or torch burns shall be removed from service. Defects of this nature may be recognized by one of the following conditions:

(i) Removal of metal by scarfing or cratering.

(ii) A sentering or burning of the base metal.

(iii) A hardened heat affected zone. A simple method for verifying the presence of small arc burns is to file the suspected area. The hardened zone will resist filing as compared to the softer base metal.

(h) Cylinders are normally produced with a symmetrical shape. Cylinders with distinct visual bulges shall be removed from service until the nature of the defect is determined. Some cylinders may have small discontinuities related to the manufacturing process - mushroomed bottoms, offset shoulders, etc. These usually can be identified and are not normally cause for concern.

(i) Cylinders shall be carefully inspected for evidences of exposure to fire. (See WAC 296-24-92005 (3)(j).)

(j) Cylinder necks shall be examined for serious cracks, folds, and flaws. (See WAC 296-24-92005 (3)(l) and (m).)

[Order 73-5, § 296-24-92009, filed 5/9/73 and Order 73-4, § 296-24-92009, filed 5/7/73.]

(1999 Ed.)

WAC 296-24-92011 Internal inspection. (1) Cylinders shall be inspected internally at least every time the cylinder is periodically retested. This examination shall be made with a light of sufficient intensity to clearly illuminate the interior walls.

(2) A hammer test consists of tapping a cylinder a light blow with a suitably sized hammer. A cylinder, emptied of liquid content, with a clean internal surface, standing free, will have a clear ring. Cylinders with internal corrosion will give a duller ring dependent upon the amount of corrosion and accumulation of foreign material. Such cylinders shall be investigated. The hammer test is very sensitive and is an easy, quick, and convenient test that can be made without removing the valve before each charging. It is an invaluable indicator of internal corrosion.

[Order 73-5, § 296-24-92011, filed 5/9/73 and Order 73-4, § 296-24-92011, filed 5/7/73.]

WAC 296-24-930 Safety relief devices for compressed gas cylinders.

[Order 73-5, § 296-24-930, filed 5/9/73 and Order 73-4, § 296-24-930, filed 5/7/73.]

WAC 296-24-93001 Definitions. (1) Safety relief device. A "safety relief device" is a device intended to prevent rupture of a cylinder under certain conditions of exposures. (The term as used herein shall include the approach channel, the operating parts, and the discharge channel.)

(2) Approach channel. An "approach channel" is the passage or passages through which gas must pass from the cylinder to reach the operating parts of the safety relief device.

(3) Discharge channel. A "discharge channel" is the passage or passages beyond the operating parts through which gas must pass to reach the atmosphere exclusive of any piping attached to the outlet of the device.

(4) Safety relief device channel. A "safety relief device channel" is the channel through which gas released by operation of the device must pass from the cylinder to the atmosphere exclusive of any piping attached to the inlet or outlet of the device.

(5) Operating part. The "operating part" of a safety relief device is the part of a safety relief device that normally closes the safety discharge channel but when moved from this position as a result of the action of heat or pressure, or a combination of the two, permits escape of gas from the cylinder.

(6) Frangible disc. A "frangible disc" is an operating part in the form of a disc, usually of metal and which is so held as to close the safety relief device channel under normal conditions. The disc is intended to burst at a predetermined pressure to permit the escape of gas.

(7) Pressure opening. A "pressure opening" is the orifice against which the frangible disc functions.

(8) Rated bursting pressure. A "rated bursting pressure" of a frangible disc is the maximum pressure for which the disc is designed to burst when in contact with the pressure opening for which it was designed when tested.

(9) Fusible plug. A "fusible plug" is an operating part in the form of a plug of suitable low melting material, usually a metal alloy, which closes the safety relief device channel

under normal conditions and is intended to yield or melt at a predetermined temperature to permit the escape of gas.

(10) Yield temperature. The "yield temperature" of a fusible plug is the temperature at which the fusible metal or alloy will yield when tested.

(11) Reinforced fusible plug. A "reinforced fusible plug" is a fusible plug consisting of a core of suitable material having a comparatively high yield temperature surrounded by a low-melting point fusible metal of the required yield temperature.

(12) Combination frangible disc-fusible plug. A "combination frangible disc-fusible plug" is a frangible disc in combination with a low melting point fusible metal, intended to prevent its bursting at its predetermined bursting pressure unless the temperature also is high enough to cause yielding or melting of the fusible metal

(13) Safety relief valve. A "safety relief valve" is a safety relief device containing an operating part that is held normally in a position closing the safety relief device channel by spring force and is intended to open and to close at predetermined pressures.

(14) Combination safety relief valve and fusible plug. A "combination safety relief valve and fusible plug" is a safety relief device utilizing a safety relief valve in combination with a fusible plug. This combination device may be an integral unit or separate units and is intended to open and to close at predetermined pressures or to open at a predetermined temperature.

(15) Set pressure. The "set pressure" of a safety relief valve is the pressure marked on the valve and at which it is set to start-to-discharge.

(16) Start-to-discharge pressure. The "start-to-discharge pressure" of a safety relief valve is the pressure at which the first bubble appears through a water seal of not over 4 inches in the outlet of the safety relief valve.

(17) Flow capacity. The "flow capacity" of a safety relief device is the capacity in cubic feet per minute of free air discharged at the required flow rating pressure.

(18) Flow rating pressure. The "flow rating pressure" is the pressure at which a safety relief device is rated for capacity.

(19) Nonliquefied compressed gas. A "nonliquefied compressed gas" is a gas, other than a gas in solution which under the charging pressure, is entirely gaseous at a temperature of 70°F.

(20) Liquefied compressed gas. A "liquefied compressed gas" is a gas which, under the charging pressure, is partially liquid at a temperature of 70°F. A flammable compressed gas which is normally nonliquefied at 70°F but which is partially liquid under the charging pressure and temperature, shall follow the requirements for liquefied compressed gases.

(21) Compressed gas in solution. A "compressed gas in solution" (Acetylene) is a nonliquefied gas which is dissolved in a solvent.

(22) Pressurized liquid compressed gas. A "pressurized liquid compressed gas" is a compressed gas other than a compressed gas in solution, which cannot be liquefied at a temperature of 70°F, and which is maintained in the liquid state

at a pressure not less than 40 p.s.i.a. by maintaining the gas at a temperature less than 70°F.

(23) Test pressure of the cylinder. The "test pressure of the cylinder" is the minimum pressure at which a cylinder must be tested as prescribed in DOT specifications for compressed gas cylinders 41 CFR Ch. 1.

(24) Free air or free gas. "Free air" or "free gas" is air or gas measured at a pressure of 14.7 pounds per square inch absolute and a temperature of 60°F.

(25) DOT regulations. As used in these standards "DOT regulations" refers to the U.S. Department of Transportation Regulations for Transportation of Explosives and Other Dangerous Articles by Land and Water in Rail Freight, Express and Baggage Services and by Motor Vehicle (Highway) and Water, including Specifications for Shipping Containers, Code of Federal Regulations, Title 49, Parts 171 to 178.

[Order 73-5, § 296-24-93001, filed 5/9/73 and Order 73-4, § 296-24-93001, filed 5/7/73.]

WAC 296-24-93003 General requirements. (1) Application. Compressed gas cylinder, portable tanks, and cargo tanks shall have pressure relief devices installed and maintained in accordance with Compressed Gas Association Pamphlets S-1.1-1963 and 1965 addenda and S-1.2-1963.

(2) Types of safety relief devices. Types of safety relief devices as covered by this section are designated as follows:

(a) Type CG-1: Frangible disc.

(b) Type CG-2: Fusible plug or reinforced fusible plug utilizing a fusible alloy with yield temperature not over 170°F, nor less than 157°F (165°F nominal).

(c) Type CG-3: Fusible plug or reinforced fusible plug utilizing a fusible alloy with yield temperature not over 220°F, nor less than 208°F (212°F nominal).

(d) Type CG-4: Combination frangible disc-fusible plug, utilizing a fusible alloy with yield temperature not over 170°F, nor less than 157°F (165°F nominal).

(e) Type CG-5: Combination frangible disc-fusible plug, utilizing a fusible alloy with yield temperature not over 220°F, nor less than 208°F (212°F nominal).

(f) Type CG-7: Safety relief valve.

(g) Type CG-8: Combination safety relief valve and fusible plug.

(3) Specifications and tests. All safety relief devices covered by this section shall meet the design, construction, marking and test specification of the "Compressed Gas Association Safety Relief Device Standards Part 1-Cylinders for Compressed Gases: S1.1-1963."

(4) Specific requirements for safety relief devices.

(a) Compressed gas cylinders, which under the regulations of the department of transportation must be equipped with safety relief devices, shall be considered acceptable when equipped with devices of proper construction, location, and discharge capacity under the conditions prescribed in Table 1 of the Compressed Gas Associations Standard S-1.1-1963.

(b) Only replacement parts or assemblies provided by the manufacturer shall be used unless the advisability of interchange is proved by adequate tests.

(c) When a frangible disc is used with a compressed gas cylinder, the rated bursting pressure of the disc shall not exceed the minimum required test pressure of the cylinder with which the device is used, except for DOT-3E cylinders (49 CFR Ch. 1) the rated bursting pressure of the device shall not exceed 4,500 pounds per square inch gage (p.s.i.g.).

(d) When a safety relief valve is used on a compressed gas cylinder, the flow rating pressure shall not exceed the minimum required test pressure of the cylinder on which the safety relief valve is installed and the reseating pressure shall not be less than the pressure in a normally charged cylinder at 130°F.

(e) When fittings and piping are used on either the upstream or downstream side or both of a safety relief device or devices, the passages shall be so designed that the flow capacity of the safety relief device will not be reduced below the capacity required for the container on which the safety relief device assembly is installed, nor to the extent that the operation of the device could be impaired. Fittings, piping, and method of attachment shall be designed to withstand normal handling and the pressures developed when the device or devices function.

(f) No shutoff valve shall be installed between the safety relief devices and the cylinder.

(5) Maintenance requirements for safety relief devices.

(a) As a precaution to keep cylinder safety relief devices in reliable operating condition, care shall be taken in the handling or storing of compressed gas cylinders to avoid damage. Care shall also be exercised to avoid plugging by paint or other dirt accumulation of safety relief device channels or other parts which could interfere with the functioning of the device. Only qualified personnel shall be allowed to service safety relief devices.

(b) Each time a compressed gas cylinder is received at a point for refilling, all safety relief devices shall be examined externally for corrosion, damage, plugging of external safety relief device channels, and mechanical defects such as leakage or extrusion of fusible metal. If there is any doubt regarding the suitability of the safety relief device for service the cylinder shall not be filled until it is equipped with a suitable device.

[Order 73-5, § 296-24-93003, filed 5/9/73 and Order 73-4, § 296-24-93003, filed 5/7/73.]

WAC 296-24-935 Safety relief devices for cargo and portable tanks storing compressed gases.

[Order 73-5, § 296-24-935, filed 5/9/73 and Order 73-4, § 296-24-935, filed 5/7/73.]

WAC 296-24-93501 Definitions. (1) Cargo tank. A "cargo tank" means any container designed to be permanently attached to any motor vehicle or other highway vehicle and in which is to be transported any compressed gas. The term "cargo tank" shall not be construed to include any tank used solely for the purpose of supplying fuel for the propulsion of the vehicle or containers fabricated under specifications for cylinders.

(2) Portable tank. A "portable tank" means any container designed primarily to be temporarily attached to a motor vehicle, other vehicle, railroad car other than tank car, or

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marine vessel, and equipped with skids, mountings, or accessories to facilitate handling of the container by mechanical means, in which is to be transported any compressed gas. The term "portable tank" shall not be construed to include any cargo tank, any tank car tank or any tank of the DOT-106A and DOT-110A-W type.

(3) Safety relief device. A "safety relief device" means a device intended to prevent rupture of a container under certain conditions of exposure.

(4) Safety relief valve. A "safety relief valve" means a safety relief device containing an operating part that is held normally in a position closing the safety relief device channel by spring force and is intended to open and to close at predetermined pressures.

(5) Set pressure. The "set pressure" of a safety relief valve is the pressure marked on the valve and at which the valve is set to start-to-discharge.

(6) Start-to-discharge pressure. The "start-to-discharge pressure" of a safety relief valve is the pressure at which the first bubble appears through a water seal of not over 4 inches on the outlet of the valve.

Note: When the nature of the service requires the use of a metal-to-metal seat safety relief valve, with or without secondary sealing means, the start-to-discharge pressure may be considered the pressure at which an audible discharge occurs.

(7) Resealing pressure. The "resealing pressure" of a safety relief valve is the pressure at which leakage ceases through a water seal of not over 4 inches on the outlet of the valve.

(8) Flow capacity. The "flow capacity" of a safety relief device is the capacity in cubic feet per minute of free air discharged at the required flow rating pressure.

(9) Flow rating pressure. The "flow rating pressure" means the pressure at which a safety relief device is rated for capacity.

(10) Free air or free gas. "Free air" or "free gas" means air or gas measured at a pressure of 14.7 pounds per square inch absolute and a temperature of 60°F.

(11) Frangible disc. A "frangible disc" means a safety relief device in the form of a disc, usually of metal, which is so held as to close the safety relief device channel under normal conditions. The disc is intended to burst at a predetermined pressure to permit the escape of gas.

(12) Fusible plug. A "fusible plug" means a safety relief device in the form of a plug of suitable low-melting material, usually a metal alloy, which closes the safety relief device channel under normal conditions and is intended to yield or melt at a predetermined temperature to permit the escape of gas.

(13) DOT design pressure. The "DOT design pressure" is identical to the term "maximum allowable working pressure" as used in the "code" and is the maximum gage pressure at the top of the tank in its operating position. To determine the minimum permissible thickness of physical characteristics of the different parts of the vessel, the static head of the lading shall be added to the DOT design pressure to determine the thickness of any specific part of the vessel. If vacuum insulation is used, the liquid container shall be designed for a pressure of 15 p.s.i. more than DOT design pressure, plus static head of the lading.

EXCEPTION: For containers constructed in accordance with paragraph U-68 or U-69 of section VIII of the ASME Boiler and Pressure Vessel Code, 1949 Edition, the maximum allowable working pressure for the purpose of these standards is considered to be 125 percent of the design pressure as provided in 49 CFR 173.315 of DOT regulations.

(14) Code. "Code" is defined as paragraph U-68, U-69, U-200, or U-201 of section VIII of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers, 1949 Edition, or section VIII of the Boiler and Pressure Vessel Code of the American Society of Mechanical Engineers, 1950, 1952, 1956, 1959, and 1962 Editions; or the Code for Unfired Pressure Vessels for Petroleum Liquids and Gases of the American Petroleum Institute and the American Society of Mechanical Engineers (API-ASME), 1951 Edition.

(15) DOT regulations. The "DOT regulations" refers to department of transportation regulations for transportation of explosives and other dangerous articles by land and water in rail freight, express and baggage services and by motor vehicle (highway) and water, including specifications for shipping containers, Code of Federal Regulations, Title 49, Parts 171 to 178.

[Order 73-5, § 296-24-93501, filed 5/9/73 and Order 73-4, § 296-24-93501, filed 5/7/73.]

WAC 296-24-93503 General requirements. (1) Application. See WAC 296-24-93003(1).

(2) Specifications and tests. All safety relief devices covered by these standards shall meet the design, construction, marking, and test specifications of the "Compressed Gas Association Safety Relief Device Standards Part 2-Cargo and Portable Tanks for Compressed Gases: S-1.2-1963."

(3) Specific requirements for safety relief devices.

(a) Each container shall be provided with one or more safety relief devices which, unless otherwise specified, shall be safety relief valves of the spring-loaded type.

(b) Safety relief valves shall be set to start-to-discharge at a pressure not in excess of 110 percent of the DOT design pressure of the container nor less than the DOT design pressure of the container except as follows:

(i) If an oversized container is used, the set pressure of the safety relief valve may be between the minimum required DOT design pressure for the lading and 110 percent of the DOT design pressure of the container used.

(ii) For sulfur dioxide containers, a minimum set pressure of 120 and 110 p.s.i.g. is permitted for the 150 and 125 p.s.i.g. DOT design pressure containers, respectively.

(iii) For carbon dioxide (refrigerated), nitrous oxide (refrigerated), and pressurized liquid argon, nitrogen and oxygen, there shall be no minimum set pressure.

(iv) For butadiene, inhibited, and liquefied petroleum gas containers, a minimum set pressure of 90 percent of the minimum design pressure permitted for these ladings may be used.

(v) For containers constructed in accord with paragraph U-68 or U-69 of the Code 1949 Edition, the set pressure marked on the safety relief valve may be 125 percent of the original DOT design pressure of the container.

(c) Only replacement parts or assemblies provided by the manufacturer of the device shall be used unless the suitability of interchange is proved by adequate tests.

(d) Safety relief valves shall have direct communication with the vapor space of the container.

(e) Any portion of liquid piping or hose which at any time may be closed at each end must be provided with a safety relief device to prevent excessive pressure.

(f) The additional restrictions of this subdivision apply to safety relief devices on containers for carbon dioxide or nitrous oxide which are shipped in refrigerated and insulated containers. The maximum operating pressure in the container may be regulated by the use of one or more pressure controlling devices, which devices shall not be in lieu of the safety relief valve required in WAC 296-24-93503 (3)(a).

(g) All safety relief devices shall be so installed and located that the cooling effect of the contents will not prevent the effective operation of the device.

(h) In addition to the safety relief valves required by WAC 296-24-93503 (3)(a) each container for carbon dioxide may be equipped with one or more frangible disc safety relief devices of suitable design set to function at a pressure not exceeding two times the DOT design pressure of the container.

(i) Subject to conditions of 49 CFR 173.315(a)(1) (DOT regulations) for methyl chloride and sulfur dioxide optional portable tanks of 225 p.s.i.g. minimum DOT design pressure, one or more fusible plugs approved by the Bureau of Explosives, 50 "F" Street Northwest, Washington, D.C. 20001, may be used in lieu of safety relief valves of the spring-loaded type. If the container is over 30 inches long a safety relief device having the total required flow capacity must be at both ends.

(j) When storage containers for liquefied petroleum gas are permitted to be shipped in accordance with 49 CFR 173.315(j) (DOT regulations), they must be equipped with safety relief devices in compliance with the requirements for safety relief devices on above-ground containers as specified in the National Fire Protection Association Pamphlet No. 58-1969 "Standard for the Storage and Handling of Liquefied Petroleum Gases."

(k) When containers are filled by pumping equipment which has a discharge capacity in excess of the capacity of the container safety relief devices, and which is capable of producing pressures in excess of DOT design pressure of the container, precautions should be taken to prevent the development of pressures in the container in excess of 120 percent of its DOT design pressure. This may be done by providing additional capacity of the safety relief valves on the container, by providing a bypass on the pump discharge, or by any other suitable method.

(l) This additional requirement applies to safety relief devices on containers for liquefied hydrogen and pressurized liquid argon, nitrogen, and oxygen. The liquid container shall be protected by one or more safety relief valves and one or more frangible discs.

(m) Safety relief devices shall be arranged to discharge unobstructed to the open air in such a manner as to prevent any impingement of escaping gas upon the container. Safety relief devices shall be arranged to discharge upward except

this is not required for carbon dioxide, nitrous oxide and pressurized liquid argon, nitrogen, and oxygen.

(n) No shutoff valves shall be installed between the safety relief devices and the container except, in cases where two or more safety relief devices are installed on the same container, a shutoff valve may be used where the arrangement of the shutoff valve or valves is such as always to insure full required capacity flow through at least one safety relief device.

(4) Maintenance requirements for safety relief devices.

(a) Care shall be exercised to avoid damage to safety relief devices. Care shall also be exercised to avoid plugging by paint or other dirt accumulation of safety relief device channels or other parts which could interfere with the functioning of the device.

(b) Only qualified personnel shall be allowed to service safety relief devices. Any servicing or repairs which require resetting of safety relief valves shall be done only by or after consultation with the valve manufacturer.

(c) Safety relief devices periodically shall be examined externally for corrosion damage, plugging of external safety relief device channels, and mechanical defects such as leakage or extrusion of fusible metal. Valves equipped with secondary resilient seals shall have the seals inspected periodically. If there is any doubt regarding the suitability of the safety relief device for service the container shall not be filled until it is equipped with a suitable safety relief device.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-93503, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-93503, filed 5/9/73 and Order 73-4, § 296-24-93503, filed 5/7/73.]

WAC 296-24-940 Air receivers.

[Order 73-5, § 296-24-940, filed 5/9/73 and Order 73-4, § 296-24-940, filed 5/7/73.]

WAC 296-24-94001 General requirements. (1) Application. These standards apply to compressed air receivers, and other equipment used in providing and utilizing compressed air for performing operations such as cleaning, drilling, hoisting, and chipping. On the other hand, however, this section does not deal with the special problems created by using compressed air to convey materials nor the problems created when working in compressed air as in tunnels and caissons. These standards are not intended to apply to compressed air machinery and equipment used on transportation vehicles such as steam railroad cars, electric railway cars, and automotive equipment.

(2) New and existing equipment.

(a) All new air receivers installed after the effective date of these standards shall be constructed in accordance with the 1968 Edition of the A.S.M.E. Boiler and Pressure Vessel Code, section VIII.

(b) All safety valves used shall be constructed, installed, and maintained in accordance with the A.S.M.E. Boiler and Pressure Vessel Code, section VIII edition 1968.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-94001, filed 7/20/94, effective 9/20/94; Order 73-5, § 296-24-94001, filed 5/9/73 and Order 73-4, § 296-24-94001, filed 5/7/73.]

(1999 Ed.)

WAC 296-24-94003 Installation and equipment requirements. (1) Installation. Air receivers shall be so installed that all drains, handholes, and manholes therein are easily accessible. Air receivers should be supported with sufficient clearance to permit a complete external inspection and to avoid corrosion of external surfaces. Under no circumstances shall an air receiver be buried underground or located in an inaccessible place. The receiver should be located as close to the compressor or after-cooler as is possible in order to keep the discharge pipe short.

(2) Drains and traps. All air receivers having an internal and external operating pressure exceeding 15 psi with no limitation on size, and air receivers having an inside diameter exceeding six inches, with no limitation on pressure, if subject to corrosion, shall be supplied with a drain pipe and valve at the lowest point in the vessel; or a pipe may be used extending inward from any other location to within one-quarter inch of the lowest point. Adequate automatic traps may be installed in addition to drain valves. The drain valve on the air receiver shall be opened and the receiver completely drained frequently and at such intervals as to prevent the accumulation of oil and water in the receiver.

(3) Gages and valves.

(a) Every air receiver shall be equipped with an indicating pressure gage (so located as to be readily visible) and with one or more spring-loaded safety valves. The total relieving capacity of such safety valves shall be such as to prevent pressure in the receiver from exceeding the maximum allowable working pressure of the receiver by more than 10 percent.

(b) No valve of any type shall be placed between the air receiver and its safety valve or valves.

(c) Safety appliances, such as safety valves, indicating devices and controlling devices, shall be constructed, located, and installed so that they cannot be readily rendered inoperative by any means, including the elements.

(d) All safety valves shall be tested frequently and at regular intervals to determine whether they are in good operating condition.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-24-94003, filed 5/15/89, effective 6/30/89; Order 73-5, § 296-24-94003, filed 5/9/73 and Order 73-4, § 296-24-94003, filed 5/7/73.]

PART L ELECTRICAL

WAC 296-24-956 Electrical. This section addresses electrical safety requirements that are necessary for the practical safeguarding of employees in their workplaces.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-956, filed 3/30/82.]

WAC 296-24-95601 Definitions applicable to WAC 296-24-956 through 296-24-985. Unless the context indicates otherwise, words used in this section shall have the meaning given.

(1) **Acceptable.** An installation or equipment is acceptable to the director of labor and industries, and approved within the meaning of this section:

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(a) If it is accepted, or certified, or listed, or labeled, or otherwise determined to be safe by a nationally recognized testing laboratory; or

(b) With respect to an installation or equipment of a kind which no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe, if it is inspected or tested by another federal agency, or by a state, municipal, or other local authority responsible for enforcing occupational safety provisions of the National Electrical Code, and found in compliance with the provisions of the National Electrical Code as applied in this section; or

(c) With respect to custom-made equipment or related installations which are designed, fabricated for, and intended for use by a particular customer, if it is determined to be safe for its intended use by its manufacturer on the basis of test data which the employer keeps and makes available for inspection to the director and his/her authorized representatives. Refer to federal regulation 29 CFR 1910.7 for definition of nationally recognized testing laboratory.

(2) **Accepted.** An installation is "accepted" if it has been inspected and found by a nationally recognized testing laboratory to conform to specified plans or to procedures of applicable codes.

(3) **Accessible.** (As applied to wiring methods.) Capable of being removed or exposed without damaging the building structure of finish, or not permanently closed in by the structure or finish of the building. (See "concealed" and "exposed.")

(4) **Accessible.** (As applied to equipment.) Admitting close approach; not guarded by locked doors, elevation, or other effective means. (See "readily accessible.")

(5) **Ampacity.** Current-carrying capacity of electric conductors expressed in amperes.

(6) **Appliances.** Utilization equipment, generally other than industrial, normally built in standardized sizes or types, which is installed or connected as a unit to perform one or more functions such as clothes washing, air conditioning, food mixing, deep frying, etc.

(7) **Approved.** Acceptable to the authority enforcing this section. The authority enforcing this section is the director of labor and industries. The definition of "acceptable" indicates what is acceptable to the director and therefore approved within the meaning of this section.

(8) **Approved for the purpose.** Approved for a specific purpose, environment, or application described in a particular standard requirement.

Suitability of equipment or materials for a specific purpose, environment or application may be determined by a nationally recognized testing laboratory, inspection agency or other organization concerned with product evaluation as part of its listing and labeling program. (See "labeled" or "listed.")

(9) **Armored cable.** Type AC armored cable is a fabricated assembly of insulated conductors in a flexible metallic enclosure.

(10) **Askarel.** A generic term for a group of nonflammable synthetic chlorinated hydrocarbons used as electrical insulating media. Askarels of various compositional types are used. Under arcing conditions the gases produced, while consisting predominantly of noncombustible hydrogen chloride,

can include varying amounts of combustible gases depending upon the askarel type.

(11) **Attachment plug (plug cap) (cap).** A device which, by insertion in a receptacle, establishes connection between the conductors of the attached flexible cord and the conductors connected permanently to the receptacle.

(12) **Automatic.** Self-acting, operating by its own mechanism when actuated by some impersonal influence, as, for example, a change in current strength, pressure, temperature, or mechanical configuration.

(13) **Bare conductor, see "conductor."**

(14) **Bonding.** The permanent joining of metallic parts to form an electrically conductive path which will assure electrical continuity and the capacity to conduct safely any current likely to be imposed.

(15) **Bonding jumper.** A reliable conductor to assure the required electrical conductivity between metal parts required to be electrically connected.

(16) **Branch circuit.** The circuit conductors between the final overcurrent device protecting the circuit and the outlet(s).

(17) **Building.** A structure which stands alone or which is cut off from adjoining structures by fire walls with all openings therein protected by approved fire doors.

(18) **Cabinet.** An enclosure designed either for surface or flush mounting, and provided with a frame, mat, or trim in which a swinging door or doors are or may be hung.

(19) **Cable tray system.** A cable tray system is a unit or assembly of units or sections, and associated fittings, made of metal or other noncombustible materials forming a rigid structural system used to support cables. Cable tray systems include ladders, troughs, channels, solid bottom trays, and other similar structures.

(20) **Cablebus.** Cablebus is an approved assembly of insulated conductors with fittings and conductor terminations in a completely enclosed, ventilated, protective metal housing.

(21) **Center pivot irrigation machine.** A center pivot irrigation machine is a multimotored irrigation machine which revolves around a central pivot and employs alignment switches or similar devices to control individual motors.

(22) **Certified.** Equipment is "certified" if it (a) has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner, or (b) is of a kind whose production is periodically inspected by a nationally recognized testing laboratory, and (c) it bears a label, tag, or other record of certification.

(23) **Circuit breaker.**

(a) **(600 volts nominal, or less.)** A device designed to open and close a circuit by nonautomatic means and to open the circuit automatically on a predetermined overcurrent without injury to itself when properly applied within its rating.

(b) **(Over 600 volts, nominal.)** A switching device capable of making, carrying, and breaking currents under normal circuit conditions, and also making, carrying for a specified time, and breaking currents under specified abnormal circuit conditions, such as those of short circuit.

(24) **Class I locations.** Class I locations are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. Class I locations include the following:

(a) **Class I, Division 1.** A Class I, Division 1 location is a location:

(i) In which hazardous concentrations of flammable gases or vapors may exist under normal operating conditions; or

(ii) In which hazardous concentrations of such gases or vapors may exist frequently because of repair or maintenance operations or because of leakage; or

(iii) In which breakdown or faulty operation of equipment or processes might release hazardous concentrations of flammable gases or vapors, and might also cause simultaneous failure of electric equipment.

Note: This classification usually includes locations where volatile flammable liquids or liquefied flammable gases are transferred from one container to another; interiors of spray booths and areas in the vicinity of spraying and painting operations where volatile flammable solvents are used; locations containing open tanks or vats of volatile flammable liquids; drying rooms or compartments for the evaporation of flammable solvents; locations containing fat and oil extraction equipment using volatile flammable solvents; portions of cleaning and dyeing plants where flammable liquids are used; gas generator rooms and other portions of gas manufacturing plants where flammable gas may escape; inadequately ventilated pump rooms for flammable gas or for volatile flammable liquids; the interiors of refrigerators and freezers in which volatile flammable materials are stored in open, lightly stoppered, or easily ruptured containers; and all other locations where ignitable concentrations of flammable vapors or gases are likely to occur in the course of normal operations.

(b) **Class I, Division 2.** A Class I, Division 2 location is a location:

(i) In which volatile flammable liquids or flammable gases are handled, processed, or used, but in which the hazardous liquids, vapors, or gases will normally be confined within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown of such containers or systems, or in case of abnormal operation of equipment; or

(ii) In which hazardous concentrations of gases or vapors are normally prevented by positive mechanical ventilation, and which might become hazardous through failure or abnormal operations of the ventilating equipment; or

(iii) That is adjacent to a Class I, Division 1 location, and to which hazardous concentrations of gases or vapors might occasionally be communicated unless such communication is prevented by adequate positive-pressure ventilation from a source of clean air, and effective safeguards against ventilation failure are provided.

Note: This classification usually includes locations where volatile flammable liquids or flammable gases or vapors are used, but which would become hazardous only in case of an accident or of some unusual operating condition. The quantity of flammable material that might escape in case of accident, the adequacy of ventilating equipment, the total area involved, and the record of the industry or business with respect to explosions or fires are all factors that merit consideration in determining the classification and extent of each location.

Piping without valves, checks, meters, and similar devices would not ordinarily introduce a hazardous condition even though used for flammable liquids or gases. Locations used for the storage of flammable liquids or a liquefied or compressed gases in sealed containers would not normally be considered hazardous unless also subject to other hazardous conditions.

Electrical conduits and their associated enclosures separated from process fluids by a single seal or barrier are classed as a Division 2 location if the outside of the conduit and enclosures is a nonhazardous location.

(25) **Class II locations.** Class II locations are those that are hazardous because of the presence of combustible dust. Class II locations include the following:

(a) **Class II, Division 1.** A Class II, Division 1 location is a location:

(i) In which combustible dust is or may be in suspension in the air under normal operating conditions, in quantities sufficient to produce explosives or ignitable mixtures; or

(ii) Where mechanical failure or abnormal operation of machinery or equipment might cause such explosive or ignitable mixtures to be produced, and might also provide a source of ignition through simultaneous failure of electric equipment, operation of protection devices, or from other causes; or

(iii) In which combustible dusts of an electrically conductive nature may be present.

Note: This classification may include areas of grain handling and processing plants, starch plants, sugar-pulverizing plants, malting plants, hay-grinding plants, coal pulverizing plants, areas where metal dusts and powders are produced or processed, and other similar locations which contain dust producing machinery and equipment (except where the equipment is dust-tight or vented to the outside). These areas would have combustible dust in the air, under normal operating conditions, in quantities sufficient to produce explosive or ignitable mixtures. Combustible dusts which are electrically nonconductive include dusts produced in the handling and processing of grain and grain products, pulverized sugar and cocoa, dried egg and milk powders, pulverized spices, starch and pastes, potato and woodflour, oil meal from beans and seed, dried hay, and other organic materials which may produce combustible dusts when processed or handled. Dusts containing magnesium or aluminum are particularly hazardous and the use of extreme caution is necessary to avoid ignition and explosion.

(b) **Class II, Division 2.** A Class II, Division 2 location is a location in which:

(i) Combustible dust will not normally be in suspension in the air in quantities sufficient to produce explosive or ignitable mixtures; and dust accumulations are normally insufficient to interfere with the normal operation of electrical equipment or other apparatus; or

(ii) Dust may be in suspension in the air as a result of infrequent malfunctioning of handling or processing equipment, and dust accumulations resulting therefrom may be ignitable by abnormal operation or failure of electrical equipment or other apparatus.

Note: This classification includes locations where dangerous concentrations of suspended dust would not be likely but where dust accumulations might form on or in the vicinity of electric equipment. These areas may contain equipment from which appreciable quantities of dust would escape under abnormal operating conditions or be adjacent to a Class II

Division 1 location, as described above, into which an explosive or ignitable concentration of dust may be put into suspension under abnormal operating conditions.

(26) **Class III locations.** Class III locations are those that are hazardous because of the presence of easily ignitable fibers or flyings but in which such fibers or flyings are not likely to be in suspension in the air in quantities sufficient to produce ignitable mixtures. Class III locations include the following:

(a) **Class III, Division 1.** A Class III, Division 1 location is a location in which easily ignitable fibers or materials producing combustible flyings are handled, manufactured, or used.

Note: Such locations usually include some parts of rayon, cotton, and other textile mills; combustible fiber manufacturing and processing plants; cotton gins and cottonseed mills; flax-processing plants; clothing manufacturing plants; woodworking plants, and establishments; and industries involving similar hazardous processes or conditions.

Easily ignitable fibers and flyings include rayon, cotton (including cotton linters and cotton waste), sisal or henequen, istle, jute, hemp, tow, cocoa fiber, oakum, baled waste kapok, Spanish moss, excelsior, and other materials of similar nature.

(b) **Class III, Division 2.** A Class III, Division 2 location is a location in which easily ignitable fibers are stored or handled, except in process of manufacture.

(27) **Collector ring.** A collector ring is an assembly of slip rings for transferring electrical energy from a stationary to a rotating member.

(28) **Concealed.** Rendered inaccessible by the structure or finish of the building. Wires in concealed raceways are considered concealed, even though they may become accessible by withdrawing them. (See "accessible. (As applied to wiring methods.")")

(29) **Conductor.**

(a) **Bare.** A conductor having no covering or electrical insulation whatsoever.

(b) **Covered.** A conductor encased within material of composition or thickness that is not recognized as electrical insulation.

(c) **Insulated.** A conductor encased within material of composition and thickness that is recognized as electrical insulation.

(30) **Conduit body.** A separate portion of a conduit or tubing system that provides access through a removable cover(s) to the interior of the system at a junction of two or more sections of the system or at a terminal point of the system. Boxes such as FS and FD or larger cast or sheet metal boxes are not classified as conduit bodies.

(31) **Controller.** A device or group of devices that serves to govern, in some predetermined manner, the electric power delivered to the apparatus to which it is connected.

(32) **Cooking unit, counter-mounted.** A cooking appliance designed for mounting in or on a counter and consisting of one or more heating elements, internal wiring, and built-in or separately mountable controls. (See "oven, wall-mounted.")

(33) **Covered conductor.** See "conductor."

(34) **Cutout.** (Over 600 volts, nominal.) An assembly of a fuse support with either a fuseholder, fuse carrier, or disconnecting blade. The fuseholder or fuse carrier may include a conducting element (fuse link), or may act as the disconnecting blade by the inclusion of a nonfusible member.

(35) **Cutout box.** An enclosure designed for surface mounting and having swinging doors or covers secured directly to and telescoping with the walls of the box proper. (See "cabinet.")

(36) **Damp location.** See "location."

(37) **Dead front.** Without live parts exposed to a person on the operating side of the equipment.

(38) **Device.** A unit of an electrical system which is intended to carry but not utilize electric energy.

(39) **Dielectric heating.** Dielectric heating is the heating of a nominally insulating material due to its own dielectric losses when the materials is placed in a varying electric field.

(40) **Disconnecting means.** A device, or group of devices, or other means by which the conductors of a circuit can be disconnected from their source of supply.

(41) **Disconnecting (or isolating) switch.** (Over 600 volts, nominal.) A mechanical switching device used for isolating a circuit or equipment from a source of power.

(42) **Dry location.** See "location."

(43) **Electric sign.** A fixed, stationary, or portable self-contained, electrically illuminated utilization equipment with words or symbols designed to convey information or attract attention.

(44) **Enclosed.** Surrounded by a case, housing, fence or walls which will prevent persons from accidentally contacting energized parts.

(45) **Enclosure.** The case or housing of apparatus, or the fence or walls surrounding an installation to prevent personnel from accidentally contacting energized parts, or to protect the equipment from physical damage.

(46) **Equipment.** A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like, used as a part of, or in connection with, an electrical installation.

(47) **Equipment grounding conductor.** See "grounding conductor, equipment."

(48) **Explosion-proof apparatus.** Apparatus enclosed in a case that is capable of withstanding an explosion of a specified gas or vapor which may occur within it and of preventing the ignition of a specified gas or vapor surrounding the enclosure by sparks, flashes, or explosion of the gas or vapor within, and which operates at such an external temperature that it will not ignite a surrounding flammable atmosphere.

(49) **Exposed.** (As applied to live parts.) Capable of being inadvertently touched or approached nearer than a safe distance by a person. It is applied to parts not suitably guarded, isolated, or insulated. (See "accessible" and "concealed.")

(50) **Exposed.** (As applied to wiring methods.) On or attached to the surface or behind panels designed to allow access. (See "accessible. (As applied to wiring methods.")")

(51) **Exposed.** (For the purpose of WAC 296-24-95615(5), communications systems.) Where the circuit is in such a position that in case of failure of supports or insulation, contact with another circuit may result.

(52) **Externally operable.** Capable of being operated without exposing the operator to contact with live parts.

(53) **Feeder.** All circuit conductors between the service equipment, or the generator switchboard of an isolated plant, and the final branch-circuit overcurrent device.

(54) **Fitting.** An accessory such as a locknut, bushing, or other part of a wiring system that is intended primarily to perform a mechanical rather than an electrical function.

(55) **Fuse.** (Over 600 volts, nominal.) An overcurrent protective device with a circuit opening fusible part that is heated and severed by the passage of overcurrent through it. A fuse comprises all the parts that form a unit capable of performing the prescribed functions. It may or may not be the complete device necessary to connect it into an electrical circuit.

(56) **Ground.** A conducting connection, whether intentional or accidental, between an electrical circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

(57) **Grounded.** Connected to earth or to some conducting body that serves in place of the earth.

(58) **Grounded, effectively.** (Over 600 volts, nominal.) Permanently connected to earth through a ground connection of sufficiently low impedance and having sufficient ampacity that ground fault current which may occur cannot build up to voltages dangerous to personnel.

(59) **Grounded conductor.** A system or circuit conductor that is intentionally grounded.

(60) **Grounding conductor.** A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode or electrodes.

(61) **Grounding conductor, equipment.** The conductor used to connect the noncurrent-carrying metal parts of equipment, raceways, and other enclosures to the system grounded conductor and/or the grounding electrode conductor at the service equipment or at the source of a separately derived system.

(62) **Grounding electrode conductor.** The conductor used to connect the grounding electrode to the equipment grounding conductor and/or to the grounded conductor of the circuit at the service equipment or at the source of a separately derived system.

(63) **Ground-fault circuit-interrupter.** A device whose function is to interrupt the electric circuit to the load when a fault current to ground exceeds some predetermined value that is less than that required to operate the overcurrent protective device of the supply circuit.

(64) **Guarded.** Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, or platforms to remove the likelihood of approach to a point of danger or contact by persons or objects.

(65) **Health care facilities.** Buildings or portions of buildings and mobile homes that contain, but are not limited to, hospitals, nursing homes, extended care facilities, clinics, and medical and dental offices, whether fixed or mobile.

(66) **Heating equipment.** For the purposes of WAC 296-24-95611(7), the term "heating equipment" includes any equipment used for heating purposes if heat is generated by induction or dielectric methods.

(67) **Hoistway.** Any shaftway, hatchway, well hole, or other vertical opening or space in which an elevator or dumb-waiter is designed to operate.

(68) **Identified.** Identified, as used in reference to a conductor or its terminal, means that such conductor or terminal can be readily recognized as grounded.

(69) **Induction heating.** Induction heating is the heating of a nominally conductive material due to its own I²R losses when the material is placed in a varying electromagnetic field.

(70) **Insulated conductor.** See "conductor."

(71) **Interrupter switch.** (Over 600 volts, nominal.) A switch capable of making, carrying, and interrupting specified currents.

(72) **Irrigation machine.** An irrigation machine is an electrically driven or controlled machine, with one or more motors, not hand portable, and used primarily to transport and distribute water for agricultural purposes.

(73) **Isolated.** Not readily accessible to persons unless special means for access are used.

(74) **Isolated power system.** A system comprising an isolating transformer or its equivalent, a line isolation monitor, and its ungrounded circuit conductors.

(75) **Labeled.** Equipment is "labeled" if there is attached to it a label, symbol, or other identifying mark of a nationally recognized testing laboratory which, (a) makes periodic inspections of the production of such equipment, and (b) whose labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

(76) **Lighting outlet.** An outlet intended for the direct connection of a lampholder, a lighting fixture, or a pendant cord terminating in a lampholder.

(77) **Line-clearance tree trimming.** The pruning, trimming, repairing, maintaining, removing, or clearing of trees or cutting of brush that is within 10 feet of electric supply lines and equipment.

(78) **Listed.** Equipment is "listed" if it is of a kind mentioned in a list which, (a) is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment, and (b) states such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

(79) **Location.**

(a) **Damp location.** Partially protected locations under canopies, marquees, roofed open porches, and like locations, and interior locations subject to moderate degrees of moisture, such as some basements, some barns, and some cold-storage warehouses.

(b) **Dry location.** A location not normally subject to dampness or wetness. A location classified as dry may be temporarily subject to dampness or wetness, as in the case of a building under construction.

(c) **Wet location.** Installations underground or in concrete slabs or masonry in direct contact with the earth, and locations subject to saturation with water or other liquids, such as vehicle-washing areas, and locations exposed to weather and unprotected.

(80) **Medium voltage cable.** Type MV medium voltage cable is a single or multiconductor solid dielectric insulated cable rated 2000 volts or higher.

(81) **Metal-clad cable.** Type MC cable is a factory assembly of one or more conductors, each individually insulated and enclosed in a metallic sheath of interlocking tape, or a smooth or corrugated tube.

(82) **Mineral-insulated metal-sheathed cable.** Type MI mineral-insulated metal-sheathed cable is a factory assembly of one or more conductors insulated with a highly compressed refractory mineral insulation and enclosed in a liquidtight and gastight continuous copper sheath.

(83) **Mobile x-ray.** X-ray equipment mounted on a permanent base with wheels and/or casters for moving while completely assembled.

(84) **Nonmetallic-sheathed cable.** Nonmetallic-sheathed cable is a factory assembly of two or more insulated conductors having an outer sheath of moisture resistant, flame-retardant, nonmetallic material. Nonmetallic sheathed cable is manufactured in the following types:

(a) **Type NM.** The overall covering has a flame-retardant and moisture-resistant finish.

(b) **Type NMC.** The overall covering is flame-retardant, moisture-resistant, fungus-resistant, and corrosion-resistant.

(85) **Oil (filled) cutout.** (Over 600 volts, nominal.) A cutout in which all or part of the fuse support and its fuse link or disconnecting blade are mounted in oil with complete immersion of the contacts and the fusible portion of the conducting element (fuse link), so that arc interruption by severing of the fuse link or by opening of the contacts will occur under oil.

(86) **Open wiring on insulators.** Open wiring on insulators is an exposed wiring method using cleats, knobs, tubes, and flexible tubing for the protection and support of single insulated conductors run in or on buildings, and not concealed by the building structure.

(87) **Outlet.** A point on the wiring system at which current is taken to supply utilization equipment.

(88) **Outline lighting.** An arrangement of incandescent lamps or electric discharge tubing to outline or call attention to certain features such as the shape of a building or the decoration of a window.

(89) **Oven, wall-mounted.** An oven for cooking purposes designed for mounting in or on a wall or other surface and consisting of one or more heating elements, internal wiring, and built-in or separately mountable controls. (See "cooking unit, counter-mounted.")

(90) **Overcurrent.** Any current in excess of the rated current of equipment or the ampacity of a conductor. It may result from overload (see definition), short circuit, or ground fault. A current in excess of rating may be accommodated by certain equipment and conductors for a given set of conditions. Hence the rules for overcurrent protection are specific for particular situations.

(91) **Overload.** Operation of equipment in excess of normal, full load rating, or of a conductor in excess of rated ampacity which, when it persists for a sufficient length of time, would cause damage or dangerous overheating. A fault, such as a short circuit or ground fault, is not an overload. (See "overcurrent.")

(92) **Panelboard.** A single panel or group of panel units designed for assembly in the form of a single panel; including buses, automatic overcurrent devices, and with or without switches for the control of light, heat, or power circuits; designed to be placed in a cabinet or cutout box placed in or against a wall or partition and accessible only from the front. (See "switchboard.")

(93) **Permanently installed decorative fountains and reflection pools.** Those that are constructed in the ground, on the ground, or in a building in such a manner that the pool cannot be readily disassembled for storage and are served by electrical circuits of any nature. These units are primarily constructed for their aesthetic value and not intended for swimming or wading.

(94) **Permanently installed swimming pools, wading and therapeutic pools.** Those that are constructed in the ground, on the ground, or in a building in such a manner that the pool cannot be readily disassembled for storage whether or not served by electrical circuits of any nature.

(95) **Portable x-ray.** X-ray equipment designed to be hand-carried.

(96) **Power and control tray cable.** Type TC power and control tray cable is a factory assembly of two or more insulated conductors, with or without associated bare or covered grounding conductors under a nonmetallic sheath, approved for installation in cable trays, in raceways, or where supported by a messenger wire.

(97) **Power fuse.** (Over 600 volts, nominal.) See "fuse."

(98) **Power-limited tray cable.** Type PLTC nonmetallic-sheathed power limited tray cable is a factory assembly of two or more insulated conductors under a nonmetallic jacket.

(99) **Power outlet.** An enclosed assembly which may include receptacles, circuit breakers, fuseholders, fused switches, buses and watt-hour meter mounting means; intended to supply and control power to mobile homes, recreational vehicles or boats, or to serve as a means for distributing power required to operate mobile or temporarily installed equipment.

(100) **Premises wiring system.** That interior and exterior wiring, including power, lighting, control, and signal circuit wiring together with all of its associated hardware, fittings, and wiring devices, both permanently and temporarily installed, which extends from the load end of the service drop, or load end of the service lateral conductors to the outlet(s). Such wiring does not include wiring internal to appliances, fixtures, motors, controllers, motor control centers, and similar equipment.

(101) **Qualified person.** One familiar with the construction and operation of the equipment and the hazards involved.

Note 1: Whether an employee is considered to be a "qualified person" will depend upon various circumstances in the workplace. It is possible and, in fact, likely for an individual to be considered "qualified" with regard to certain equipment in the workplace, but "unqualified" as to other equipment. (See WAC 296-24-970 for training requirements that specifically apply to qualified persons.)

Note 2: An employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

(102) **Raceway.** A channel designed expressly for holding wires, cables, or busbars, with additional functions as permitted in this part. Raceways may be of metal or insulating material, and the term includes rigid metal conduit, rigid non-metallic conduit, intermediate metal conduit, liquidtight flexible metal conduit, flexible metallic tubing, flexible metal conduit, electrical metallic tubing, underfloor raceways, cellular concrete floor raceways, cellular metal floor raceways, surface raceways, wireways, and busways.

(103) **Readily accessible.** Capable of being reached quickly for operation, renewal, or inspections, without requiring those to whom ready access is requisite to climb over or remove obstacles or to resort to portable ladders, chairs, etc. (See "accessible.")

(104) **Receptacle.** A receptacle is a contact device installed at the outlet for the connection of a single attachment plug. A single receptacle is a single contact device with no other contact device on the same yoke. A multiple receptacle is a single device containing two or more receptacles.

(105) **Receptacle outlet.** An outlet where one or more receptacles are installed.

(106) **Remote-control circuit.** Any electric circuit that controls any other circuit through a relay or an equivalent device.

(107) **Sealable equipment.** Equipment enclosed in a case or cabinet that is provided with a means of sealing or locking so that live parts cannot be made accessible without opening the enclosure. The equipment may or may not be operable without opening the enclosure.

(108) **Separately derived system.** A premises wiring system whose power is derived from generator, transformer, or converter winding and has no direct electrical connection, including a solidly connected grounded circuit conductor, to supply conductors originating in another system.

(109) **Service.** The conductors and equipment for delivering energy from the electricity supply system to the wiring system of the premises served.

(110) **Service cable.** Service conductors made up in the form of a cable.

(111) **Service conductors.** The supply conductors that extend from the street main or from transformers to the service equipment of the premises supplied.

(112) **Service drop.** The overhead service conductors from the last pole or other aerial support to and including the splices, if any, connecting to the service-entrance conductors at the building or other structure.

(113) **Service-entrance cable.** Service-entrance cable is a single conductor or multiconductor assembly provided with or without an overall covering, primarily used for services and of the following types:

(a) *Type SE*, having a flame-retardant, moisture-resistant covering, but not required to have inherent protection against mechanical abuse.

(b) *Type USE*, recognized for underground use, having a moisture-resistant covering, but not required to have a flame-retardant covering or inherent protection against mechanical abuse. Single-conductor cables having an insulation specifically approved for the purpose do not require an outer covering.

(114) **Service-entrance conductors, overhead system.** The service conductors between the terminals of the service equipment and a point usually outside the building, clear of building walls, where joined by tap or splice to the service drop.

(115) **Service entrance conductors, underground system.** The service conductors between the terminals of the service equipment and the point of connection to the service lateral. Where service equipment is located outside the building walls, there may be no service-entrance conductors, or they may be entirely outside the building.

(116) **Service equipment.** The necessary equipment, usually consisting of a circuit breaker or switch and fuses, and their accessories, located near the point of entrance of supply conductors to a building or other structure, or an otherwise defined area, and intended to constitute the main control and means of cutoff of the supply.

(117) **Service raceway.** The raceway that encloses the service-entrance conductors.

(118) **Shielded nonmetallic-sheathed cable.** Type SNM, shielded nonmetallic-sheathed cable is a factory assembly of two or more insulated conductors in an extruded core of moisture-resistant, flame-resistant nonmetallic material, covered with an overlapping spiral metal tape and wire shield and jacketed with an extruded moisture-resistant, flame-resistant, oil-resistant, corrosion-resistant, fungus-resistant, and sunlight-resistant nonmetallic material.

(119) **Show window.** Any window used or designed to be used for the display of goods or advertising material, whether it is fully or partly enclosed or entirely open at the rear and whether or not it has a platform raised higher than the street floor level.

(120) **Sign.** See "electric sign."

(121) **Signaling circuit.** Any electric circuit that energizes signaling equipment.

(122) **Special permission.** The written consent of the authority having jurisdiction.

(123) **Storable swimming or wading pool.** A pool with a maximum dimension of fifteen feet and a maximum wall height of three feet and is so constructed that it may be readily disassembled for storage and reassembled to its original integrity.

(124) **Switchboard.** A large single panel, frame, or assembly of panels which have switches, buses, instruments, overcurrent and other protective devices mounted on the face or back or both. Switchboards are generally accessible from the rear as well as from the front and are not intended to be installed in cabinets. (See "panelboard.")

(125) **Switches.**

(a) **General-use switch.** A switch intended for use in general distribution and branch circuits. It is rated in amperes, and it is capable of interrupting its rated current at its rated voltage.

(b) **General-use snap switch.** A form of general-use switch so constructed that it can be installed in flush device boxes or on outlet box covers, or otherwise used in conjunction with wiring systems recognized by this part.

(c) **Isolating switch.** A switch intended for isolating an electric circuit from the source of power. It has no interrupt-

ing rating, and it is intended to be operated only after the circuit has been opened by some other means.

(d) **Motor-circuit switch.** A switch, rated in horsepower, capable of interrupting the maximum operating overload current of a motor of the same horsepower rating as the switch at the rated voltage.

(126) **Switching devices.** (Over 600 volts, nominal.) Devices designed to close and/or open one or more electric circuits. Included in this category are circuit breakers, cut-outs, disconnecting (or isolating) switches, disconnecting means, interrupter switches, and oil (filled) cutouts.

(127) **Transportable x-ray.** X-ray equipment installed in a vehicle or that may readily be disassembled for transport in a vehicle.

(128) **Utilization equipment.** Utilization equipment means equipment which utilizes electric energy for mechanical, chemical, heating, lighting, or similar useful purpose.

(129) **Utilization system.** A utilization system is a system which provides electric power and light for employee workplaces, and includes the premises wiring system and utilization equipment.

(130) **Ventilated.** Provided with a means to permit circulation of air sufficient to remove an excess of heat, fumes, or vapors.

(131) **Volatile flammable liquid.** A flammable liquid having a flash point below 38 degrees C (100 degrees F) or whose temperature is above its flash point.

(132) **Voltage (of a circuit).** The greatest root-mean-square (effective) difference of potential between any two conductors of the circuit concerned.

(133) **Voltage, nominal.** A nominal value assigned to a circuit or system for the purpose of conveniently designating its voltage class (as 120/240, 480Y/277, 600, etc.). The actual voltage at which a circuit operates can vary from the nominal within a range that permits satisfactory operation of equipment.

(134) **Voltage to ground.** For grounded circuits, the voltage between the given conductor and that point or conductor of the circuit that is grounded; for undergrounded circuits, the greatest voltage between the given conductor and any other conductor of the circuit.

(135) **Watertight.** So constructed that moisture will not enter the enclosure.

(136) **Weatherproof.** So constructed or protected that exposure to the weather will not interfere with successful operation. Rainproof, raintight, or watertight equipment can fulfill the requirements for weatherproof where varying weather conditions other than wetness, such as snow, ice, dust, or temperature extremes, are not a factor.

(137) **Wet location.** See "location."

(138) **Wireways.** Wireways are sheet-metal troughs with hinged or removable covers for housing and protecting electric wires and cable and in which conductors are laid in place after the wireway has been installed as a complete system.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-95601, filed 7/20/94, effective 9/20/94; 91-24-017 (Order 91-07), § 296-24-95601, filed 11/22/91, effective 12/24/91; 88-23-054 (Order 88-25), § 296-24-95601, filed 11/14/88; 87-24-051 (Order 87-24), § 296-24-95601, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95601, filed 3/30/82.]

WAC 296-24-95603 Electric utilization systems. (1) Scope.

(a) **Covered.** The provisions of WAC 296-24-95603 through 296-24-985 cover electrical installations and utilization equipment installed or used within or on buildings, structures, and other premises including:

- (i) Yards;
- (ii) Carnivals;
- (iii) Parking and other lots;
- (iv) Mobile homes;
- (v) Recreational vehicles;
- (vi) Industrial substations under 750 volts. Chapter 296-44 WAC, Safety standards—Electrical Construction Code, shall apply to industrial substations of 750 volts or more;
- (vii) Conductors that connect the installations to a supply of electricity; and
- (viii) Other outside conductors on the premises.

(b) **Not covered.** The provisions of WAC 296-24-95603 through 296-24-985 do not cover:

- (i) Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles.
- (ii) Installations underground in mines.
- (iii) Installations of railways for generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations used exclusively for signaling and communication purposes.
- (iv) Installations of communication equipment under the exclusive control of communication utilities, located outdoors or in building spaces used exclusively for such installations.
- (v) Installations under the exclusive control of electric utilities for the purpose of communication or metering; or for the generation, control, transformation, transmission, and distribution of electric energy located in buildings used exclusively by utilities for such purposes or located outdoors on property owned or leased by the utility or on public highways, streets, roads, etc., or outdoors by established rights on private property.

(2) Extent of application.

(a) The requirements contained in the sections listed below shall apply to all electrical installations and utilization equipment, regardless of when they were designed or installed:

Sections:

WAC 296-24-95605	(2)	Examination, installation, and use of equipment.
" "	(3)	Splices.
" "	(4)	Arcing parts.
" "	(5)	Marking.
" "	(6)	Identification of disconnecting means.
" "	(7)(b)	Guarding of live parts.
WAC 296-24-95607	(5)(a)(i)	Protection of conductors and equipment.
" "	(5)(a)(iv)	Location in or on premises.
" "	(5)(a)(v)	Arcing or suddenly moving parts.
" "	(6)(a)(ii)	2-Wire DC systems to be grounded.

Sections:

"	"	(6)(a)(iii) and (iv) AC systems to be grounded.
"	"	(6)(a)(v) AC systems 50 to 1000 volts not required to be grounded.
"	"	(6)(c) Grounding connections.
"	"	(6)(d) Grounding path.
WAC 296-24-95607	(6)(e)(iv) (A) through (D)	Fixed equipment required to be grounded.
"	"	(6)(e)(v) Grounding of equipment connected by cord and plug.
"	"	(6)(e)(vi) Grounding or nonelectrical equipment.
"	"	(6)(f)(i) Methods of grounding fixed equipment.
WAC 296-24-95609	(7)(a)(i) and (ii)	Flexible cords and cables, uses.
"	"	(7)(a)(iii) Flexible cords and cables prohibited.
"	"	(7)(b)(ii) Flexible cords and cables, splices.
"	"	(7)(b)(iii) Pull at joints and terminals of flexible cords and cables.
WAC 296-24-95613	. . . . .	Hazardous (classified) locations.

(b) Every electric utilization system and all utilization equipment installed after March 15, 1972, and every major replacement, modification, repair, or rehabilitation, after March 15, 1972, of any part of any electric utilization system or utilization equipment installed before March 15, 1972, shall comply with the provisions of WAC 296-24-956 through 296-24-985.

Note: "Major replacements, modifications, repairs, or rehabilitations" include work similar to that involved when a new building or facility is built, a new wing is added, or an entire floor is renovated.

(c) The following provisions apply to electric utilization systems and utilization equipment installed after April 16, 1981:

WAC 296-24-95605	(8)(d)(i) and (ii)	Entrance and access to work space (over 600 volts).
WAC 296-24-95607	(5) (a)(vi)(B)	Circuit breakers operated vertically.
"	"	(5)(a)(vi)(C) Circuit breakers used as switches.
"	"	(6)(g)(ii) Grounding of systems of 1000 volts or more supplying portable or mobile equipment.
WAC 296-24-95609	(10)(f)(ii)(B)	Switching series capacitors over 600 volts.
WAC 296-24-95611	(3)(b)	Warning signs for elevators and escalators.
"	"	(9) Electrically controlled irrigation machines.
"	"	(10)(e) Ground-fault circuit interrupters for fountains.
WAC 296-24-95615	(1)(a)(ii)	Physical protection of conductors over 600 volts.
"	"	(3)(b) Marking of Class 2 and Class 3 power supplies.
"	"	(4) Fire protective signaling circuits.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-95603, filed 11/22/91, effective 12/24/91; 87-24-051 (Order 87-24), § 296-24-95603, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95603, filed 3/30/82.]

WAC 296-24-95605 General requirements. (1) **Approval.** The conductors and equipment required or permitted by this section shall be acceptable only if approved.

(2) **Examination, installation, and use of equipment.**

(a) **Examination.** Electrical equipment shall be free from recognized hazards that are likely to cause death or serious physical harm to employees. Safety of equipment shall be determined using the following considerations:

(i) Suitability for installation and use in conformity with the provisions of this part. Suitability of equipment for an identified purpose may be evidenced by listing or labeling for that identified purpose.

(ii) Mechanical strength and durability, including, for parts designed to enclose and protect other equipment, the adequacy of the protection thus provided.

(iii) Electrical insulation.

(iv) Heating effects under conditions of use.

(v) Arcing effects.

(vi) Classification by type, size, voltage, current capacity, specific use.

(vii) Other factors which contribute to the practical safeguarding of employees using or likely to come in contact with the equipment.

(b) **Installation and use.** Listed or labeled equipment shall be used or installed in accordance with any instructions included in the listing or labeling.

(3) **Splices.** Conductors shall be spliced or joined with splicing devices suitable for the use or by brazing, welding, or soldering with a fusible metal or alloy. Soldered splices shall first be so spliced or joined as to be mechanically and electrically secure without solder and then soldered. All splices and joints and the free ends of conductors shall be covered with an insulation equivalent to that of the conductors or with an insulating device suitable for the purpose.

(4) **Arcing parts.** Parts of electric equipment which in ordinary operation produce arcs, sparks, flames, or molten metal shall be enclosed or separated and isolated from all combustible material.

(5) **Marking.** Electrical equipment may not be used unless the manufacturer's name, trademark, or other descriptive marking by which the organization responsible for the product may be identified is placed on the equipment. Other markings shall be provided giving voltage, current, wattage, or other ratings as necessary. The marking shall be of sufficient durability to withstand the environment involved.

(6) **Identification of disconnecting means and circuits.** Each disconnecting means required by this part for motors and appliances shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. Each service, feeder, and branch circuit, at its disconnecting means or overcurrent device, shall be legibly marked to indicate its purpose, unless located and arranged so the purpose is evident. These markings shall be of sufficient durability to withstand the environment involved.

(7) **600 volts, nominal, or less.**

(a) **Working space about electric equipment.** Sufficient access and working space shall be provided and maintained about all electric equipment to permit ready and safe operation and maintenance of such equipment.

(i) **Working clearances.** Except as required or permitted elsewhere in this chapter, the dimension of the working space in the direction of access to live parts operating at 600 volts or less and likely to require examination, adjustment, servicing, or maintenance while alive may not be less than indicated in Table S-1. In addition to the dimensions shown in Table S-1, workspace may not be less than 30 inches wide in front of the electric equipment. Distances shall be measured from the live parts if they are exposed, or from the enclosure front or opening if the live parts are enclosed. Concrete, brick, or tile walls are considered to be grounded. Working space is not required in back of assemblies such as dead-front switchboards or motor control centers where there are no renewable or adjustable parts such as fuses or switches on the back and where all connections are accessible from locations other than the back.

TABLE S-1—Working clearances

Nominal voltage to ground	Minimum clear distance for condition ² (ft)		
	(a)	(b)	(c)
0-150 -----	1/3	1/3	3
151-600 -----	1/3	3 1/2	4

¹ Minimum clear distances may be 2 feet 6 inches for installations built prior to effective date of this section.

² Conditions (a), (b), (c), are as follows: (a) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating material. Insulated wire or insulated busbars operating at not over 300 volts are not considered live parts. (b) Exposed live parts on one side and grounded parts on the other side (c) Exposed live parts on both sides of the workspace (not guarded as provided in condition (a)) with the operator between.

(ii) **Clear spaces.** Working space required by this part may not be used for storage. When normally enclosed live parts are exposed for inspection or servicing, the working space, if in a passageway or general open space, shall be suitably guarded.

(iii) **Access and entrance to working space.** At least one entrance of sufficient area shall be provided to give access to the working space about electric equipment.

(iv) **Front working space.** Where there are live parts normally exposed on the front of switchboards or motor control centers, the working space in front of such equipment may not be less than 3 feet.

(v) **Illumination.** Illumination shall be provided for all working spaces about service equipment, switchboards, panelboards, and motor control centers installed indoors.

(vi) **Headroom.** The minimum headroom of working spaces about service equipment, switchboards, panelboards, or motor control centers shall be 6 feet 3 inches.

Note: As used in this section, a motor control center is an assembly of one or more enclosed sections having a common power bus and principally containing motor control units.

(b) **Guarding of live parts.**

(i) Except as required or permitted elsewhere in this section, live parts of electric equipment operating at 50 volts or

more shall be guarded against accidental contact by approved cabinets or other forms of approved enclosures, or by any of the following means:

(A) By location in a room, vault, or similar enclosure that is accessible only to qualified persons.

(B) By suitable permanent, substantial partitions or screens so arranged that only qualified persons will have access to the space within reach of the live parts. Any openings in such partitions or screens shall be so sized and located that persons are not likely to come into accidental contact with live parts or to bring conducting objects into contact with them.

(C) By location on a suitable balcony, gallery, or platform so elevated and arranged as to exclude unqualified persons.

(D) By elevation of 8 feet or more above the floor or other working surface.

(ii) In locations where electric equipment would be exposed to physical damage, enclosures or guards shall be so arranged and of such strength as to prevent such damage.

(iii) Entrances to rooms and other guarded locations containing exposed live parts shall be marked with conspicuous warning signs forbidding unqualified persons to enter.

(8) **Over 600 volts, nominal.**

(a) **General.** Conductors and equipment used on circuits exceeding 600 volts, nominal, shall comply with all applicable provisions of subsections (1) through (7) of this section and with the following provisions which supplement or modify those requirements. The provisions of (b), (c) and (d) of this subsection do not apply to equipment on the supply side of the service conductors.

(b) **Enclosure for electrical installations.** Electrical installations in a vault, room, closet or in an area surrounded by a wall, screen, or fence, access to which is controlled by lock and key or other approved means, are considered to be accessible to qualified persons only. A wall, screen, or fence less than 8 feet in height is not considered to prevent access unless it has other features that provide a degree of isolation equivalent to an 8 foot fence. The entrances to all buildings, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 volts, nominal, shall be kept locked or shall be under the observation of a qualified person at all times.

(i) **Installations accessible to qualified persons only.** Electrical installations having exposed live parts shall be accessible to qualified persons only and shall comply with the applicable provisions of (c) of this subsection.

(ii) **Installations accessible to unqualified persons.** Electrical installations that are open to unqualified persons shall be made with metal-enclosed equipment or shall be enclosed in a vault or in an area, access to which is controlled by a lock. If metal-enclosed equipment is installed so that the bottom of the enclosure is less than 8 feet above the floor, the door or cover shall be kept locked. Metal-enclosed switchgear, unit substations, transformers, pull boxes, connection boxes, and other similar associated equipment shall be marked with appropriate caution signs. If equipment is exposed to physical damage from vehicular traffic, suitable guards shall be provided to prevent such damage. Ventilating or similar openings in metal-enclosed equipment shall be

designed so that foreign objects inserted through these openings will be deflected from energized parts.

(c) **Workspace about equipment.** Sufficient space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment. Where energized parts are exposed, the minimum clear workspace may not be less than 6 feet 6 inches high (measured vertically from the floor or platform), or less than 3 feet wide (measured parallel to the equipment). The depth shall be as required in Table S-2. The workspace shall be adequate to permit at least a 90-degree opening of doors or hinged panels.

(i) **Working space.** The minimum clear working space in front of electric equipment such as switchboards, control panels, switches, circuit breakers, motor controllers, relays, and similar equipment may not be less than specified in Table S-2 unless otherwise specified in this part. Distances shall be measured from the live parts if they are exposed, or from the enclosure front or opening if the live parts are enclosed. However, working space is not required in back of equipment such as deadfront switchboards or control assemblies where there are no renewable or adjustable parts (such as fuses or switches) on the back and where all connections are accessible from locations other than the back. Where rear access is required to work on deenergized parts on the back of enclosed equipment, a minimum working space of 30 inches horizontally shall be provided.

TABLE S-2—Minimum Depth of Clear Working Space in Front of Electric Equipment

Nominal voltage to ground	Conditions ² (ft)		
	(a)	(b)	(c)
601 to 2,500	3	4	5
2,501 to 9,000	4	5	6
9,001 to 25,000	5	6	9
25,001 to 75kV ¹	6	8	10
Above 75kV ¹	8	10	12

¹Minimum depth of clear working space in front of electric equipment with a nominal voltage to ground above 25,000 volts may be the same as for 25,000 volts under conditions (a), (b) and (c) for installations built prior to April 16, 1981. (2) Conditions (a), (b) and (c) are as follows: (a) Exposed live parts on one side and no live or grounded parts on the other side of the working space, or exposed live parts on both sides effectively guarded by suitable wood or other insulating materials. Insulated wire or insulated busbars operating at not over 300 volts are not considered live parts. (b) Exposed live parts on one side and grounded parts on the other side. Concrete, brick, or tile walls will be considered as grounded surfaces. (c) Exposed live parts on both sides of the workspace not guarded as provided in condition (a) with the operator between.

(ii) **Illumination.** Adequate illumination shall be provided for all working spaces about electric equipment. The lighting outlets shall be so arranged that persons changing lamps or making repairs on the lighting system will not be endangered by live parts or other equipment. The points of control shall be so located that persons are not likely to come in contact with any live part or moving part of the equipment while turning on the lights.

(iii) **Elevation of unguarded live parts.** Unguarded live parts above working space shall be maintained at elevations not less than specified in Table S-3.

TABLE S-3—Elevation of Unguarded Energized Parts Above Working Space

Nominal voltage between phases	Minimum elevation
601 to 7,500	*8 feet 6 inches.
7,501 to 35,000	9 feet.
Over 35kV	9 feet+ 0.37 inches per kV above 35kV.

Note: Minimum elevation may be 8 feet 0 inches for installations built prior to April 16, 1981, if the nominal voltage between phases is in the range of 601-6600 volts.

(d) **Entrance and access to workspace.** (See WAC 296-24-95603 (2)(c).)

(i) At least one entrance not less than 24 inches wide and 6 feet 6 inches high shall be provided to give access to the working space about electric equipment. On switchboard and control panels exceeding 48 inches in width, there shall be one entrance at each end of such board where practicable. Where bare energized parts at any voltage or insulated energized parts above 600 volts are located adjacent to such entrance, they shall be suitably guarded.

(ii) Permanent ladders or stairways shall be provided to give safe access to the working space around electric equipment installed on platforms, balconies, mezzanine floors, or in attic or roof rooms or spaces.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-95605, filed 7/20/94, effective 9/20/94; 87-24-051 (Order 87-24), § 296-24-95605, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95605, filed 3/30/82.]

WAC 296-24-95607 Wiring design and protection. (1) Use and identification of grounded and grounding conductors.

(a) **Identification of conductors.** A conductor used as a grounded conductor shall be identifiable and distinguishable from all other conductors. A conductor used as an equipment grounding conductor shall be identifiable and distinguishable from all other conductors.

(b) **Polarity of connections.** No grounded conductor may be attached to any terminal or lead so as to reverse designated polarity.

(c) **Use of grounding terminals and devices.** A grounding terminal or grounding-type device on a receptacle, cord connector, or attachment plug may not be used for purposes other than grounding.

(2) **Outlet devices.** Outlet devices shall have an ampere rating not less than the load to be served.

(3) **Outside conductors, 600 volts, nominal, or less.** Subdivisions (a), (b), (c) and (d) of this subsection apply to branch circuit, feeder, and service conductors rated 600 volts, nominal, or less and run outdoors as open conductors. Subdivision (e) of this subsection applies to lamps installed under such conductors.

(a) **Conductors on poles.** Conductors supported on poles shall provide a horizontal climbing space not less than the following:

(i) Power conductors below communication conductors—30 inches.

(ii) Power conductors alone or above communication conductors: 300 volts or less—24 inches; more than 300 volts—30 inches.

(iii) Communication conductors below power conductors with power conductors 300 volts or less—24 inches; more than 300 volts—30 inches.

(b) **Clearance from ground.** Open conductors shall conform to the following minimum clearances:

(i) 10 feet—above finished grade, sidewalks, or from any platform or projection from which they might be reached.

(ii) 12 feet—over areas subject to vehicular traffic other than truck traffic.

(iii) 15 feet—over areas other than those specified in item (b)(iv) of this subsection that are subject to truck traffic.

(iv) 18 feet—over public streets, alleys, roads, and driveways.

(c) **Clearance from building openings.** Conductors shall have a clearance of at least 3 feet from windows, doors, porches, fire escapes, or similar locations. Conductors run above the top level of a window are considered to be out of reach from that window and, therefore, do not have to be 3 feet away.

(d) **Clearance over roofs.** Conductors shall have a clearance of not less than 8 feet from the highest point of roofs over which they pass, except that:

(i) Where the voltage between conductors is 300 volts or less and the roof has a slope of not less than 4 inches in 12, the clearance from the roofs shall be at least 3 feet; or

(ii) Where the voltage between conductors is 300 volts or less and the conductors do not pass over more than 4 feet of the overhang portion of the roof and they are terminated at a through-the-roof raceway or approved support, the clearance from the roofs shall be at least 18 inches.

(e) **Location of outdoor lamps.** Lamps for outdoor lighting shall be located below all live conductors, transformers, or other electric equipment, unless such equipment is controlled by a disconnecting means that can be locked in the open position or unless adequate clearances or other safeguards are provided for relamping operations.

(4) Services.

(a) Disconnecting means.

(i) **General.** Means shall be provided to disconnect all conductors in a building or other structure from the service-entrance conductors. The disconnecting means shall plainly indicate whether it is in the open or closed position and shall be installed at a readily accessible location nearest the point of entrance of the service-entrance conductors.

(ii) **Simultaneous opening of poles.** Each service disconnecting means shall simultaneously disconnect all ungrounded conductors.

(b) **Services over 600 volts, nominal.** The following additional requirements apply to services over 600 volts, nominal.

(i) **Guarding.** Service-entrance conductors installed as open wires shall be guarded to make them accessible only to qualified persons.

(ii) **Warning signs.** Signs warning of high voltage shall be posted where other than qualified employees might come in contact with live parts.

(5) Overcurrent protection.

(a) **600 volts, nominal, or less.** The following requirements apply to overcurrent protection of circuits rated 600 volts, nominal, or less.

(i) **Protection of conductors and equipment.** Conductors and equipment shall be protected from overcurrent in accordance with their ability to safely conduct current.

(ii) **Grounded conductors.** Except for motor running overload protection, overcurrent devices may not interrupt the continuity of the grounded conductor unless all conductors of the circuit are opened simultaneously.

(iii) **Disconnection of fuses and thermal cutouts.** Except for service fuses, all cartridge fuses which are accessible to other than qualified persons and all fuses and thermal cutouts on circuits over 150 volts to ground shall be provided with disconnecting means. This disconnecting means shall be installed so that the fuse or thermal cutout can be disconnected from its supply without disrupting service to equipment and circuits unrelated to those protected by the overcurrent device.

(iv) **Location in or on premises.** Overcurrent devices shall be readily accessible to each employee or authorized building management personnel. These overcurrent devices may not be located where they will be exposed to physical damage nor in the vicinity of easily ignitable material.

(v) **Arcing or suddenly moving parts.** Fuses and circuit breakers shall be so located or shielded that employees will not be burned or otherwise injured by their operation.

(vi) Circuit breakers.

(A) Circuit breakers shall clearly indicate whether they are in the open (off) or closed (on) position.

(B) Where circuit breaker handles on switchboards are operated vertically rather than horizontally or rotationally, the up position of the handle shall be the closed (on) position. (See WAC 296-24-95603 (2)(c).)

(C) If used as switches in 120-volt, fluorescent lighting circuits, circuit breakers shall be approved for the purpose and marked "SWD." (See WAC 296-24-95603 (2)(c).)

(b) **Over 600 volts, nominal.** Feeders and branch circuits over 600 volts, nominal, shall have short-circuit protection.

(6) **Grounding.** Subdivisions (a) through (g) of this subsection contain grounding requirements for systems, circuits, and equipment.

(a) **Systems to be grounded.** The following systems which supply premises wiring shall be grounded:

(i) All 3-wire DC systems shall have their neutral conductor grounded.

(ii) Two-wire DC systems operating at over 50 volts through 300 volts between conductors shall be grounded unless:

(A) They supply only industrial equipment in limited areas and are equipped with a ground detector; or

(B) They are rectifier-derived from an AC system complying with items (a)(iii), (a)(iv), and (a)(v) of this subsection; or

(C) They are fire-protective signaling circuits having a maximum current of 0.030 amperes.

(iii) AC circuits of less than 50 volts shall be grounded if they are installed as overhead conductors outside of buildings or if they are supplied by transformers and the transformer

primary supply system is ungrounded or exceeds 150 volts to ground.

(iv) AC systems of 50 volts to 1000 volts shall be grounded under any of the following conditions, unless exempted by item (a)(v) of this subsection:

(A) If the system can be so grounded that the maximum voltage to ground on the ungrounded conductors does not exceed 150 volts;

(B) If the system is nominally rated 480Y/277 volt, 3-phase, 4-wire in which the neutral is used as a circuit conductor;

(C) If the system is nominally rated 240/120 volt, 3-phase, 4-wire in which the midpoint of one phase is used as a circuit conductor; or

(D) If a service conductor is uninsulated.

(v) AC systems of 50 volts to 1000 volts are not required to be grounded under any of the following conditions:

(A) If the system is used exclusively to supply industrial electric furnaces for melting, refining, tempering, and the like.

(B) If the system is separately derived and is used exclusively for rectifiers supplying only adjustable speed industrial drives.

(C) If the system is separately derived and is supplied by a transformer that has a primary voltage rating less than 1000 volts, provided all of the following conditions are met:

(I) The system is used exclusively for control circuits;

(II) The conditions of maintenance and supervision assure that only qualified persons will service the installation;

(III) Continuity of control power is required; and

(IV) Ground detectors are installed on the control system.

(D) If the system is an isolated power system that supplies circuits in health care facilities.

(b) **Conductors to be grounded.** For AC premises wiring systems the identified conductor shall be grounded.

(c) **Grounding connections.**

(i) For a grounded system, a grounding electrode conductor shall be used to connect both the equipment grounding conductor and the grounded circuit conductor to the grounding electrode. Both the equipment grounding conductor and the grounding electrode conductor shall be connected to the grounded circuit conductor on the supply side of the service disconnecting means, or on the supply side of the system disconnecting means or overcurrent devices if the system is separately derived.

(ii) For an ungrounded service-supplied system, the equipment grounding conductor shall be connected to the grounding electrode conductor at the service equipment. For an ungrounded separately derived system, the equipment grounding conductor shall be connected to the grounding electrode conductor at, or ahead of, the system disconnecting means or overcurrent devices.

(iii) On extensions of existing branch circuits which do not have an equipment grounding conductor, grounding-type receptacles may be grounded to a grounded cold water pipe near the equipment.

(d) **Grounding path.** The path to ground from circuits, equipment, and enclosures shall be permanent and continuous.

(e) **Supports, enclosures, and equipment to be grounded.**

(i) **Supports and enclosures for conductors.** Metal cable trays, metal raceways, and metal enclosures for conductors shall be grounded, except that:

(A) Metal enclosures such as sleeves that are used to protect cable assemblies from physical damage need not be grounded; or

(B) Metal enclosures for conductors added to existing installations of open wire, knob-and-tube wiring, and nonmetallic-sheathed cable need not be grounded if all of the following conditions are met:

(I) Runs are less than 25 feet;

(II) Enclosures are free from probable contact with ground, grounded metal, metal laths, or other conductive materials; and

(III) Enclosures are guarded against employee contact.

(ii) **Service equipment enclosures.** Metal enclosures for service equipment shall be grounded.

(iii) **Frames of ranges and clothes dryers.** Frames of electric ranges, wall-mounted ovens, counter-mounted cooking units, clothes dryers, and metal outlet or junction boxes which are part of the circuit for these appliances shall be grounded.

(iv) **Fixed equipment.** Exposed noncurrent-carrying metal parts of fixed equipment which may become energized shall be grounded under any of the following conditions:

(A) If within 8 feet vertically or 5 feet horizontally of ground or grounded metal objects and subject to employee contact.

(B) If located in a wet or damp location and not isolated.

(C) If in electrical contact with metal.

(D) If in a hazardous (classified) location.

(E) If supplied by a metal-clad, metal-sheathed, or grounded metal raceway wiring method.

(F) If equipment operates with any terminal at over 150 volts to the ground; however, the following need not be grounded:

(I) Enclosures for switches or circuit breakers used for other than service equipment and accessible to qualified persons only;

(II) Metal frames of electrically heated appliances which are permanently and effectively insulated from ground; and

(III) The cases of distribution apparatus such as transformers and capacitors mounted on wooden poles at a height exceeding 8 feet above ground or grade level.

(v) **Equipment connected by cord and plug.** Under any of the conditions described in subitems (e)(v)(A) through (e)(v)(C) of this subsection, exposed noncurrent-carrying metal parts of cord-connected and plug-connected equipment which may become energized shall be grounded.

(A) If in hazardous (classified) locations (see WAC 296-24-95613).

(B) If operated at over 150 volts to ground, except for guarded motors and metal frames of electrically heated appliances if the appliance frames are permanently and effectively insulated from ground.

(C) If the equipment is of the following types:

(I) Refrigerators, freezers, and air conditioners;

(II) Clothes-washing, clothes-drying and dishwashing machines, sump pumps, and electrical aquarium equipment;

(III) Hand-held motor-operated tools;

(IV) Motor-operated appliances of the following types: Hedge clippers, lawn mowers, snow blowers, and wet scrubbers;

(V) Cord-connected and plug-connected appliances used in damp or wet locations or by employees standing on the ground or on metal floors or working inside of metal tanks or boilers;

(VI) Portable and mobile x-ray and associated equipment;

(VII) Tools likely to be used in wet and conductive locations; and

(VIII) Portable hand lamps. Tools likely to be used in wet and conductive locations need not be grounded if supplied through an isolating transformer with an ungrounded secondary of not over 50 volts. Listed or labeled portable tools and appliances protected by an approved system of double insulation, or its equivalent, need not be grounded. If such a system is employed, the equipment shall be distinctively marked to indicate that the tool or appliance utilizes an approved system of double insulation.

(vi) **Nonelectrical equipment.** The metal parts of the following nonelectrical equipment shall be grounded: Frames and tracks of electrically operated cranes; frames of nonelectrically driven elevator cars to which electric conductors are attached; hand operated metal shifting ropes or cables of electric elevators, and metal partitions, grill work, and similar metal enclosures around equipment of over 750 volts between conductors.

(f) Methods of grounding fixed equipment.

(i) Noncurrent-carrying metal parts of fixed equipment, if required to be grounded by this section, shall be grounded by an equipment grounding conductor which is contained within the same raceway, cable, or cord, or runs with or encloses the circuit conductors. For DC circuits only, the equipment grounding conductor may be run separately from the circuit conductors.

(ii) Electric equipment is considered to be effectively grounded if it is secured to, and in electrical contact with, a metal rack or structure that is provided for its support and the metal rack or structure is grounded by the method specified for the noncurrent-carrying metal parts of fixed equipment in item (f)(i) of this subsection. For installations made before May 30, 1982, only, electric equipment is also considered to be effectively grounded if it is secured to, and in metallic contact with, the grounded structural metal frame of a building. Metal car frames supported by metal hoisting cables attached to or running over metal sheaves or drums of grounded elevator machines are also considered to be effectively grounded.

(g) Grounding of systems and circuits of 1000 volts and over (high voltage).

(i) **General.** If high voltage systems are grounded, they shall comply with all applicable provisions of subdivisions (a) through (f) of this subsection as supplemented and modified by the subdivision (g) of this subsection.

(ii) **Grounding of systems supplying portable or mobile equipment.** (See WAC 296-24-95603 (2)(c).) Systems supplying portable or mobile high voltage equipment,

other than substations installed on a temporary basis, shall comply with the following:

(A) Portable and mobile high voltage equipment shall be supplied from a system having its neutral grounded through an impedance. If a delta-connected high voltage system is used to supply the equipment, a system neutral shall be derived.

(B) Exposed noncurrent-carrying metal parts of portable and mobile equipment shall be connected by an equipment grounding conductor to the point at which the system neutral impedance is grounded.

(C) Ground-fault detection and relaying shall be provided to automatically deenergize any high voltage system component which has developed a ground fault. The continuity of the equipment grounding conductor shall be continuously monitored so as to deenergize automatically the high voltage feeder to the portable equipment upon loss of continuity of the equipment grounding conductor.

(D) The grounding electrode to which the portable or mobile equipment system neutral impedance is connected shall be isolated from and separated in the ground by at least 20 feet from any other system or equipment grounding electrode, and there shall be no direct connection between the grounding electrodes, such as buried pipe, fence, etc.

(iii) **Grounding of equipment.** All noncurrent-carrying metal parts of portable equipment and fixed equipment including their associated fences, housings, enclosures, and supporting structures shall be grounded. However, equipment which is guarded by location and isolated from ground need not be grounded. Additionally, pole-mounted distribution apparatus at a height exceeding 8 feet above ground or grade level need not be grounded.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-95607, filed 11/22/91, effective 12/24/91; 87-24-051 (Order 87-24), § 296-24-95607, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95607, filed 3/30/82.]

WAC 296-24-95609 Wiring methods, components, and equipment for general use. (1) Wiring methods. The provisions of this section do not apply to the conductors that are an integral part of factory-assembled equipment.

(a) General requirements.

(i) **Electrical continuity of metal raceways and enclosures.** Metal raceways, cable armor, and other metal enclosures for conductors shall be metallically joined together into a continuous electric conductor and shall be so connected to all boxes, fittings, and cabinets as to provide effective electrical continuity.

(ii) **Wiring in ducts.** No wiring systems of any type shall be installed in ducts used to transport dust, loose stock or flammable vapors. No wiring system of any type may be installed in any duct used for vapor removal or for ventilation of commercial-type cooking equipment, or in any shaft containing only such ducts.

(b) **Temporary wiring.** Temporary electrical power and lighting wiring methods may be of a class less than would be required for a permanent installation. Except as specifically modified in this section, all other requirements of this part for permanent wiring shall apply to temporary wiring installations.

(i) **Uses permitted, 600 volts, nominal or less.** Temporary electrical power and lighting installations 600 volts, nominal, or less may be used only:

(A) During and for remodeling, maintenance, repair, or demolition of buildings, structures, or equipment, and similar activities;

(B) For experimental or development work; and

(C) For a period not to exceed 90 days for Christmas decorative lighting, carnivals, and similar purposes.

(ii) **Uses permitted, over 600 volts, nominal.** Temporary wiring over 600 volts, nominal, may be used only during periods of tests, experiments, or emergencies.

(iii) **General requirements for temporary wiring.**

(A) Feeders shall originate in an approved distribution center. The conductors shall be run as multiconductor cord or cable assemblies, or, where not subject to physical damage, they may be run as open conductors on insulators not more than 10 feet apart.

(B) Branch circuits shall originate in an approved power outlet or panelboard. Conductors shall be multiconductor cord or cable assemblies or open conductors. If run as open conductors they shall be fastened at ceiling height every 10 feet. No branch-circuit conductor may be laid on the floor. Each branch circuit that supplies receptacles or fixed equipment shall contain a separate equipment grounding conductor if run as open conductors.

(C) Receptacles shall be of the grounding type. Unless installed in a complete metallic raceway, each branch circuit shall contain a separate equipment grounding conductor and all receptacles shall be electrically connected to the grounding conductor.

(D) No bare conductors nor earth returns may be used for the wiring of any temporary circuit.

(E) Suitable disconnecting switches or plug connectors shall be installed to permit the disconnection of all ungrounded conductors of each temporary circuit.

(F) Lamps for general illumination shall be protected from accidental contact or breakage. Protection shall be provided by elevation of at least 7 feet from normal working surface or by a suitable fixture or lampholder with a guard.

(G) Flexible cords and cables shall be protected from accidental damage. Sharp corners and projections shall be avoided. Where passing through doorways or other pinch points, flexible cords and cables shall be provided with protection to avoid damage.

(c) **Cable trays.**

(i) **Uses permitted.**

(A) Only the following may be installed in cable tray systems:

(I) Mineral-insulated metal-sheathed cable (Type MI);

(II) Armored cable (Type AC);

(III) Metal-clad cable (Type MC);

(IV) Power-limited tray cable (Type PLTC);

(V) Nonmetallic-sheathed cable (Type NM or NMC);

(VI) Shielded nonmetallic-sheathed cable (Type SNM);

(VII) Multiconductor service-entrance cable (Type SE or USE);

(VIII) Multiconductor underground feeder and branch-circuit cable (Type UF);

(IX) Power and control tray cable (Type TC);

(X) Other factory-assembled, multiconductor control, signal, or power cables which are specifically approved for installation in cable trays; or

(XI) Any approved conduit or raceway with its contained conductors.

(B) In industrial establishments only, where conditions of maintenance and supervision assure that only qualified persons will service the installed cable tray system, the following cables may also be installed in ladder, ventilated trough, or 4 inch ventilated channel-type cable trays:

(I) Single conductor cables which are 250 MCM or larger and are Types RHH, RHW, MV, USE, or THW, and other 250 MCM or larger single conductor cables if specifically approved for installation in cable trays. Where exposed to direct rays of the sun, cables shall be sunlight-resistant.

(II) Type MV cables, where exposed to direct rays of the sun, shall be sunlight-resistant.

(C) Cable trays in hazardous (classified) locations shall contain only the cable types permitted in such locations.

(ii) **Uses not permitted.** Cable tray systems may not be used in hoistways or where subjected to severe physical damage.

(d) **Open wiring on insulators.**

(i) **Uses permitted.** Open wiring on insulators is only permitted on systems of 600 volts, nominal, or less for industrial or agricultural establishments and for services.

(ii) **Conductor supports.** Conductors shall be rigidly supported on noncombustible, nonabsorbent insulating materials and may not contact any other objects.

(iii) **Flexible nonmetallic tubing.** In dry locations where not exposed to severe physical damage, conductors may be separately enclosed in flexible nonmetallic tubing. The tubing shall be in continuous lengths not exceeding 15 feet and secured to the surface by straps at intervals not exceeding 4 feet 6 inches.

(iv) **Through walls, floors, wood cross members, etc.** Open conductors shall be separated from contact with walls, floors, and wood cross members, or partitions through which they pass by tubes or bushings of noncombustible, nonabsorbent insulating material. If the bushing is shorter than the hole, a waterproof sleeve of nonconductive material shall be inserted in the hole and an insulating bushing slipped into the sleeve at each end in such a manner as to keep the conductors absolutely out of contact with the sleeve. Each conductor shall be carried through a separate tube or sleeve.

(v) **Protection from physical damage.** Conductors within 7 feet from the floor are considered exposed to physical damage. Where open conductors cross ceiling joints and wall studs and are exposed to physical damage, they shall be protected.

(2) **Cabinets, boxes, and fittings.**

(a) **Conductors entering boxes, cabinets, or fittings.**

Conductors entering boxes, cabinets, or fittings shall be protected from abrasion, and openings through which conductors enter shall be effectively closed. Unused openings in cabinets, boxes, and fittings shall also be effectively closed.

(b) **Covers and canopies.** All pull boxes, junction boxes, and fittings shall be provided with covers approved for the purpose. If metal covers are used they shall be grounded. In completed installations each outlet box shall have a cover,

faceplate, or fixture canopy. Covers of outlet boxes having holes through which flexible cord pendants pass shall be provided with bushings designed for the purpose or shall have smooth, well-rounded surfaces on which the cords may bear.

(c) **Pull and junction boxes for systems over 600 volts, nominal.** In addition to other requirements in this section for pull and junction boxes, the following shall apply to these boxes for systems over 600 volts, nominal:

(i) Boxes shall provide a complete enclosure for the contained conductors or cables.

(ii) Boxes shall be closed by suitable covers securely fastened in place. Underground box covers that weight over 100 pounds meet this requirement. Covers for boxes shall be permanently marked "HIGH VOLTAGE." The marking shall be on the outside of the box cover and shall be readily visible and legible.

(3) **Switches.**

(a) **Knife switches.** Single-throw knife switches shall be so connected that the blades are dead when the switch is in the open position. Single-throw knife switches shall be so placed that gravity will not tend to close them. Single-throw knife switches approved for use in the inverted position shall be provided with a locking device that will ensure that the blades remain in the open position when so set. Double-throw knife switches may be mounted so that the throw will be either vertical or horizontal. However, if the throw is vertical a locking device shall be provided to ensure that the blades remain in the open position when so set.

(b) **Faceplates for flush-mounted snap switches.** Flush snap switches that are mounted in ungrounded metal boxes and located within reach of conducting floors or other conducting surfaces shall be provided with faceplates of nonconducting, noncombustible material.

(4) **Switchboards and panelboards.** Switchboards that have any exposed live parts shall be located in permanently dry locations and accessible only to qualified persons. Panelboards shall be mounted in cabinets, cutout boxes, or enclosures approved for the purpose and shall be dead front. However, panelboards other than the dead front externally-operable type are permitted where accessible only to qualified persons. Exposed blades of knife switches shall be dead when open.

(5) **Enclosures for damp or wet locations.**

(a) Cabinets, cutout boxes, fittings, boxes, and panelboard enclosures in damp or wet locations shall be installed so as to prevent moisture or water from entering and accumulating within the enclosures. In wet locations the enclosures shall be weatherproof.

(b) Switches, circuit breakers, and switchboards installed in wet locations shall be enclosed in weatherproof enclosures.

(6) **Conductors for general wiring.** All conductors used for general wiring shall be insulated unless otherwise permitted in this section. The conductor insulation shall be of a type that is approved for the voltage, operating temperature, and location of use. Insulated conductors shall be distinguishable by appropriate color or other suitable means as being grounded conductors, ungrounded conductors, or equipment grounding conductors.

(7) **Flexible cords and cables.**

(a) **Use of flexible cords and cables.**

(i) Flexible cords and cables shall be approved and suitable for conditions of use and location. Flexible cords and cables shall be used only for:

- (A) Pendants;
- (B) Wiring of fixtures;
- (C) Connection of portable lamps or appliances;
- (D) Elevator cables;
- (E) Wiring of cranes and hoists;
- (F) Connection of stationary equipment to facilitate their frequent interchange;

(G) Prevention of the transmission of noise or vibration;

(H) Appliances where the fastening means and mechanical connections are designed to permit removal for maintenance and repair; or

(I) Data processing cables approved as a part of the data processing system.

(ii) If used as permitted in subitem (a)(i)(C), (a)(i)(F) or (a)(i)(H) of this subsection, the flexible cord shall be equipped with an attachment plug and shall be energized from an approved receptacle outlet.

(iii) Unless specifically permitted in item (a)(i) of this subsection, flexible cords and cables may not be used:

- (A) As a substitute for the fixed wiring of a structure;
- (B) Where run through holes in walls, ceilings, or floors;
- (C) Where run through doorways, windows, or similar openings;
- (D) Where attached to building surfaces; or
- (E) Where concealed behind building walls, ceilings, or floors.

(iv) Flexible cords used in show windows and showcases shall be Type S, SO, SJ, SJO, ST, STO, SJT, SJTO, or AFS except for the wiring of chain-supported lighting fixtures and supply cords for portable lamps and other merchandise being displayed or exhibited.

(b) **Identification, splices, and terminations.**

(i) A conductor of a flexible cord or cable that is used as a grounded conductor or an equipment grounding conductor shall be distinguishable from other conductors. Types SJ, SJO, SJT, SJTO, S, SO, ST, and STO shall be durably marked on the surface with the type designation, size, and number of conductors.

(ii) Flexible cords shall be used only in continuous lengths without splice or tap. Hard service flexible cords No. 12 or larger may be repaired if spliced so that the splice retains the insulation, outer sheath properties, and usage characteristics of the cord being spliced.

(iii) Flexible cords shall be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws.

(8) **Portable cables over 600 volts, nominal.** Multiconductor portable cable for use in supplying power to portable or mobile equipment at over 600 volts, nominal, shall consist of No. 8 or larger conductors employing flexible stranding. Cables operated at over 2,000 volts shall be shielded for the purpose of confining the voltage stresses to the insulation. Grounding conductors shall be provided. Connectors for these cables shall be of a locking type with provisions to prevent their opening or closing while energized. Strain relief shall be provided at connections and terminations. Portable cables may not be operated with splices unless the splices are

of the permanent molded, vulcanized, or other approved type. Termination enclosures shall be suitably marked with a high voltage hazard warning, and terminations shall be accessible only to authorized and qualified personnel.

(9) **Fixture wires.**

(a) **General.** Fixture wires shall be approved for the voltage, temperature, and location of use. A fixture wire which is used as a grounded conductor shall be identified.

(b) **Uses permitted.** Fixture wires may be used:

(i) For installation in lighting fixtures and in similar equipment where enclosed or protected and not subject to bending or twisting in use; or

(ii) For connecting lighting fixtures to the branch-circuit conductors supplying the fixtures.

(c) **Uses not permitted.** Fixture wires may not be used as branch-circuit conductors except as permitted for Class 1 power limited circuits.

(10) **Equipment for general use.**

(a) **Lighting fixtures, lampholders, lamps, and receptacles.**

(i) Fixtures, lampholders, lamps, rosettes, and receptacles may have no live parts normally exposed to employee contact. However, rosettes and cleat-type lampholders and receptacles located at least 8 feet above the floor may have exposed parts.

(ii) Handlamps of the portable type supplied through flexible cords shall be equipped with a handle of molded composition or other material approved for the purpose, and a substantial guard shall be attached to the lampholder or the handle.

(iii) Lampholders of the screw-shell type shall be installed for use as lampholders only. Lampholders installed in wet or damp locations shall be of the weatherproof type.

(iv) Fixtures installed in wet or damp locations shall be approved for the purpose and shall be so constructed or installed that water cannot enter or accumulate in wireways, lampholders, or other electrical parts.

(b) **Receptacles, cord connectors, and attachment plugs (caps).**

(i) Receptacles, cord connectors, and attachment plugs shall be constructed so that no receptacle or cord connector will accept an attachment plug with a different voltage or current rating than that for which the device is intended. However, a 20-ampere T-slot receptacle or cord connector may accept a 15-ampere attachment plug of the same voltage rating.

(ii) A receptacle installed in a wet or damp location shall be suitable for the location.

(c) **Appliances.**

(i) Appliances, other than those in which the current-carrying parts at high temperatures are necessarily exposed, may have no live parts normally exposed to employee contact.

(ii) A means shall be provided to disconnect each appliance.

(iii) Each appliance shall be marked with its rating in volts and amperes or volts and watts.

(d) **Motors.** This subdivision applies to motors, motor circuits, and controllers.

(i) **In sight from.** If specified that one piece of equipment shall be "in sight from" another piece of equipment, one shall be visible and not more than 50 feet from the other.

(ii) **Disconnecting means.**

(A) A disconnecting means shall be located in sight from the controller location. However, a single disconnecting means may be located adjacent to a group of coordinated controllers mounted adjacent to each other or a multimotor continuous process machine. The controller disconnecting means for motor branch circuits over 600 volts, nominal, may be out of sight of the controller, if the controller is marked with a warning label giving the location and identification of the disconnecting means which is to be locked in the open position.

(B) The disconnecting means shall disconnect the motor and the controller from all ungrounded supply conductors and shall be so designed that no pole can be operated independently.

(C) If a motor and the driven machinery are not in sight from the controller location, the installation shall comply with one of the following conditions:

(I) The controller disconnecting means shall be capable of being locked in the open position.

(II) A manually operable switch that will disconnect the motor from its source of supply shall be placed in sight from the motor location.

(D) The disconnecting means shall plainly indicate whether it is in the open (off) or closed (on) position.

(E) The disconnecting means shall be readily accessible. If more than one disconnect is provided for the same equipment, only one need be readily accessible.

(F) An individual disconnecting means shall be provided for each motor, but a single disconnecting means may be used for a group of motors under any one of the following conditions:

(I) If a number of motors drive special parts of a single machine or piece of apparatus, such as a metal or woodworking machine, crane, or hoist;

(II) If a group of motors is under the protection of one set of branch-circuit protective devices; or

(III) If a group of motors is in a single room in sight from the location of the disconnecting means.

(iii) **Motor overload, short-circuit, and ground-fault protection.** Motors, motor-control apparatus, and motor branch-circuit conductors shall be protected against overheating due to motor overloads or failure to start, and against short-circuits or ground faults. These provisions shall not require overload protection that will stop a motor where a shutdown is likely to introduce additional or increased hazards, as in the case of fire pumps, or where continued operation of a motor is necessary for a safe shutdown of equipment or process and motor overload sensing devices are connected to a supervised alarm.

(iv) **Protection of live parts—all voltages.**

(A) Stationary motors having commutators, collectors, and brush rigging located inside of motor end brackets and not conductively connected to supply circuits operating at more than 150 volts to ground need not have such parts guarded. Exposed live parts of motors and controllers operat-

ing at 50 volts or more between terminals shall be guarded against accidental contact by any of the following:

(I) By installation in a room or enclosure that is accessible only to qualified persons;

(II) By installation on a suitable balcony, gallery, or platform, so elevated and arranged as to exclude unqualified persons; or

(III) By elevation 8 feet or more above the floor.

(B) Where live parts of motors or controllers operating at over 150 volts to ground are guarded against accidental contact only by location, and where adjustment or other attendance may be necessary during the operation of the apparatus, suitable insulating mats or platforms shall be provided so that the attendant cannot readily touch live parts unless standing on the mats or platforms.

(e) Transformers.

(i) The following items cover the installation of all transformers except the following:

(A) Current transformers;

(B) Dry-type transformers installed as a component part of other apparatus;

(C) Transformers which are an integral part of an x-ray, high frequency, or electrostatic-coating apparatus;

(D) Transformers used with Class 2 and Class 3 circuits, sign and outline lighting, electric discharge lighting, and power-limited fire-protective signalling circuits; and

(E) Liquid-filled or dry-type transformers used for research, development, or testing, where effective safeguard arrangements are provided.

(ii) The operating voltage of exposed live parts of transformer installations shall be indicated by warning signs or visible markings on the equipment or structure.

(iii) Dry-type, high fire point liquid-insulated, and askarel-insulated transformers installed indoors and rated over 35kV shall be in a vault.

(iv) If they present a fire hazard to employees, oil-insulated transformers installed indoors shall be in a vault.

(v) Combustible material, combustible buildings and parts of buildings, fire escapes, and door and window openings shall be safeguarded from fires which may originate in oil-insulated transformers attached to or adjacent to a building or combustible material.

(vi) Transformer vaults shall be constructed so as to contain fire and combustible liquids within the vault and to prevent unauthorized access. Locks and latches shall be so arranged that a vault door can be readily opened from the inside.

(vii) Any pipe or duct system foreign to the vault installation may not enter or pass through a transformer vault.

(viii) Materials may not be stored in transformer vaults.

(f) Capacitors.

(i) All capacitors, except surge capacitors or capacitors included as a component part of other apparatus, shall be provided with an automatic means of draining the stored charge after the capacitor is disconnected from its source of supply.

(ii) Capacitors rated over 600 volts, nominal, shall comply with the following additional requirements:

(A) Isolating or disconnecting switches (with no interrupting rating) shall be interlocked with the load interrupting

device or shall be provided with prominently displayed caution signs to prevent switching load current.

(B) For series capacitors (see WAC 296-24-95603 (2)(c)), the proper switching shall be assured by use of at least one of the following:

(I) Mechanically sequenced isolating and bypass switches;

(II) Interlocks; or

(III) Switching procedure prominently displayed at the switching location.

(g) **Storage batteries.** Provisions shall be made for sufficient diffusion and ventilation of gases from storage batteries to prevent the accumulation of explosive mixtures.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-95609, filed 7/20/94, effective 9/20/94; 87-24-051 (Order 87-24), § 296-24-95609, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050, 82-08-026 (Order 82-10), § 296-24-95609, filed 3/30/82.]

WAC 296-24-95611 Specific purpose equipment and installations. (1) Electric signs and outline lighting.

(a) **Disconnecting means.** Signs operated by electronic or electromechanical controllers located outside the sign shall have a disconnecting means located inside the controller enclosure or within sight of the controller location, and it shall be capable of being locked in the open position. Such disconnecting means shall have no pole that can be operated independently, and it shall open all ungrounded conductors that supply the controller and sign. All other signs, except the portable type, and all outline lighting installations shall have an externally operable disconnecting means which can open all ungrounded conductors and is within the sight of the sign or outline lighting it controls.

(b) Doors or covers giving access to uninsulated parts of indoor signs or outline lighting exceeding 600 volts and accessible to other than qualified persons shall either be provided with interlock switches to disconnect the primary circuit or shall be so fastened that the use of other than ordinary tools will be necessary to open them.

(2) **Cranes and hoists.** This subsection applies to the installation of electric equipment and wiring used in connection with cranes, monorail hoists, hoists, and all runways.

(a) Disconnecting means.

(i) A readily accessible disconnecting means shall be provided between the runway contact conductors and the power supply.

(ii) Another disconnecting means, capable of being locked in the open position, shall be provided in the leads from the runway contact conductors or other power supply on any crane or monorail hoist.

(A) If this additional disconnection means is not readily accessible from the crane or monorail hoist operating station means shall be provided at the operating station, to open the power circuit to all motors of the crane or monorail hoist.

(B) The additional disconnect may be omitted if a monorail hoist or hand-propelled crane bridge installation meets all of the following:

(I) The unit is floor controlled;

(II) The unit is within view of the power supply disconnecting means; and

(III) No fixed work platform has been provided for servicing the unit.

(b) **Control.** A limit switch or other device shall be provided to prevent the load block from passing the safe upper limit of travel of any hoisting mechanism.

(c) **Clearance.** The dimension of the working space in the direction of access to live parts which may require examination, adjustment, servicing, or maintenance while alive shall be a minimum of 2 feet 6 inches. Where controls are enclosed in cabinets, the door(s) shall either open at least 90 degrees or be removable.

(3) **Elevators, dumbwaiters, escalators, and moving walks.**

(a) **Disconnecting means.** Elevators, dumbwaiters, escalators, and moving walks shall have a single means for disconnecting all ungrounded main power supply conductors for each unit.

(b) **Warning signs.** If interconnections between control panels are necessary for operation of the system on a multicar installation that remains energized from a source other than the disconnecting means, a warning sign shall be mounted on or adjacent to the disconnecting means. The sign shall be clearly legible and shall read "Warning—Parts of the control panel are not de-energized by this switch." (See WAC 296-24-95603 (2)(c).)

(c) **Control panels.** If control panels are not located in the same space as the drive machine, they shall be located in cabinets with doors or panels capable of being locked closed.

(4) **Electric welders—disconnecting means.**

(a) A disconnecting means shall be provided in the supply circuit for each motor-generator arc welder, and for each AC transformer and DC rectifier arc welder which is not equipped with a disconnect mounted as an integral part of the welder.

(b) A switch or circuit breaker shall be provided by which each resistance welder and its control equipment can be isolated from the supply circuit. The ampere rating of this disconnecting means may not be less than the supply conductor ampacity.

(5) **Data processing systems—disconnecting means.** A disconnecting means shall be provided to disconnect the power to all electronic equipment in data processing or computer rooms. This disconnecting means shall be controlled from locations readily accessible to the operator at the principal exit doors. There shall also be a similar disconnecting means to disconnect the air conditioning system serving this area.

(6) **X-ray equipment.** This subsection applies to x-ray equipment for other than medical or dental use.

(a) **Disconnecting means.**

(i) A disconnecting means shall be provided in the supply circuit. The disconnecting means shall be operable from a location readily accessible from the x-ray control. For equipment connected to a 120-volt branch circuit of 30 amperes or less, a grounding-type attachment plug cap and receptacle of proper rating may serve as a disconnecting means.

(ii) If more than one piece of equipment is operated from the same high-voltage circuit, each piece or each group of equipment as a unit shall be provided with a high-voltage switch or equivalent disconnecting means. This disconnect-

ing means shall be constructed, enclosed, or located so as to avoid contact by employees with its live parts.

(b) **Control.**

(i) **Radiographic and fluoroscopic types.** Radiographic and fluoroscopic-type equipment shall be effectively enclosed or shall have interlocks that de-energize the equipment automatically to prevent ready access to live current-carrying parts.

(ii) **Diffraction and irradiation types.** Diffraction-type and irradiation-type equipment shall be provided with a means to indicate when it is energized unless the equipment or installation is effectively enclosed or is provided with interlocks to prevent access to live current-carrying parts during operation.

(7) **Induction and dielectric heating equipment.**

(a) **Scope.** Subdivisions (b) and (c) of this subsection cover induction and dielectric heating equipment and accessories for industrial and scientific applications, but not for medical dental applications or for appliances.

(b) **Guarding and grounding.**

(i) **Enclosures.** The converting apparatus (including the DC line) and high-frequency electric circuits (excluding the output circuits and remote-control circuits) shall be completely contained within enclosures of noncombustible material.

(ii) **Panel controls.** All panel controls shall be of dead-front construction.

(iii) **Access to internal equipment.** Where doors are used for access to voltages from 500 to 1000 volts AC or DC, either door locks or interlocks shall be provided. Where doors are used for access to voltages of over 1000 volts AC or DC, either mechanical lockouts with a disconnecting means to prevent access until voltage is removed from the cubicle, or both door interlocking and mechanical door locks, shall be provided.

(iv) **Warning labels.** "Danger" labels shall be attached on the equipment and shall be plainly visible even when doors are open or panels are removed from compartments containing voltages of over 250 volts AC or DC.

(v) **Work applicator shielding.** Protective cages or adequate shielding shall be used to guard work applicators other than induction heating coils. Induction heating coils shall be protected by insulation and/or refractory materials. Interlock switches shall be used on all hinged access doors, sliding panels, or other such means of access to the applicator. Interlock switches shall be connected in such a manner as to remove all power from the applicator when any one of the access doors or panels is open. Interlocks on access doors or panels are not required if the applicator is an induction heating coil at DC ground potential or operating at less than 150 volts AC.

(vi) **Disconnecting means.** A readily accessible disconnecting means shall be provided by which each unit of heating equipment can be isolated from its supply circuit.

(c) **Remote control.** If remote controls are used for applying power, a selector switch shall be provided and interlocked to provide power from only one control point at a time. Switches operated by foot pressure shall be provided with a shield over the contact button to avoid accidental closing the switch.

(8) Electrolytic cells.

(a) **Scope.** These provisions for electrolytic cells apply to the installation of the electrical components and accessory equipment of electrolytic cells, electrolytic cell lines, and process power supply for the production of aluminum, cadmium, chlorine, copper, fluorine, hydrogen peroxide, magnesium, sodium, sodium chlorate, and zinc. Cells used as a source of electric energy and for electroplating processes and cells used for production of hydrogen are not covered by these provisions.

(b) Definitions applicable to this subsection.

Cell line: An assembly of electrically interconnected electrolytic cells supplied by a source of direct-current power.

Cell line attachments and auxiliary equipment: Cell line attachments and auxiliary equipment include, but are not limited to: Auxiliary tanks; process piping; duct work; structural supports; exposed cell line conductors; conduits and other raceways; pumps; positioning equipment and cell cutout or bypass electrical devices. Auxiliary equipment also includes tools, welding machines, crucibles, and other portable equipment used for operation and maintenance within the electrolytic cell line working zone. In the cell line working zone, auxiliary equipment includes the exposed conductive surfaces of ungrounded cranes and crane-mounted cell-servicing equipment.

Cell line working zone: The cell line working zone is the space envelope wherein operation or maintenance is normally performed on or in the vicinity of exposed energized surfaces of cell lines or their attachments.

Electrolytic cells: A receptacle or vessel in which electrochemical reactions are caused by applying energy for the purpose of refining or producing usable materials.

(c) **Application.** Installations covered by subsection (8) of this section shall comply with all applicable provisions of this section except as follows:

(i) Overcurrent protection of electrolytic cell DC process power circuits need not comply with the requirements of WAC 296-24-95607(5).

(ii) Equipment located or used within the cell line working zone or associated with the cell line DC power circuits need not comply with the provisions of WAC 296-24-95607(6).

(iii) Electrolytic cells, cell line conductors, cell line attachments, and the wiring of auxiliary equipment and devices within the cell line working zone need not comply with the provisions of WAC 296-24-95605 and 296-24-95607 (2) and (3).

(d) Disconnecting means.

(i) If more than one DC cell line process power supply serves the same cell line, a disconnecting means shall be provided on the cell line circuit side of each power supply to disconnect it from the cell line circuit.

(ii) Removable links or removable conductors may be used as the disconnecting means.

(e) Portable electric equipment.

(i) The frames and enclosures of portable electric equipment used within the cell line working zone may not be grounded. However, these frames and enclosures may be

grounded if the cell line circuit voltage does not exceed 200 volts DC or if the frames are guarded.

(ii) Ungrounded portable electric equipment shall be distinctively marked and may not be interchangeable with grounded portable electric equipment.

(f) Power supply circuits and receptacles for portable electric equipment.

(i) Circuits supplying power to ungrounded receptacles for hand-held, cord- and plug-connected equipment shall be electrically isolated from any distribution system supplying areas other than the cell line working zone and shall be ungrounded. Power for these circuits shall be supplied through isolating transformers.

(ii) Receptacles and their mating plugs for ungrounded equipment may not have provision for a grounding conductor and shall be of a configuration which prevents their use for equipment required to be grounded.

(iii) Receptacles on circuits supplied by an isolating transformer with an ungrounded secondary shall have a distinctive configuration, shall be distinctively marked, and may not be used in any other location in the plant.

(g) Fixed and portable electric equipment.

(i) AC systems supplying fixed and portable electric equipment within the cell line working zone need not be grounded.

(ii) Exposed conductive surfaces, such as electric equipment housings, cabinets, boxes, motors, raceways and the like that are within the cell line working zone need not be grounded.

(iii) Auxiliary electrical devices, such as motors, transducers, sensors, control devices, and alarms, mounted on an electrolytic cell or other energized surface, shall be connected by any of the following means:

(A) Multiconductor hard usage or extra hard usage flexible cord;

(B) Wire or cable in suitable raceways; or

(C) Exposed metal conduit, cable tray, armored cable, or similar metallic systems installed with insulating breaks such that they will not cause a potentially hazardous electrical condition.

(iv) Fixed electric equipment may be bonded to the energized conductive surfaces of the cell line, its attachments, or auxiliaries. If fixed electric equipment is mounted on an energized conductive surface, it shall be bonded to that surface.

(h) **Auxiliary nonelectric connections.** Auxiliary nonelectric connections, such as air hoses, water hoses, and the like, to an electrolytic cell, its attachments, or auxiliary equipment may not have continuous conductive reinforcing wire, armor, braids, and the like. Hoses shall be of a nonconductive material.

(i) Cranes and hoists.

(i) The conductive surfaces of cranes and hoists that enter the cell line working zone need not be grounded. The portion of an overhead crane or hoist which contacts an energized electrolytic cell or energized attachments shall be insulated from ground.

(ii) Remote crane or hoist controls which may introduce hazardous electrical conditions into the cell line working zone shall employ one or more of the following systems:

(A) Insulated and ungrounded control circuit;

(B) Nonconductive rope operator;

(C) Pendent pushbutton with nonconductive supporting means and having nonconductive surfaces or ungrounded exposed conductive surfaces; or

(D) Radio.

(9) **Electrically driven or controlled irrigation machines.** (See WAC 296-24-95603 (2)(c).)

(a) **Lightning protection.** If an electrically driven or controlled irrigation machine has a stationary point, a driven ground rod shall be connected to the machine at the stationary point for lightning protection.

(b) **Disconnecting means.** The main disconnecting means for a center pivot irrigation machine shall be located at the point of connection of electrical power to the machine and shall be readily accessible and capable of being locked in the open position. A disconnecting means shall be provided for each motor and controller.

(10) **Swimming pools, fountains, and similar installations.**

(a) **Scope.** Subdivisions (b) through (e) of this subsection apply to electric wiring for and equipment in or adjacent to all swimming, wading, therapeutic, and decorative pools and fountains, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment. Therapeutic pools in health care facilities are exempt from these provisions.

(b) **Lighting and receptacles.**

(i) **Receptacles.** A single receptacle of the locking and grounding type that provides power for a permanently installed swimming pool recirculating pump motor may be located not less than 5 feet from the inside walls of a pool. All other receptacles on the property shall be located at least 10 feet from the inside walls of a pool. Receptacles which are located within 15 feet of the inside walls of the pool shall be protected by ground-fault circuit interrupters.

Note: In determining these dimensions, the distance to be measured is the shortest path the supply cord of an appliance connected to the receptacle would follow without piercing a floor, wall, or ceiling of a building or other effective permanent barrier.

(ii) **Lighting fixtures and lighting outlets.**

(A) Unless they are 12 feet above the maximum water level, lighting fixtures and lighting outlets may not be installed over a pool or over the area extending 5 feet horizontally from the inside walls of a pool. However, a lighting fixture or lighting outlet which has been installed before April 16, 1981, may be located less than 5 feet measured horizontally from the inside walls of a pool if it is at least 5 feet above the surface of the maximum water level and shall be rigidly attached to the existing structure. It shall also be protected by a ground-fault circuit interrupter installed in the branch circuit supplying the fixture.

(B) Unless installed 5 feet above the maximum water level and rigidly attached to the structure adjacent to or enclosing the pool, lighting fixtures and lighting outlets installed in the area extending between 5 feet and 10 feet horizontally from the inside walls of a pool shall be protected by a ground-fault circuit interrupter.

(c) **Cord-connected and plug-connected equipment.** Flexible cords used with the following equipment may not

exceed 3 feet in length and shall have a copper equipment grounding conductor with a grounding-type attachment plug.

(i) Cord-connected and plug-connected lighting fixtures installed within 16 feet of the water surface of permanently installed pools.

(ii) Other cord-connected and plug-connected, fixed or stationary equipment used with permanently installed pools.

(d) **Underwater equipment.**

(i) A ground-fault circuit interrupter shall be installed in the branch circuit supplying underwater fixtures operating at more than 15 volts. Equipment installed underwater shall be approved for the purpose.

(ii) No underwater lighting fixtures may be installed for operation at over 150 volts between conductors.

(e) **Fountains.** All electric equipment operating at more than 15 volts, including power supply cords, used with fountains shall be protected by ground-fault circuit interrupters. (See WAC 296-24-95603 (2)(c).)

(11) Safety procedure and protective equipment required for exposure to movie theater Xenon bulbs. Exposure also includes opening of the lamphouse where the bulb is installed. The following are minimum requirements for theater personnel or others who install, change, or dispose of Xenon bulbs and are exposed to potential explosion hazard:

(a) All bulbs, new, used or subject to future disposal, must be stored in the protective jacket provided until time of use.

(b) Protective equipment shall be furnished at no cost to the employee and the use shall be strictly enforced for any exposed employee. Basic safety equipment required is:

(i) Full protective face shield with crown protector.

(ii) Safety glasses for use under face shield. (To meet required impact resistance test of ANSI Z87.1.)

(iii) Impact resistant, long-sleeved jacket of a length adequate to protect vital organs.

(iv) Impact resistant gloves.

(c) A bulb subject to disposal should be removed with the regular, proper precautions, carefully placed in its protective jacket or cover and deliberately broken by dropping from a sufficient height. An unbroken bulb must never be disposed of as regular garbage or trash.

(d) Bulbs must be handled only at room temperature. If they have been in operation, adequate time (at least 10 minutes) must be allowed for the bulb to cool to room temperature before handling.

[Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-24-95611, filed 1/10/91, effective 2/12/91; 87-24-051 (Order 87-24), § 296-24-95611, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95611, filed 3/30/82.]

WAC 296-24-95613 Hazardous (classified) locations.

(1) **Scope.** This section covers the requirements for electric equipment and wiring in locations which are classified depending on the properties of the flammable vapors, liquids or gases, or combustible dusts or fibers which may be present therein and the likelihood that a flammable combustible concentration or quantity is present. Hazardous (classified) locations may be found in occupancies such as, but not limited to, the following: Aircraft hangars, gasoline dispensing and service stations, bulk storage plants for gasoline or other volatile

flammable liquids, paint-finishing process plants, health care facilities, agricultural or other facilities where excessive combustible dusts may be present, marinas, boat yards, and petroleum and chemical processing plants. Each room, section or area shall be considered individually in determining its classification. These hazardous (classified) locations are assigned six designations as follows:

Class I,	Division 1
Class I,	Division 2
Class II,	Division 1
Class II,	Division 2
Class III,	Division 1
Class III,	Division 2

For definitions of these locations see WAC 296-24-95601(1). All applicable requirements in this part shall apply to hazardous (classified) locations, unless modified by provisions of this section.

(2) **Electrical installations.** Equipment, wiring methods, and installations of equipment in hazardous (classified) locations shall be intrinsically safe, or approved for the hazardous (classified) location, or safe for the hazardous (classified) location. Requirements for each of these options are as follows:

(a) **Intrinsically safe.** Equipment and associated wiring approved as intrinsically safe shall be permitted in any hazardous (classified) location for which it is approved.

(b) **Approved for the hazardous (classified) location.**

(i) Equipment shall be approved not only for the class of location but also for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present.

Note: NFPA 70, the National Electrical Code, lists or defines hazardous gases, vapors, and dusts by "groups" characterized by their ignitable or combustible properties.

(ii) Equipment shall be marked to show the class, group, and operating temperature or temperature range, based on operation in a 40 degrees C ambient, for which it is approved. The temperature marking may not exceed the ignition temperature of the specific gas or vapor to be encountered. However, the following provisions modify this marking requirement for specific equipment:

(A) Equipment of the nonheat-producing type, such as junction boxes, conduit, and fittings, and equipment of the heat-producing type having a maximum temperature not more than 100 degrees C (212 degrees F) need not have a marked operating temperature or temperature range.

(B) Fixed lighting fixtures marked for use in Class I, Division 2 locations only, need not be marked to indicate the group.

(C) Fixed general-purpose equipment in Class I locations, other than lighting fixtures, which is acceptable for use in Class I, Division 2 locations need not be marked with the class, group, division, or operating temperature.

(D) Fixed dust-tight equipment, other than lighting fixtures, which is acceptable for use in Class II, Division 2 and Class III locations need not be marked with the class, group, division, or operating temperature.

(c) **Safe for the hazardous (classified) location.** Equipment which is safe for the location shall be of a type and

design which the employer demonstrates will provide protection from the hazards arising from the combustibility and flammability of vapors, liquids, gases, dusts, or fibers.

Note: The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installations which will meet this requirement. The guidelines of this document address electric wiring, equipment, and systems installed in hazardous (classified) locations and contain specific provisions for the following: Wiring methods, wiring connections; conductor insulation, flexible cords, sealing and drainage, transformers, capacitors, switches, circuit breakers, fuses, motor controllers, receptacles, attachment plugs, meters, relays, instruments, resistors, generators, motors, lighting fixtures, storage battery charging equipment, electric cranes, electric hoists and similar equipment, utilization equipment, signaling systems, alarm systems, remote control systems, local loud speaker and communication systems, ventilation piping, live parts, lighting surge protection, and grounding. Compliance with these guidelines will constitute one means, but not the only means, of compliance with this subsection.

(3) **Conduits.** All conduits shall be threaded and shall be made wrench-tight. Where it is impractical to make a threaded joint tight, a bonding jumper shall be utilized.

(4) **Equipment in Division 2 locations.** Equipment that has been approved for a Division 1 location may be installed in a Division 2 location of the same class and group. General-purpose equipment or equipment in general-purpose enclosures may be installed in Division 2 locations if the equipment does not constitute a source of ignition under normal operating conditions.

(5) **Motors and generators.** Motors and generators shall conform to the following: Class I, Division 1. In Class I, Division 1 locations, motors, generators and other rotating electric machinery shall be: (a) Approved for Class I, Division 1 locations (explosion-proof); or (b) of the totally enclosed type supplied with positive-pressure ventilation from a source of clean air with discharge to a safe area, so arranged to prevent energizing of the machine until ventilation has been established and the enclosure has been purged with at least 10 volumes of air, and also arranged to automatically deenergize the equipment when the air supply fails; or (c) of the totally enclosed inert-gas-filled type supplied with a suitable reliable source of inert gas for pressuring the enclosure, with devices provided to ensure a positive pressure in the enclosure and arranged to automatically deenergize the equipment when the gas supply fails; or (d) of a type designed to be submerged in a liquid which is flammable only when vaporized and mixed with air, or in a gas or vapor at a pressure greater than atmospheric and which is flammable only when mixed with air; and the machine is so arranged to prevent energizing it until it has been purged with the liquid or gas to exclude air, and also arranged to automatically deenergize the equipment when the supply of liquid, or gas or vapor fails or the pressure is reduced to atmospheric. Totally enclosed motors of types (b) and (c) shall have no external surface with an operating temperature in degrees Celsius in excess of eighty percent of the ignition temperature of the gas or vapor involved, as determined by ASTM test procedure (Designation: D-2155-69). Appropriate devices shall be provided to detect any increase in temperature of the motor beyond design limits and automatically deenergize the equipment or provide an adequate alarm. Auxiliary equipment

shall be of a type approved for the location in which it is installed.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-95613, filed 7/20/94, effective 9/20/94; 87-24-051 (Order 87-24), § 296-24-95613, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050, 82-08-026 (Order 82-10), § 296-24-95613, filed 3/30/82.]

WAC 296-24-95615 Special systems. (1) **Systems over 600 volts, nominal.** Subdivisions (a) through (d) of this subsection cover the general requirements for all circuits and equipment operated at over 600 volts.

(a) Wiring methods for fixed installations.

(i) Above-ground conductors shall be installed in rigid metal conduit, in intermediate metal conduit, in cable trays, in cablebus, in other suitable raceways, or as open runs of metal-clad cable suitable for the use and purpose. However, open runs of nonmetallic-sheathed cable or of bare conductors or busbars may be installed in locations accessible only to qualified persons. Metallic shielding components, such as tapes, wires, or braids for conductors, shall be grounded. Open runs of insulated wires and cables having a bare lead sheath or a braided outer covering shall be supported in a manner designed to prevent physical damage to the braid or sheath.

(ii) Conductors emerging from the ground shall be enclosed in approved raceways. (See WAC 296-24-95603 (2)(c).)

(b) Interrupting and isolating devices.

(i) Circuit breaker installations located indoors shall consist of metal-enclosed units or fire-resistant cell-mounted units. In locations accessible only to qualified personnel, open mounting of circuit breakers is permitted. A means of indicating the open and closed position of circuit breakers shall be provided.

(ii) Fused cutouts installed in buildings or transformer vaults shall be of a type approved for the purpose. They shall be readily accessible for fuse replacement.

(iii) A means shall be provided to completely isolate equipment for inspection and repairs. Isolating means which are not designed to interrupt the load current of the circuit shall be either interlocked with an approved circuit interrupter or provided with a sign warning against opening them under load.

(c) Mobile and portable equipment.

(i) **Power cable connections to mobile machines.** A metallic enclosure shall be provided on the mobile machine for enclosing the terminals of the power cable. The enclosure shall include provisions for a solid connection for the ground wire(s) terminal to effectively ground the machine frame. The method of cable termination used shall prevent any strain or pull on the cable from stressing the electrical connections. The enclosure shall have provision for locking so only authorized qualified persons may open it and shall be marked with a sign warning of the presence of energized parts.

(ii) **Guarding live parts.** All energized switching and control parts shall be enclosed in effectively grounded metal cabinets or enclosures. Circuit breakers and protective equipment shall have the operating means projecting through the metal cabinet or enclosure so these units can be reset without locked doors being opened. Enclosures and metal cabinets

shall be locked so that only authorized qualified persons have access and shall be marked with a sign warning of the presence of energized parts. Collector ring assemblies on revolving-type machines (shovels, draglines, etc.) shall be guarded.

(d) Tunnel installations.

(i) **Application.** The provisions of this subsection apply to installation and use of high-voltage power distribution and utilization equipment which is portable and/or mobile, such as substations, trailers, cars, mobile shovels, draglines, hoists, drills, dredges, compressors, pumps, conveyors, and underground excavators.

(ii) **Conductors.** Conductors in tunnels shall be installed in one or more of the following:

- (A) Metal conduit or other metal raceway,
- (B) Type MC cable, or
- (C) Other approved multiconductor cable.

Conductors shall also be so located or guarded as to protect them from physical damage. Multiconductor portable cable may supply mobile equipment. An equipment grounding conductor shall be run with circuit conductors inside the metal raceway or inside the multiconductor cable jacket. The equipment grounding conductor may be insulated or bare.

(iii) **Guarding live parts.** Bare terminals of transformers, switches, motor controllers, and other equipment shall be enclosed to prevent accidental contact with energized parts. Enclosures for use in tunnels shall be drip-proof, weather-proof, or submersible as required by the environmental conditions.

(iv) **Disconnecting means.** A disconnecting means that simultaneously opens all ungrounded conductors shall be installed at each transformer or motor location.

(v) **Grounding and bonding.** All nonenergized metal parts of electric equipment and metal raceways and cable sheaths shall be effectively grounded and bonded to all metal pipes and rails at the portal and at intervals not exceeding 1000 feet throughout the tunnel.

(2) Emergency power systems.

(a) **Scope.** The provisions for emergency systems apply to circuits, systems, and equipment intended to supply power for illumination and special loads, in the event of failure of the normal supply.

(b) **Wiring methods.** Emergency circuit wiring shall be kept entirely independent of all other wiring and equipment and may not enter the same raceway, cable, box, or cabinet as other wiring except either where common circuit elements suitable for the purpose are required, or for transferring power from the normal to the emergency source.

(c) **Emergency illumination.** Where emergency lighting is necessary, the system shall be so arranged that the failure of any individual lighting element, such as the burning out of a light bulb, cannot leave any space in total darkness.

(3) Class 1, Class 2, and Class 3 remote control, signaling, and power-limited circuits.

(a) **Classification.** Class 1, Class 2, or Class 3 remote control, signaling, or power-limited circuits are characterized by their usage and electrical power limitation which differentiates them from light and power circuits. These circuits are classified in accordance with their respective voltage and power limitations as summarized in items (a)(i) through (a)(iii) of this subsection.

(i) Class 1 circuits.

(A) A Class 1 power-limited circuit is supplied from a source having a rated output of not more than 30 volts and 1000 volt-amperes.

(B) A Class 1 remote control circuit or a Class 1 signaling circuit has a voltage which does not exceed 600 volts; however, the power output of the source need not be limited.

(ii) Class 2 and Class 3 circuits.

(A) Power for Class 2 and Class 3 circuits is limited either inherently (in which no overcurrent protection is required) or by a combination of a power source and overcurrent protection.

(B) The maximum circuit voltage is 150 volts AC or DC for a Class 2 inherently limited power source, and 100 volts AC or DC for a Class 3 inherently limited power source.

(C) The maximum circuit voltage is 30 volts AC and 60 volts DC for a Class 2 power source limited by overcurrent protection, and 150 volts AC or DC for a Class 3 power source limited by overcurrent protection.

(iii) The maximum circuit voltages in items (a)(i) and (a)(ii) of this subsection apply to sinusoidal AC or continuous DC power sources, and where wet contact occurrence is not likely.

(b) **Marking.** A Class 2 or Class 3 power supply unit shall be durably marked where plainly visible to indicate the class of supply and its electrical rating. (See WAC 296-24-95603 (2)(c).)

(4) **Fire protective signaling systems.** (See WAC 296-24-95603 (2)(c).)

(a) **Classifications.** Fire protective signaling circuits shall be classified either as nonpower limited or power limited.

(b) **Power sources.** The power sources for use with fire protective signaling circuits shall be either power limited or nonlimited as follows:

(i) The power supply of nonpower-limited fire protective signaling circuits shall have an output voltage not in excess of 600 volts.

(ii) The power for power-limited fire protective signaling circuits shall be either inherently limited, in which no overcurrent protection is required, or limited by a combination of power source and overcurrent protection.

(c) **Nonpower-limited conductor location.** Nonpower-limited fire protective signaling circuits and Class 1 circuits may occupy the same enclosure, cable, or raceway provided all conductors are insulated for maximum voltage of any conductor within the enclosure, cable or raceway. Power supply and fire protective signaling circuit conductors are permitted in the same enclosure, cable, or raceway only if connected to the same equipment.

(d) **Power-limited conductor location.** Where open conductors are installed, power-limited fire protective signaling circuits shall be separated at least 2 inches from conductors of any light, power, Class 1, and nonpower-limited fire protective signaling circuits unless a special and equally protective method of conductor separation is employed. Cables and conductors of two or more power-limited fire protective signaling circuits or Class 3 circuits are permitted in the same cable, enclosure, or raceway. Conductors of one or more Class 2 circuits are permitted within the same cable, enclosure,

or raceway with conductors of power-limited fire protective signaling circuits provided that the insulation of Class 2 circuit conductors in the cable, enclosure, or raceway is at least that needed for the power-limited fire protective signaling circuits.

(e) **Identification.** Fire protective signaling circuits shall be identified at terminal and junction locations in a manner which will prevent unintentional interference with the signaling circuit during testing and servicing. Power-limited fire protective signaling circuits shall be durably marked as such where plainly visible at terminations.

(5) Communications systems.

(a) **Scope.** These provisions for communication systems apply to such systems as central-station-connected and non-central-station-connected telephone circuits, radio and television receiving and transmitting equipment, including community antenna television and radio distribution systems, telegraph, district messenger, and outside wiring for fire and burglar alarm, and similar central station systems. These installations need not comply with the provisions of WAC 296-24-95605 through 296-24-95615(4) except 296-24-95607 (3)(a) and 296-24-95613(2).

(b) Protective devices.

(i) Communication circuits so located as to be exposed to accidental contact with light or power conductors operating at over 300 volts shall have each circuit so exposed provided with a protector approved for the purpose.

(ii) Each conductor of a lead-in from an outdoor antenna shall be provided with an antenna discharge unit or other suitable means that will drain static charges from the antenna system.

(c) Conductor location.**(i) Outside of buildings.**

(A) Receiving distribution lead-in or aerial-drop cables attached to buildings and lead-in conductors to radio transmitters shall be so installed as to avoid the possibility of accidental contact with electric light or power conductors.

(B) The clearance between lead-in conductors and any lightning protection conductors may not be less than 6 feet.

(ii) **On poles.** Where practicable, communication conductors on poles shall be located below the light or power conductors. Communications conductors may not be attached to a crossarm that carries light or power conductors.

(iii) **Inside of buildings.** Indoor antennas, lead-ins, and other communication conductors attached as open conductors to the inside of buildings shall be located at least 2 inches from conductors of any light or power or Class 1 circuits unless a special and equally protective method of conductor separation, approved for the purpose, is employed.

(d) **Equipment location.** Outdoor metal structures supporting antennas, as well as self-supporting antennas such as vertical rods or dipole structures, shall be located as far away from overhead conductors of electric light and power circuits of over 150 volts to ground as necessary to avoid the possibility of the antenna or structure falling into or making accidental contact with such circuits.

(e) Grounding.

(i) **Lead-in conductors.** If exposed to contact with electric light and power conductors, the metal sheath of aerial cables entering buildings shall be grounded or shall be inter-

rupted close to the entrance to the building by an insulating joint or equivalent device. Where protective devices are used, they shall be grounded in an approved manner.

(ii) **Antenna structures.** Masts and metal structures supporting antennas shall be permanently and effectively grounded without splice or connection in the grounding conductor.

(iii) **Equipment enclosures.** Transmitters shall be enclosed in a metal frame or grill or separated from the operating space by a barrier, all metallic parts of which are effectively connected to ground. All external metal handles and controls accessible to the operating personnel shall be effectively grounded. Unpowered equipment and enclosures shall be considered grounded where connected to an attached coaxial cable with an effectively grounded metallic shield.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95615, filed 3/30/82.]

WAC 296-24-95617 Reserved.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-95617, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-24-95617, filed 3/30/82.]

WAC 296-24-95699 Appendices. Appendix A - Reference documents. The following references provide information which can be helpful in understanding and complying with the requirements contained in WAC 296-24-956 through 296-24-95615.

ANSI A17.1-71 Safety Code for Elevators, Dumbwaiters, Escalators and Moving Walks.

ANSI B9.1-71 Safety Code for Mechanical Refrigeration.

ANSI B30.2-76 Safety Code for Overhead and Gantry Cranes.

ANSI B30.3-75 Hammerhead Tower Cranes.

ANSI B30.4-73 Safety Code for Portal, Tower, and Pillar Cranes.

ANSI B30.5-68 Safety Code for Crawler, Locomotive, and Truck Cranes.

ANSI B30.6-77 Derricks.

ANSI B30.7-77 Base Mounted Drum Hoists.

ANSI B30.8-71 Safety Code for Floating Cranes and Floating Derricks.

ANSI B30.11-73 Monorail Systems and Underhung Cranes.

ANSI B30.12-75 Handling Loads Suspended from Rotorcraft.

ANSI B30.13-77 Controlled Mechanical Storage Cranes.

ANSI B30.15-73 Safety Code for Mobile Hydraulic Cranes.

ANSI B30.16-73 Overhead Hoists.

ANSI C2-81 National Electrical Safety Code.

ANSI C33.27-74 Safety Standard for Outlet Boxes and Fittings for Use in Hazardous Locations, Class I, Groups A, B, C, and D, and Class II, Groups E, F, and G.

ANSI K61.1-72 Safety Requirements for the Storage and Handling of Anhydrous Ammonia.

ASTM D2155-66 Test Method for Autoignition Temperature of Liquid Petroleum Products.

ASTM D3176-74 Method for Ultimate Analysis of Coal and Coke.

ASTM D3180-74 Method for Calculating Coal and Coke Analyses from as Determined to Different Bases.

IEEE 463-77 Standard for Electrical Safety Practices in Electrolytic Cell Line Working Zones.

NFPA 20-76 Standard for the Installation of Centrifugal Fire Pumps.

NFPA 30-78 Flammable and Combustible Liquids Code.

NFPA 32-74 Standard for Drycleaning Plants.

NFPA 33-73 Standard for Spray Application Using Flammable and Combustible Materials.

NFPA 34-74 Standard for Dip Tanks Containing Flammable or Combustible Liquids.

NFPA 35-76 Standard for the Manufacture of Organic Coatings.

NFPA 36-74 Standard for Solvent Extraction Plants.

NFPA 40-74 Standard for the Storage and Handling of Cellulose Nitrate Motion Picture Film.

NFPA 56A-73 Standard for the Use of Inhalation Anesthetics (Flammable and Nonflammable).

NFPA 56F-74 Standard for Nonflammable Medical Gas Systems.

NFPA 58-76 Standard for the Storage and Handling of Liquefied Petroleum Gases.

NFPA 59-76 Standard for the Storage and Handling of Liquefied Petroleum Gases at Utility Gas Plants.

NFPA 70-78 National Electrical Code.

NFPA 70C-74 Hazardous Locations Classification.

NFPA 70E Standard for the Electrical Safety Requirements for Employee Workplaces.

NFPA 71-77 Standard for the Installation, Maintenance, and Use of Central Station Signaling Systems.

NFPA 72A-75 Standard for the Installation, Maintenance, and Use of Local Protective Signaling Systems for Watchman, Fire Alarm, and Supervisory Service.

NFPA 72B-75 Standard for the Installation, Maintenance, and Use of Auxiliary Protective Signaling Systems for Fire Alarm Service.

NFPA 72C-75 Standard for the Installation, Maintenance, and Use of Remote Station Protective Signaling Systems.

NFPA 72D-75 Standard for the Installation, Maintenance, and Use of Proprietary Protective Signaling Systems for Watchman, Fire Alarm, and Supervisory Service.

NFPA 72E-74 Standard for Automatic Fire Detectors.

- NFPA 74-75 Standard for Installation, Maintenance, and Use of Household Fire Warning Equipment.
- NFPA 76A-73 Standard for Essential Electrical Systems for Health Care Facilities.
- NFPA 77-72 Recommended Practice on Static Electricity.
- NFPA 80-77 Standard for Fire Doors and Windows.
- NFPA 86A-73 Standard for Ovens and Furnaces; Design, Location and Equipment.
- NFPA 88A-73 Standard for Parking Structures.
- NFPA 88B-73 Standard for Repair Garages.
- NFPA 91-73 Standard for the Installation of Blower and Exhaust Systems for Dust, Stock, and Vapor Removal, or Conveying.
- NFPA 101-78 Code for Safety to Life from Fire in Buildings and Structures. (Life Safety Code.)
- NFPA 325M-69 Fire-Hazard Properties of Flammable Liquids, Gases, and Volatile Solids.
- NFPA 493-75 Standard for Intrinsically Safe Apparatus for Use in Class I Hazardous Locations and its Associated Apparatus.
- NFPA 496-74 Standard for Purged and Pressurized Enclosures for Electrical Equipment in Hazardous Locations.
- NFPA 497-75 Recommended Practice for Classification of Class I Hazardous Locations for Electrical Installations in Chemical Plants.
- NFPA 505-75 Fire Safety Standard for Powered Industrial Trucks Including Type Designations and Areas of Use.
- NMAB 353-1-79 Matrix of Combustion-Relevant Properties and Classification of Gases, Vapors, and Selected Solids.
- NMAB 353-2-79 Test Equipment for Use in Determining Classifications of Combustible Dusts.
- NMAB 353-3-80 Classification of Combustible Dusts in Accordance with the National Electrical Code.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 82-08-026 (Order 82-10), § 296-24-95699, filed 3/30/82.]

WAC 296-24-960 Working on or near exposed energized parts. (1) Application. This section applies to work performed on exposed live parts (involving either direct contact or contact by means of tools or materials) or near enough to them for employees to be exposed to any hazard they present.

(2) Work on energized equipment. Only qualified persons shall work on electric circuit parts or equipment that have not been deenergized under the procedures of WAC 296-24-975(2). Such persons shall be capable of working safely on energized circuits and shall be familiar with the proper use of special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools.

(3) General requirements - high voltage lines.

(a) Minimum clearance.

(i) No work shall be performed, no material shall be piled, stored or otherwise handled, no scaffolding, commer-

cial signs, or structures shall be erected or dismantled, nor any tools, machinery or equipment operated within the specified minimum distances from any energized high voltage electrical conductor capable of energizing the material or equipment; except where the electrical distribution and transmission lines have been deenergized and visibly grounded at point of work, or where insulating barriers not a part of or an attachment to the equipment have been erected, to prevent physical contact with the lines, equipment shall be operated proximate to, under, over, by, or near powerlines only in accordance with the following:

(ii) For lines rated 50 kv. or below, minimum clearance between the lines and any part of the equipment or load shall be 10 feet.

(iii) For lines rated over 50 kv. minimum, clearance between the lines and any part of the equipment or load shall be 10 feet plus 0.4 inch for each 1 kv. over 50 kv., or twice the length of the line insulator but never less than 10 feet.

(b) Overhead electric lines. Where overhead electric conductors are encountered in proximity to a work area, the employer shall be responsible for:

(i) Ascertaining the voltage and minimum clearance distance required, and

(ii) Maintaining the minimum clearance distance, and

(iii) Ensuring that the requirements of subsection (3) of this section are complied with.

(c) Not covered: Employees working under chapters 296-32 and 296-45 WAC.

(4) Low voltage lines. When work is being carried out in proximity to energized electrical service conductors operating at 750 volts or less, such work shall be performed in a manner to prevent contact by any worker with the energized conductors.

(5) Overhead lines. If work is to be performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before work is started. If the lines are to be deenergized, arrangements shall be made with the person or organization that operates or controls the electric circuits involved to deenergize and ground them. If protective measures, such as guarding, isolating, or insulating, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

(6) Unqualified persons. When an unqualified person is working in an elevated position, or on the ground, near overhead lines, the location shall be such that the person and the longest conductive object he or she may contact cannot come closer to any unguarded, energized overhead line than the following distances:

(a) For voltages to ground 50kV or below—10 ft.;

(b) For voltages to ground over 50kV—10 ft. plus 0.4 inch for every 1 kV over 50 kV.

(7) Qualified persons. When a qualified person is working in the vicinity of overhead lines, whether in an elevated position or on the ground, the person shall not approach or take any conductive object without an approved insulating handle closer to exposed energized parts than shown in subsections (3) and (4) of this section unless:

(a) The person is insulated from the energized part (gloves, with sleeves if necessary, rated for the voltage

involved are considered to be insulation of the person from the energized part on which work is performed); or

(b) The energized part is insulated both from all other conductive objects at a different potential and from the person; or

(c) The person is insulated from all conductive objects at a potential different from that of the energized part.

(8) Vehicular and mechanical equipment.

(a) Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 ft. is maintained. If the voltage is higher than 50kV, the clearance shall be increased 0.4 inch for every 1kV over that voltage. However, under any of the following conditions, the clearance may be reduced:

(i) If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4 ft. If the voltage is higher than 50kV, the clearance shall be increased 0.4 inch for every 1kV over that voltage.

(ii) If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

(b) If the equipment is an aerial lift insulated for the voltage involved, and if the work is performed by a qualified person, the clearance (between the uninsulated portion of the aerial lift and the power line) may be reduced to the distance given in subsections (3) and (4) of this section.

(c) Employees standing on the ground shall not contact the vehicle or mechanical equipment or any of its attachments, unless:

(i) The employee is using protective equipment rated for the voltage; or

(ii) The equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the line than permitted in this section.

(d) If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding shall not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

(9) Illumination.

(a) Employees shall not enter spaces containing exposed energized parts, unless illumination is provided that enables the employees to perform the work safely.

(b) Where lack of illumination or an obstruction precludes observation of the work to be performed, employees shall not perform tasks near exposed energized parts. Employees shall not reach blindly into areas which may contain energized parts.

(10) Confined or enclosed work spaces. When an employee works in a confined or enclosed space (such as a

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manhole or vault) that contains exposed energized parts, the employer shall provide, and the employee shall use, protective shields, protective barriers, or insulating materials as necessary to avoid inadvertent contact with these parts. Doors, hinged panels, and the like shall be secured to prevent their swinging into an employee and causing the employee to contact exposed energized parts.

(11) Conductive materials and equipment. Conductive materials and equipment that are in contact with any part of an employee's body shall be handled in a manner that will prevent them from contacting exposed energized conductors or circuit parts. If an employee must handle long dimensional conductive objects (such as ducts and pipes) in areas with exposed live parts, the employer shall institute work practices (such as the use of insulation, guarding, and material handling techniques) which will minimize the hazard.

(12) Portable ladders. Portable ladders shall have non-conductive siderails if they are used where the employee or the ladder could contact exposed energized parts.

(13) Conductive apparel. Conductive articles of jewelry and clothing (such as watch bands, bracelets, rings, key chains, necklaces, metalized aprons, cloth with conductive thread, or metal headgear) shall not be worn if they might contact exposed energized parts.

(14) Housekeeping duties.

(a) Where live parts present an electrical contact hazard, employees shall not perform housekeeping duties at such close distances to the parts that there is a possibility of contact, unless adequate safeguards (such as insulating equipment or barriers) are provided.

(b) Electrically conductive cleaning materials (including conductive solids such as steel wool, metalized cloth, and silicon carbide, as well as conductive liquid solutions) shall not be used in proximity to energized parts unless procedures are followed which will prevent electrical contact.

(15) Interlocks. Only a qualified person following the requirements of this section may defeat an electrical safety interlock, and then only temporarily while he or she is working on the equipment. The interlock system shall be returned to its operable condition when this work is completed.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-24-960, filed 7/20/94, effective 9/20/94; 91-24-017 (Order 91-07), § 296-24-960, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-13-045 (Order 82-22), § 296-24-960, filed 6/11/82; 82-02-003 (Order 81-32), § 296-24-960, filed 12/24/81.]

WAC 296-24-965 Safety-related work practices. (1) Scope. Covered work by both qualified and unqualified persons. The provisions of WAC 296-24-960 through 296-24-985 cover electrical safety-related work practices for both qualified persons (those who have training in avoiding the electrical hazards of working on or near exposed energized parts) and unqualified persons (those with little or no such training) working on, near, or with the following installations:

(a) Premises wiring. Installations of electric conductors and equipment within or on buildings or other structures, and on other premises such as yards, carnival, parking, and other lots, and industrial substations;

(b) Wiring for connection to supply. Installations of conductors that connect to the supply of electricity;

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(c) Other wiring. Installations of other outside conductors on the premises; and

(d) Optical fiber cable. Installations of optical fiber cable where such installations are made along with electric conductors.

Note: See WAC 296-24-95601 for the definition of "qualified person." See WAC 296-24-970 for training requirements that apply to qualified and unqualified persons.

(2) Other covered work by unqualified persons. The provisions of WAC 296-24-960 through 296-24-985 also cover work performed by unqualified persons on, near, or with the installations listed in subsection (3) of this section.

(3) Excluded work by qualified persons. The provisions of WAC 296-24-960 through 296-24-985 do not apply to work performed by qualified persons on or directly associated with the following installations:

(a) Generation, transmission, and distribution installations. Installations for the generation, control, transformation, transmission, and distribution of electric energy (including communication and metering) located in buildings used for such purposes or located outdoors.

Note 1: Work on or directly associated with installations of utilization equipment used for purposes other than generating, transmitting, or distributing electric energy (such as installations which are in office buildings, warehouses, garages, machine shops, or recreational buildings, or other utilization installations which are not an integral part of a generating installation, substation, or control center) is covered under subsection (1)(a) of this section.

Note 2: Work on or directly associated with generation, transmission, or distribution installations includes:

1. Work performed directly on such installations, such as repairing overhead or underground distribution lines or repairing a feed-water pump for the boiler in a generating plant.
2. Work directly associated with such installations, such as line-clearance tree trimming and replacing utility poles.
3. Work on electric utilization circuits in a generating plant provided that:
 - a. Such circuits are commingled with installations of power generation equipment or circuits; and
 - b. The generation equipment or circuits present greater electrical hazards than those posed by the utilization equipment or circuits (such as exposure to higher voltages or lack of overcurrent protection).

(b) Communications installations. Installations of communication equipment to the extent that the work is covered under chapter 296-32 WAC.

(c) Installations in vehicles. Installations in ships, watercraft, railway rolling stock, aircraft, or automotive vehicles other than mobile homes and recreational vehicles.

(d) Railway installations. Installations of railways for generation, transformation, transmission, or distribution of power used exclusively for operation of rolling stock or installations of railways used exclusively for signaling and communication purposes.

[Statutory Authority: Chapter 49.17 RCW, 91-24-017 (Order 91-07), § 296-24-965, filed 11/22/91, effective 12/24/91.]

WAC 296-24-970 Training. (1) Scope. The training requirements contained in this section apply to employees who face a risk of electric shock that is not reduced to a safe level by the electrical installation requirements of WAC 296-24-95605 through 296-24-95615.

Note: Employees in occupations listed in Table S-4 face such a risk and are required to be trained. Other employees who also may reasonably be expected to face a comparable risk of injury due to electric shock or other electrical hazards must also be trained.

(2) Content of training.

(a) Practices addressed in this standard. Employees shall be trained in and familiar with the safety-related work practices required by WAC 296-24-960 through 296-24-985 that pertain to their respective job assignments.

(b) Additional requirements for unqualified persons. Employees who are covered by subsection (1) of this section but who are not qualified persons shall also be trained in and familiar with any electrically related safety practices not specifically addressed by WAC 296-24-960 through 296-24-985 but which are necessary for their safety.

(c) Additional requirements for qualified persons. Qualified persons (i.e., those permitted to work on or near energized parts) shall, at a minimum, be trained in and familiar with the following:

- (i) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;
- (ii) The skills and techniques necessary to determine the nominal voltage of exposed live parts; and
- (iii) The clearance distances specified in WAC 296-24-960 and the corresponding voltages to which the qualified person will be exposed.

Note 1: For the purposes of WAC 296-24-960 through 296-24-985 a person must have the training required by (c) of this subsection in order to be considered a qualified person.

Note 2: Qualified persons whose work on energized equipment involves either direct contact or contact by means of tools or materials must also have the training needed to meet WAC 296-24-960.

(3) Type of training. The training required by this section shall be of the classroom or on-the-job type. The degree of training provided shall be determined by the risk to the employee.

TABLE S-4.—TYPICAL OCCUPATIONAL CATEGORIES OF EMPLOYEES FACING A HIGHER THAN NORMAL RISK OF ELECTRICAL ACCIDENT

Occupation
Blue collar supervisors. ¹
Electrical and electronic engineers. ¹
Electrical and electronic equipment assemblers. ¹
Electrical and electronic technicians. ¹
Electricians.
Industrial machine operators. ¹
Material handling equipment operators. ¹
Mechanics and repairers. ¹
Painters. ¹
Riggers and roustabouts. ¹
Stationary engineers. ¹
Welders.

¹ Workers in these groups do not need to be trained if their work or the work of those they supervise does not bring them or the employees they supervise close enough to exposed parts of electric circuits operating at 50 volts or more to ground for a hazard to exist.

[Statutory Authority: Chapter 49.17 RCW, 91-24-017 (Order 91-07), § 296-24-970, filed 11/22/91, effective 12/24/91.]

WAC 296-24-975 Selection and use of work practices.

(1) General. Safety-related work practices shall be employed to prevent electric shock or other injuries resulting from either direct or indirect electrical contacts, when work is performed near or on equipment or circuits which are or may be energized. The specific safety-related work practices shall be consistent with the nature and extent of the associated electrical hazards.

(a) Deenergized parts. Live parts to which an employee may be exposed shall be deenergized before the employee works on or near them, unless the employer can demonstrate that deenergizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations. Live parts that operate at less than 50 volts to ground need not be deenergized if there will be no increased exposure to electrical burns or to explosion due to electric arcs.

Note 1: Examples of increased or additional hazards include interruption of life support equipment, deactivation of emergency alarm systems, shutdown of hazardous location ventilation equipment, or removal of illumination for an area.

Note 2: Examples of work that may be performed on or near energized circuit parts because of infeasibility due to equipment design or operational limitations include testing of electric circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous industrial process in a chemical plant that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

Note 3: Work on or near deenergized parts is covered by subsection (2) of this section.

(b) Energized parts. If the exposed live parts are not deenergized (i.e., for reasons of increased or additional hazards or infeasibility), other safety-related work practices shall be used to protect employees who may be exposed to the electrical hazards involved. Such work practices shall protect employees against contact with energized circuit parts directly with any part of their body or indirectly through some other conductive object. The work practices that are used shall be suitable for the conditions under which the work is to be performed and for the voltage level of the exposed electric conductors or circuit parts. Specific work practice requirements are detailed in WAC 296-24-960.

(2) Working on or near exposed deenergized parts.

(a) Application. This subsection applies to work on exposed deenergized parts or near enough to them to expose the employee to any electrical hazard they present. Conductors and parts of electric equipment that have been deenergized but have not been locked out or tagged according to this subsection shall be treated as energized parts, and WAC 296-24-960 applies to work on or near them.

(b) Lockout and tagging. While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been deenergized, the circuits energizing the parts shall be locked out or tagged or both according to the requirements of this section. The requirements shall be followed in the order in which they are presented (i.e., (b)(i) of this subsection first, then (b)(ii) of this subsection).

Note 1: As used in this section, fixed equipment refers to equipment fastened in place or connected by permanent wiring methods.

Note 2: Lockout and tagging procedures that comply with chapter 296-24 WAC Part A-4 will also be deemed to comply with (b) of this subsection provided that:

1. The procedures address the electrical safety hazards covered by this part; and
2. The procedures also incorporate the requirements of (b)(iii)(D) and (b)(iv)(B) of this subsection.

(i) Procedures. The employer shall maintain a written copy of the procedures outlined in (b) of this subsection and shall make it available for inspection by employees and by the director and his or her authorized representatives.

Note: The written procedures may be in the form of a copy of subsection (2) of this section.

(ii) Deenergizing equipment.

(A) Safe procedures for deenergizing circuits and equipment shall be determined before circuits or equipment are deenergized.

(B) The circuits and equipment to be worked on shall be disconnected from all electric energy sources. Control circuit devices, such as push buttons, selector switches, and interlocks, shall not be used as the sole means for deenergizing circuits or equipment. Interlocks for electric equipment shall not be used as a substitute for lockout and tagging procedures.

(C) Stored electric energy which might endanger personnel shall be released. Capacitors shall be discharged and high capacitance elements shall be short-circuited and grounded, if the stored electric energy might endanger personnel.

Note: If the capacitors or associated equipment are handled in meeting this requirement, they shall be treated as energized.

(D) Stored nonelectrical energy in devices that could reenergize electric circuit parts shall be blocked or relieved to the extent that the circuit parts could not be accidentally energized by the device.

(iii) Application of locks and tags.

(A) A lock and a tag shall be placed on each disconnecting means used to deenergize circuits and equipment on which work is to be performed, except as provided in subitems (C) and (E) of this item. The lock shall be attached to prevent persons from operating the disconnecting means unless they resort to undue force or the use of tools.

(B) Each tag shall contain a statement prohibiting unauthorized operation of the disconnecting means and removal of the tag.

(C) If a lock cannot be applied, or if the employer can demonstrate that tagging procedures will provide a level of safety equivalent to that obtained by the use of a lock, a tag may be used without a lock.

(D) A tag used without a lock, as permitted by subitem (C) of this item, shall be supplemented by at least one additional safety measure that provides a level of safety equivalent to that obtained by the use of a lock. Examples of additional safety measures include the removal of an isolating circuit element, blocking of a controlling switch, or opening of an extra disconnecting device.

(E) A lock may be placed without a tag only under the following conditions:

(I) Only one circuit or piece of equipment is deenergized; and

(II) The lockout period does not extend beyond the work shift; and

(III) Employees exposed to the hazards associated with reenergizing the circuit or equipment are familiar with this procedure.

(iv) Verification of deenergized condition. The requirements of this subsection shall be met before any circuits or equipment can be considered and worked as deenergized.

(A) A qualified person shall operate the equipment operating controls or otherwise verify that the equipment cannot be restarted.

(B) A qualified person shall use test equipment to test the circuit elements and electrical parts of equipment to which employees will be exposed and shall verify that the circuit elements and equipment parts are deenergized. The test shall also determine if any energized condition exists as a result of inadvertently induced voltage or unrelated voltage backfeed even though specific parts of the circuit have been deenergized and presumed to be safe. If the circuit to be tested is over 600 volts, nominal, the test equipment shall be checked for proper operation immediately before and immediately after this test.

(v) Reenergizing equipment. These requirements shall be met, in the order given, before circuits or equipment are reenergized, even temporarily.

(A) A qualified person shall conduct tests and visual inspections, as necessary, to verify that all tools, electrical jumpers, shorts, grounds, and other such devices have been removed, so that the circuits and equipment can be safely energized.

(B) Employees exposed to the hazards associated with reenergizing the circuit or equipment shall be warned to stay clear of circuits and equipment.

(C) Each lock and tag shall be removed by the employee who applied it or under his or her direct supervision. However, if this employee is absent from the workplace, then the lock or tag may be removed by a qualified person designated to perform this task provided that:

(I) The employer ensures that the employee who applied the lock or tag is not available at the workplace; and

(II) The employer ensures that the employee is aware that the lock or tag has been removed before he or she resumes work at that workplace.

(D) There shall be a visual determination that all employees are clear of the circuits and equipment.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-24-975, filed 7/20/94, effective 9/20/94; 91-24-017 (Order 91-07), § 296-24-975, filed 11/22/91, effective 12/24/91.]

WAC 296-24-980 Safeguards for personnel protection. (1) Use of protective equipment.

(a) Personal protective equipment.

(i) Employees working in areas where there are potential electrical hazards shall be provided with, and shall use, electrical protective equipment that is appropriate for the specific parts of the body to be protected and for the work to be performed.

Note: Personal protective equipment requirements are contained in chapter 296-24 WAC Part A-2.

(ii) Protective equipment shall be maintained in a safe, reliable condition and shall be periodically inspected or tested, as required by chapter 296-24 WAC Part A-2.

(iii) If the insulating capability of protective equipment may be subject to damage during use, the insulating material shall be protected. (For example, an outer covering of leather is sometimes used for the protection of rubber insulating material.)

(iv) Employees shall wear nonconductive head protection wherever there is a danger of head injury from electric shock or burns due to contact with exposed energized parts.

(v) Employees shall wear protective equipment for the eyes or face wherever there is danger of injury to the eyes or face from electric arcs or flashes or from flying objects resulting from electrical explosion.

(b) General protective equipment and tools.

(i) When working near exposed energized conductors or circuit parts, each employee shall use insulated tools or handling equipment if the tools or handling equipment might make contact with such conductors or parts. If the insulating capability of insulated tools or handling equipment is subject to damage, the insulating material shall be protected.

(A) Fuse handling equipment, insulated for the circuit voltage, shall be used to remove or install fuses when the fuse terminals are energized.

(B) Ropes and handlines used near exposed energized parts shall be nonconductive.

(ii) Protective shields, protective barriers, or insulating materials shall be used to protect each employee from shock, burns, or other electrically related injuries while that employee is working near exposed energized parts which might be accidentally contacted or where dangerous electric heating or arcing might occur. When normally enclosed live parts are exposed for maintenance or repair, they shall be guarded to protect unqualified persons from contact with the live parts.

(2) Alerting techniques. The following alerting techniques shall be used to warn and protect employees from hazards which could cause injury due to electric shock, burns, or failure of electric equipment parts:

(a) Safety signs and tags. Safety signs, safety symbols, or accident prevention tags shall be used where necessary to warn employees about electrical hazards which may endanger them, as required by chapter 296-24 WAC Part B-2.

(b) Barricades. Barricades shall be used in conjunction with safety signs where it is necessary to prevent or limit employee access to work areas exposing employees to unisolated energized conductors or circuit parts. Conductive barricades may not be used where they might cause an electrical contact hazard.

(c) Attendants. If signs and barricades do not provide sufficient warning and protection from electrical hazards, an attendant shall be stationed to warn and protect employees.

[Statutory Authority: Chapter 49.17 RCW, 91-24-017 (Order 91-07), § 296-24-980, filed 11/22/91, effective 12/24/91.]

WAC 296-24-985 Use of equipment. (1) Portable electric equipment. This section applies to the use of cord- and plug-connected equipment, including flexible cord sets (extension cords).

(a) Handling. Portable equipment shall be handled in a manner which will not cause damage. Flexible electric cords connected to equipment shall not be used for raising or low-

ering the equipment. Flexible cords shall not be fastened with staples or otherwise hung in such a fashion as could damage the outer jacket or insulation.

(b) Visual inspection.

(i) Portable cord- and plug-connected equipment and flexible cord sets (extension cords) shall be visually inspected before use on any shift for external defects (such as loose parts, deformed and missing pins, or damage to outer jacket or insulation) and for evidence of possible internal damage (such as pinched or crushed outer jacket). Cord- and plug-connected equipment and flexible cord sets (extension cords) which remain connected once they are put in place and are not exposed to damage need not be visually inspected until they are relocated.

(ii) If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee shall use it until repairs and tests necessary to render the equipment safe have been made.

(iii) When an attachment plug is to be connected to a receptacle (including any on a cord set), the relationship of the plug and receptacle contacts shall first be checked to ensure they are of proper mating configurations.

(c) Grounding-type equipment.

(i) A flexible cord used with grounding-type equipment shall contain an equipment grounding conductor.

(ii) Attachment plugs and receptacles shall not be connected or altered in a manner which would prevent proper continuity of the equipment grounding conductor at the point where plugs are attached to receptacles. Additionally, these devices shall not be altered to allow the grounding pole of a plug to be inserted into slots intended for connection to the current-carrying conductors.

(iii) Adapters which interrupt the continuity of the equipment grounding connection shall not be used.

(d) Conductive work locations. Portable electric equipment and flexible cords used in highly conductive work locations (such as those inundated with water or other conductive liquids), or in job locations where employees are likely to contact water or conductive liquids, shall be approved for those locations.

(e) Connecting attachment plugs.

(i) Employees' hands shall not be wet when plugging and unplugging flexible cords and cord- and plug-connected equipment, if energized equipment is involved.

(ii) Energized plug and receptacle connections shall be handled only with insulating protective equipment if the condition of the connection could provide a conducting path to the employee's hand (if, for example, a cord connector is wet from being immersed in water).

(iii) Locking-type connectors shall be properly secured after connection.

(2) Electric power and lighting circuits.

(a) Routine opening and closing of circuits. Load rated switches, circuit breakers, or other devices specifically designed as disconnecting means shall be used for the opening, reversing, or closing of circuits under load conditions. Cable connectors not of the load-break type, fuses, terminal lugs, and cable splice connections shall not be used for such purposes, except in an emergency.

(b) Reclosing circuits after protective device operation. After a circuit is deenergized by a circuit protective device, the circuit shall not be manually reenergized until it has been determined that the equipment and circuit can be safely energized. The repetitive manual reclosing of circuit breakers or reenergizing circuits through replaced fuses is prohibited.

Note: When it can be determined from the design of the circuit and the overcurrent devices involved that the automatic operation of a device was caused by an overload rather than a fault condition, no examination of the circuit or connected equipment is needed before the circuit is reenergized.

(c) Overcurrent protection modification. Overcurrent protection of circuits and conductors shall not be modified, even on a temporary basis, beyond that allowed by chapter 296-24 WAC Part L the installation safety requirements for overcurrent protection.

(3) Test instruments and equipment.

(a) Use. Only qualified persons shall perform testing work on electric circuits or equipment.

(b) Visual inspection. Test instruments and equipment and all associated test leads, cables, power cords, probes, and connectors shall be visually inspected for external defects and damage before the equipment is used. If there is a defect or evidence of damage that might expose an employee to injury, the defective or damaged item shall be removed from service, and no employee shall use it until necessary repairs and tests to render the equipment safe have been made.

(c) Rating of equipment. Test instruments and equipment and their accessories shall be rated for the circuits and equipment to which they will be connected and shall be designed for the environment in which they will be used.

(4) Occasional use of flammable or ignitable materials. Where flammable materials are present only occasionally, electric equipment capable of igniting them shall not be used, unless measures are taken to prevent hazardous conditions from developing. Such materials include, but are not limited to: Flammable gases, vapors, or liquids; combustible dust; and ignitable fibers or flyings.

Note: Electrical installation requirements for locations where flammable materials are present on a regular basis are contained in WAC 296-24-95613.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-24-985, filed 11/22/91, effective 12/24/91.]

Chapter 296-27 WAC

RECORDKEEPING AND REPORTING

WAC

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296-27-16005	Objects of inspection. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16005, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16009	Follow-up inspections. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-27-16009, filed 1/17/86; 81-14-006 (Order 81-13), § 296-27-16009, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16013	WISHA—Required investigations and inspections. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16013, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16015	WITS—In general. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16015, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16017	WITS—Safety. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16017, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16019	WITS—Safety. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16019, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16021	WITS—Safety—Limit on number of inspections. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), § 296-27-16021, filed 6/22/81.] Repealed by 87-03-011 (Order 86-48), filed 1/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-27-16023	Adjustment factors. [Statutory Authority: RCW 49.17.040 and 49.17.050. 81-14-006 (Order 81-13), §

WAC 296-27-010 Purpose and scope. The regulations of this chapter implement sections RCW 49.17.050(5), 49.17.220(1), 49.17.220(2), 49.17.230, and 49.17.260 of the Washington Industrial Safety and Health Act of 1973. These sections provide for recordkeeping and reporting by employers covered under the act as necessary or appropriate for enforcement of the act, for developing information regarding the causes and prevention of occupational accidents and illnesses, and for maintaining a program of collection, compilation, and analysis of industrial safety and health statistics.

Pursuant to the provisions of 29 CFR 1904.10, records maintained by an employer and reports submitted pursuant to, and in accordance with the requirements of an approved state plan under section 18 of the Federal Occupational Safety and Health Act of 1970 (Public Law 91-596, 84 STAT. 1590) shall be regarded as compliance with 29 CFR Part 1904 - "Recording and reporting occupational injuries and illnesses."

Compliance with and requirements of this chapter, as recognized by the Washington industrial safety and health state plan, is regarded as compliance with the provisions of the above-cited federal requirements. Employers complying with the recordkeeping and reporting requirements of this chapter are not required to keep records as required by the federal recordkeeping and reporting regulations (Ref. 29 CFR 1904.10).

The recordkeeping and reporting requirements of this chapter are separate and distinct from the record keeping and reporting requirements under Title 51 RCW (the Industrial Insurance Act) unless otherwise noted in this chapter.

[Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-010, filed 6/28/78; Order 74-22, § 296-27-010, filed 5/6/74.]

WAC 296-27-020 Definitions. (1) "Act" means the Washington Industrial Safety and Health Act of 1973, chapter 49.17 RCW, as now or hereafter amended.

(2) The definitions and interpretations included in RCW 49.17.020 shall be applicable to such terms when used in this chapter, unless a different interpretation is clearly required by the context.

(3) "Recordable occupational injuries or illnesses of employees" means any occupational injury or illness of employees which result in:

(a) Occupational fatalities, regardless of the length of time between injury and death, or the length of the illness preceding the time of death (no recording is required for fatalities occurring after a termination of employment, except when recording may otherwise be required by a specific industrial safety and health standard adopted pursuant to the act); or

(b) Lost workday cases, other than fatalities, that result in lost workdays (see subsection (7) of this section); or

(c) Occupational illnesses, or nonfatal cases without lost workdays which result in transfer to another job or termination of employment, or require medical treatment (other than first aid) or involve loss of consciousness or restriction of work or motion. This category also includes any diagnosed occupational illnesses which are reported to the employer but are not classified as fatalities or lost workday cases.

(4) "Medical treatment" means and includes treatment administered by a physician or by registered professional personnel under the standing orders of a physician. Medical treatment does not include first aid treatment even though provided by a physician or registered professional personnel.

(5) "First-aid treatment" means any one-time treatment, and any follow-up visit or visits for the purpose of observation of minor scratches, cuts, burns, splinters and so forth which do not ordinarily require professional medical care, the extent of treatment that could be expected to be given by a person trained in basic first-aid using supplies from a first-aid kit. Such one-time treatment and follow-up visit or visits for the purpose of observation are considered first aid even though provided by a physician or registered professional personnel. Tests, such as x-rays, shall not be confused with treatment.

(6) "Hospitalization" means to be sent to; to go to; or be admitted to a hospital or an equivalent medical facility and receive medical treatment beyond what would be generally classified as first-aid treatment.

(7) "Lost workdays":

(a) "Lost workdays - days away from work" means the number of days (consecutive or not) after the day of injury or illness which the employee would have worked but could not because of occupational injury or illness. The number of "lost workdays - days away from work," should not include the day of the injury, or the day the illness occurred, or any days which the employee was not scheduled to work; e.g. Saturday, Sunday, or holidays.

(b) "Lost workdays - days of restricted activity" means the number of workdays (consecutive or not) on which, because of the injury or illness:

(i) The employee was assigned to a temporary job; or

(ii) The employee worked at a permanent job less than full time; or

(iii) The employee worked at a permanently assigned job but could not perform all the duties normally assigned to that job.

The number of "lost workdays - days of restricted activity" should not include the day of the injury or the day the illness occurred, or any other days which the employee was not scheduled to work; e.g. Saturday, Sunday, or holidays, etc.

(8) "Establishment" means:

(a) A single physical location where business is conducted or where services or industrial operations are performed. (For example: A factory, mill, store, hotel, restaurant, movie theater, farm, ranch, bank, sales office, warehouse, or central administrative office.) Where distinctly separate activities are performed at a single physical location, such as contract construction activities operated from the same physical location as a lumber yard, each activity shall be treated as a separate establishment.

(b) For firms engaged in activities such as agriculture, construction, transportation, communications, electric, gas or sanitary services, which may be physically disbursed, "establishment" means a place to which employees report each day.

(c) For employees who do not primarily report or work at a single establishment, and who are generally not supervised in their daily work, such as travelling salesmen, technicians, engineers, etc., "establishment" means the location from which they are paid, or the base from which employees operate to carry out their activities.

(9) Establishments classified in standard industrial classification codes (SIC) 52 through 89.

(a) Establishments whose primary activity constitutes retail trade; finance, insurance, real estate and services are classified in SIC's 52 through 89.

(b) Retail trades are classified as SIC's 52 through 59 and for the most part include establishments engaged in selling merchandise to the general public for personal or household consumption. Some of the retail trades are: Automotive dealers, apparel and accessory stores, furniture and home furnishing stores, and eating and drinking places.

(c) Finance, insurance and real estate are classified as SIC's 60 through 67 and include establishments which are engaged in banking, credit other than banking, security dealings, insurance, and real estate.

(d) Services are classified as SIC's 70 through 89 and include establishments which provide a variety of services for individuals, businesses, government agencies, and other organizations. Some of the service industries are: Personal and business services, in addition to legal, education, social, and cultural; and membership organizations.

(e) The primary activity of an establishment is determined as follows: For finance, insurance, real estate, and services establishments, the value of receipts or revenue for services rendered by an establishment determines its primary activity. In establishments with diversified activities, the activities determined to account for the largest share of production, sales or revenue will identify the primary activity. In some instances these criteria will not adequately represent the relative economic importance of each of the varied activities. In such cases, employment or payroll should be used in place of the normal basis for determining the primary activity.

(10) "WISHERS" means Washington industrial safety and health evaluation and reporting system.

(11) "WISHA poster" means the job safety and health protection poster - form F416-081-000.

(12) "Occupational illness" means such illness as arises naturally and approximately out of employment under the provisions of the act.

Note: Examples of occupational illnesses appear on the instruction page of Form OSHA No. 200.

(13) "Occupational" means industrial and industrial means occupational.

(14) "OSHA" means occupational safety and health administration.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-27-020, filed 11/22/91, effective 12/24/91; 89-11-035 (Order 89-03), § 296-27-020, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-15-017 (Order 83-19), § 296-27-020, filed 7/13/83, effective 9/12/83. Statutory Authority: Chapters 42.30 and 43.22

RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-020, filed 6/28/78; Order 74-22, § 296-27-020, filed 5/6/74.]

WAC 296-27-030 Log and summary of occupational injuries and illnesses. (1) Except as provided in subsection (2) of this section, each employer shall:

(a) Maintain in each establishment a log and summary of all recordable occupational injuries and illnesses for that establishment; and

(b) Enter each recordable injury and illness on the log as early as practicable, but no later than six working days after receiving information that a recordable case has occurred. For this purpose Form OSHA No. 200 or an equivalent which is as readable and comprehensible to a person not familiar with it shall be used. The log and summary shall be completed in the detail provided in instructions on Form OSHA No. 200.

(2) Any employer may maintain the log and summary of all recordable occupational injuries and illnesses at a place other than the establishment or by means of data processing equipment, or both, if at each of the employer's establishments there is available a copy of the log and summary which reflects separately the injury and illness experience of that establishment complete and current to a date within forty-five calendar days.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-030, filed 7/31/79. Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-030, filed 6/28/78; Order 74-22, § 296-27-030, filed 5/6/74.]

WAC 296-27-040 Period covered by logs. Logs and summaries of occupational injuries and illnesses shall be established on a calendar year basis.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-040, filed 7/31/79; Order 74-22, § 296-27-040, filed 5/6/74.]

WAC 296-27-050 Supplementary record. In addition to the log and summary of occupational injuries and illnesses provided for under WAC 296-27-030, each employer shall have available for inspection at each establishment or other location as specified in WAC 296-27-020 within six working days after receiving information that a recordable case has occurred, a supplementary record for each occupational injury or illness for that establishment. The record shall be completed in the detail prescribed in the instructions accompanying Form OSHA No. 101. The department of labor and industries accident report Form F 242-130-000 may be used as an alternative to the Form OSHA 101. Other reports are acceptable alternative records if they contain the information required by Form OSHA No. 101. If no acceptable alternative record is maintained for other purposes, Form OSHA No. 101 shall be used for the necessary information or shall be otherwise maintained in a convenient form.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-050, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-050, filed 7/31/79. Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-050, filed 6/28/78; Order 74-22, § 296-27-050, filed 5/6/74.]

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WAC 296-27-060 Annual summary. (1) Each employer shall post an annual summary of occupational injuries and illnesses for each establishment. This summary shall consist of a copy of the year's totals from the Form OSHA No. 200 and the following information from that form: Calendar year covered, company name, establishment name, establishment address, certification signature, title, and date. A Form OSHA No. 200 shall be used in presenting the summary. If no injuries or illnesses occurred in the year, zeros must be entered on the totals line, and the form must be posted.

(2) The summary shall be completed by February 1 each calendar year.

(3) Each employer, or the officer or employee of the employer who supervises the preparation of the log and summary of occupational injuries and illnesses, shall certify that the annual summary of occupational injuries and illnesses is true and complete. The certification shall be accomplished by affixing the signature of the employer, or the officer or employer who supervises the preparation of the annual summary of occupational injuries and illnesses, at the bottom of the last page of the log and summary, or by appending a separate statement to the log and summary certifying that the summary is true and complete.

(4)(a) Each employer shall post a copy of the establishment's summary in each establishment. The summary covering the previous calendar year shall be posted no later than February 1, and shall remain in place until March 1. For employees who do not primarily report or work at a single establishment, or who do not report to any fixed establishment on a regular basis, employers shall satisfy this posting requirement by presenting or mailing a copy of the summary portion of the log and summary during the month of February of the following year to each such employee who receives pay during that month. For multi-establishment employers where operations have closed down in some establishments during the calendar year, it will not be necessary to post summaries for those establishments.

(b) A failure to post a copy of the establishment's summary, or otherwise satisfy the posting requirements as specified in this section, may result in the issuance of citations and assessments of penalties pursuant to RCW 49.17.120 and 49.17.180.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-060, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-060, filed 6/28/78; Order 74-22, § 296-27-060, filed 5/6/74.]

WAC 296-27-070 Retention of records. Records provided for in WAC 296-27-030, 296-27-050, and 296-27-060 including Form OSHA No. 200 shall be retained in each establishment for five years following the end of the year to which they relate.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-070, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-070, filed 7/31/79; Order 74-22, § 296-27-070, filed 5/6/74.]

WAC 296-27-075 Employees not in fixed establishments. Employers of employees engaged in physically dis-

persed operations, such as occur in construction, installation, repair or service activities, who do not report to any fixed establishment on a regular basis, but are subject to common supervision, may satisfy the provisions of WAC 296-27-030, 296-27-050, and 296-27-070, with respect to such employees by:

(1) Maintaining the required records for each operation, or group of operations which is subject to common supervision (field superintendent, field supervisor, etc.) in an established central place;

(2) Having the address and telephone number of the central place available at each worksite; and

(3) Having personnel available at the central place during normal business hours to provide information from the records maintained there by telephone or mail.

[Order 74-22, § 296-27-075, filed 5/6/74.]

WAC 296-27-077 Small employers. (1) An employer who had no more than ten employees at any time during the calendar year immediately preceding the current calendar year need not comply with any of the requirements of this chapter except the following:

(a) Obligation to report under WAC 296-27-090 concerning fatalities or multiple hospitalization accidents; and

(b) Obligation to maintain a log of occupational injuries and illnesses under WAC 296-27-030 and to make reports under WAC 296-27-140 upon being notified in writing by the bureau of labor statistics and the department of labor and industries that the employer has been selected to participate in a statistical survey of occupational injuries and illnesses.

[Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-077, filed 6/28/78.]

WAC 296-27-078 Private employers classified in standard industrial classification codes (SIC) 52 through 89, (except 52 through 54, 70, 75, 76, 79 and 80). A private employer whose establishment is classified in SIC's 52 through 89, (excluding 52 through 54, 70, 75, 76, 79 and 80) need not comply, for such establishment, with the record-keeping requirements of this chapter except the following:

(1) Obligation to report under WAC 296-27-090 concerning fatalities or multiple hospitalization accidents.

(2) Obligation to maintain a log of occupational injuries and illnesses under WAC 296-27-140, upon being notified in writing by the Bureau of Labor Statistics that the employer has been selected to participate in a statistical survey of occupational injuries and illnesses.

(3) The requirements of this section shall become effective January 1, 1984.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-078, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-27-078, filed 11/30/83; 83-15-017 (Order 83-19), § 296-27-078, filed 7/13/83, effective 9/12/83.]

WAC 296-27-080 Access to records. (1) Each employer shall provide upon request records provided for in WAC 296-27-030, 296-27-050, and 296-27-060, for inspection and copying by designated or authorized representatives

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of the department of labor and industries, compliance safety and health officers of the Occupational Safety and Health Administration, U.S. Department of Labor during any occupational safety and health inspection provided for under 29 CFR 1903 and section 8 of the Federal Occupational Safety and Health Act, by any representatives of the Bureau of Labor Statistics, U.S. Department of Labor, or by any representative of the Secretary of Health and Human Services during any investigation under section 20(b) of the Federal Occupational Safety and Health Act.

(2)(a) The log and summary of all recordable occupational injuries and illnesses (OSHA No. 200) (the log) provided for in WAC 296-27-030 shall, upon request, be made available by the employer to any employee, former employee, and to their representatives for examination and copying in a reasonable manner and at reasonable times. The employee, former employee, and their representatives shall have access to the log for any establishment in which the employee is or has been employed.

(b) Nothing in this section shall be deemed to preclude employees and employee representatives from collectively bargaining to obtain access to information relating to occupational injuries and illnesses in addition to the information made available under this section.

(c) Access to the log provided under this section shall pertain to all logs retained under the requirements of WAC 296-27-070.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-080, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-080, filed 7/31/79; Order 74-22, § 296-27-080, filed 5/6/74.]

WAC 296-27-090 Reporting of fatality or multiple hospitalization incidents. (1) Within eight hours after the fatality or probable fatality of any employee from a work-related incident or the inpatient hospitalization of two or more employees as a result of a work-related incident, the employer of any employees so affected, shall orally report the fatality/multiple hospitalization by telephone or in person, to the nearest office of the department or by using the OSHA toll-free central telephone number, 1-800-321-6742.

(a) This requirement applies to each such fatality or hospitalization of two or more employees which occurs within thirty days of the incident.

(b) Exception: If any employer does not learn of a reportable incident at the time it occurs and the incident would otherwise be reportable under this subsection, the employer shall make a report within eight hours of the time the incident is reported to any agent or employee of the employer.

(c) Each report required by this subsection shall relate the following information: Establishment name, location of the incident, time of the incident, number of fatalities or hospitalized employees, contact person, phone number, and a brief description of the incident.

(2) Equipment involved in an incident resulting in an immediate or probable fatality or in the in-patient hospitalization of two or more employees shall not be moved until a representative of the department of labor and industries investigates the incident and authorizes removal of such equipment.

When removal of such equipment is necessary in order to prevent further incident or to remove the victim, such equipment may be moved as required.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-27-090, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-27-090, filed 1/17/86; Order 74-22, § 296-27-090, filed 5/6/74.]

WAC 296-27-100 Falsification, failure to keep records or reports. (1) RCW 49.17.190(2) of the act provides that "whoever knowingly makes any false statement, representation, or certification in any application, record, report, plan or other document filed or required to be maintained pursuant to this chapter shall, upon conviction, be guilty of a gross misdemeanor and be punished by a fine of not more than \$10,000, or by imprisonment of not more than six months, or by both."

(2) Failure to maintain records or file reports required by this chapter, or in the detail required by the forms and instructions issued under this chapter, may result in the issuance of citations and assessment of penalties as provided for in RCW 49.17.120, 49.17.140, 49.17.180, or 49.17.190.

[Order 74-22, § 296-27-100, filed 5/6/74.]

WAC 296-27-110 Change of ownership. Where an establishment has changed ownership, the employer shall be responsible for maintaining records and filing reports only for that period of the year during which he/she owned such establishment. However, in the case of any change of ownership, the employer shall preserve those records, if any, of the prior ownership which are required to be kept under this chapter. These records shall be retained at each establishment to which they relate, for the period, or the remainder thereof, required under WAC 296-27-070.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-27-110, filed 7/20/94, effective 9/20/94; Order 74-22, § 296-27-110, filed 5/6/74.]

WAC 296-27-120 Petitions for recordkeeping exceptions. (1)(a) In order to achieve a uniform, national system for the recordkeeping and reporting of occupational injuries and illnesses, the state of Washington and the United States Department of Labor have agreed that as applied to employers as defined by subsection 3(5) of the Occupational Safety and Health Act of 1970 (Public Law 91-596, 81 STAT 1950) the state shall not grant any variances or exceptions to the record keeping and reporting regulations of this chapter, with the exception of approval of forms to serve as the substitutes for OSHA 101 and OSHA 200 (see WAC 296-27-030 and 296-27-050), without prior approval of the bureau of labor statistics.

(b) Any public employer who wishes to maintain records in a manner different from that prescribed by this chapter may submit a petition containing the information specified in subsection (5) of this section to the director, Department of Labor and Industries, P.O. Box 44000, Olympia, Washington 98504-4000.

(2) All petitions for authorization to maintain records in a manner different than that required by this chapter shall be submitted to the director or directly to the bureau of labor sta-

tistics. The director, upon receipt of a petition submitted pursuant to the provisions of subsection (3) of this section, shall immediately forward copies of same to appropriate officials of the bureau of labor statistics. Should said federal officials inform the director of their belief in the desirability or necessity of additional notice or conferences pursuant to provisions of subsection (7) of this section, the director shall provide or cause to be provided such additional notice and/or afford an opportunity for interested parties for informal conferences or hearings concerning the petition. For the purposes of this section, the occupational safety and health administration and the bureau of labor statistics shall be considered interested parties.

The bureau of labor statistics shall be afforded the opportunity to review the petition and any comments submitted in regard thereto. The director shall not grant the petition prior to a finding by the said federal agency that the alternative procedure proposed will not hamper or interfere with the purposes of the Occupational Safety and Health Act of 1970.

(3) Submission of petition. Any employer, who for good cause wishes to maintain records in a manner different from that required by this chapter, may submit a petition containing the information specified in subsection (5) of this section to the director.

(4) Opportunity for comment. Affected employees, or their representatives shall have an opportunity to submit written data, views, or arguments concerning the petition to the director within ten working days following the receipt of notice under subdivision (5)(e) of this section.

(5) Contents of petition. A petition filed under subsection (3) of this section shall include:

- (a) The name and address of the applicant;
- (b) The address of the place or places (establishment or establishments) of the employment involved;
- (c) Specifications of the reasons for seeking relief;
- (d) A description of the different recordkeeping procedures which are proposed by the applicant;
- (e) A statement that:

(i) The applicant has informed his/her affected employees of the petition by giving a copy thereof to them or to their authorized representative, posting a statement giving a summary of the petition and specifying where a copy of the petition may be obtained, at the place or places where notices to employees are normally posted, and by other appropriate means. A statement posted pursuant to these provisions shall be posted in each establishment identified in WAC 296-27-020(8).

(ii) The applicant has in the same manner informed affected employees and their representatives of their rights under subsection (3) of this section.

(6) Additional notice - conferences.

(a) In addition to the actual notice provided for in subdivision (5)(e) of this section, the director may provide, or cause to be provided, such additional notice of the petition as he/she may deem appropriate.

(b) The director may also afford an opportunity to interested parties for informational conferences or hearings concerning the petition.

(7) After review of the petition, and any comments submitted in regard thereto, and upon completion of any neces-

sary appropriate investigation concerning the petition, if the director finds that the alternative procedure proposed will not hamper or interfere with the purposes of the act, and will provide equivalent information, he/she may grant the petition subject to such conditions as he/she may determine appropriate, subject to the provisions of WAC 296-27-120(2), and subject to revocation for cause.

(8) Publication. When any relief is granted to an applicant under this chapter, notice of such relief, and the reasons therefor, may be published in the federal register.

(9) Revocation. Whenever any relief under this section is sought to be revoked for any failure to comply with the conditions thereof, an opportunity for informal hearing or conference shall be afforded to the employers and effected employees, or their representatives, and other interested parties. Except in cases of willfulness or where public safety or health requires otherwise, before the commencement of any such informal proceeding, the employer shall:

(a) Be notified in writing of the facts of conduct which may warrant the action and,

(b) Be given an opportunity to demonstrate or achieve compliance.

(10) Compliance after submission of petitions. The submission of a petition or any delay by the director in acting upon a petition shall not relieve any employer from any obligation to comply with the provisions of this chapter.

(11) The director shall honor exceptions to the provisions of 29 CFR 1904 - RECORDING AND REPORTING OCCUPATIONAL INJURIES AND ILLNESSES, granted by the bureau of labor statistics to companies having establishments in states other than Washington, when such exceptions apply to the establishments within this state.

(12) There shall be consultation between the appropriate representatives of the department, the occupational safety and health administration, and the bureau of labor statistics in order to enjoy the effective implementation of this chapter.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-120, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-120, filed 6/28/78; Order 76-29, § 296-27-120, filed 9/30/76; Order 74-22, § 296-27-120, filed 5/6/74.]

WAC 296-27-121 Additional recordkeeping requirements. The director may require that additional records and reporting be kept and done in order to achieve the purposes of the act.

[Order 76-29, § 296-27-121, filed 9/30/76.]

WAC 296-27-130 Description of statistical program. RCW 49.17.260 directs the director to develop and maintain a program of collection, compilation and analysis of occupational safety and health statistics. The program shall include periodic surveys of occupational injuries and illnesses.

[Statutory Authority: RCW 49.17.040, 49.17.150, and 49.17.240. 79-08-115 (Order 79-9), § 296-27-130, filed 7/31/79; Order 74-22, § 296-27-130, filed 5/6/74.]

WAC 296-27-140 Duties of employers—Statistical program. Upon receipt of an occupational injuries and illnesses survey form, supplied by the department of labor and

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industries in conjunction with the Bureau of Labor Statistics, the employer shall promptly complete the form in accordance with the instructions contained therein and return it in accordance with the aforesaid instructions.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-140, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-140, filed 6/28/78; Order 74-22, § 296-27-140, filed 5/6/74.]

WAC 296-27-150 Effective date of regulations. Pursuant to the finding of the director that additional time is needed to afford affected employers a reasonable opportunity to make changes in methods, means, or practices to meet the requirements of WAC 296-27-010 through 296-27-140, the effective date of these requirements shall be January 1, 1978.

[Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-27-150, filed 6/28/78; Order 74-22, § 296-27-150, filed 5/6/74.]

WAC 296-27-15501 Division of consultation and compliance, public records. Requests for inspection or copies of records and documents in the custody of the department should be made to the department's designated records officer. The department's records are maintained at 7273 Linderson Way, SW, Tumwater, WA P.O. Box 44632, Olympia, WA 98504-4632. General information can be obtained at service locations and field offices throughout the state.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-15501, filed 7/20/94, effective 9/20/94; 88-14-108 (Order 88-11), § 296-27-15501, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-27-15501, filed 1/17/86.]

WAC 296-27-15503 Special exemptions for confidential reports within the department's files. Whenever a departmental file contains an investigative report or information from a source who furnished such information under an express promise that the identity of such source would be held in confidence, such investigative report or information shall be exempt from disclosure to the extent that disclosure would reveal the identity of the source. If an investigative report can be disclosed in such a way as to conceal its source, the contents of such report may be withheld only to the extent necessary to do so. When such information is withheld, the records officer shall give a general characterization of the information withheld but not the identity of the information's source.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-11-054, § 296-27-15503, filed 5/20/97, effective 6/20/97. Statutory Authority: Chapter 49.17 RCW. 96-17-056, § 296-27-15503, filed 8/20/96, effective 10/15/96; 94-15-096 (Order 94-07), § 296-27-15503, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-27-15503, filed 1/17/86.]

WAC 296-27-15505 Accident investigation reports. Results of accident investigations and related reports are confidential and will not be freely released by the department, see RCW 49.17.260.

Accident investigation reports will be made available without the need of a court order only to the following:

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(1) Employees of governmental agencies in the performance of their official duties;

(2) The injured worker, his/her legal representative, or his/her labor organization representative;

(3) The legal representative or labor organization representative of a deceased worker, including any beneficiary of a deceased worker actually receiving benefits under the terms of Title 51 RCW, the Industrial Insurance Act. The records officer may provide accident investigation reports to the closest surviving member of the deceased worker's immediate family;

(4) The employer of any injured or deceased worker;

(5) Any other employer or person whose actions or business operations are the subject of the report or investigation; or

(6) Any attorney representing a party in any pending legal action in which an investigative report constitutes material and relevant evidence.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-27-15505, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-27-15505, filed 1/17/86.]

WAC 296-27-160 Safety and health inspections. The Washington Industrial Safety and Health Act (WISHA), chapter 49.17 RCW, authorizes the department of labor and industries (the department) to inspect work places to protect the health and safety of employees. The following sections describe the method, manner, and frequency of the department's safety and health inspections. The purposes of safety and health inspections are to:

(1) Determine if an employer is complying with WISHA safety and health standards; and

(2) Determine if an employer is furnishing a place of employment free from recognized hazards that are causing or are likely to cause death or serious physical harm to their employees.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 87-03-011 (Order 86-48), § 296-27-160, filed 1/12/87; 81-14-006 (Order 81-13), § 296-27-160, filed 6/22/81.]

WAC 296-27-16001 Definitions. For the purpose of these inspection rules:

(1) "Department" shall mean the department of labor and industries.

(2) "De minimus violation" is a violation of a standard, where such violation, has no direct relationship to safety or health.

(3) "General violation" is a violation where any accident or occupational illness resulting from such violation probably would not cause death or serious physical harm but which would have a direct or immediate relationship to the safety and health of employees.

(4) "Nonabatement violation" exists when any employer fails to correct a violation(s) for which they have been cited, by the set abatement date.

(5) "Imminent danger violation" is any violation(s) resulting from conditions or practices in any place of employment, which are such that a danger exists which could reasonably be expected to cause death or serious physical harm, immediately or before such danger can be eliminated through

the enforcement procedures otherwise provided by the Washington Industrial Safety and Health Act.

(6) "Industrial insurance experience factor" is based on a comparison of the actual incurred losses to the expected losses for the oldest three of the four fiscal years preceding the effective date of premium rates.

(a) An experience factor greater than 1.0000 indicates that an employer's actual incurred losses are greater than expected.

(b) An experience factor of less than 1.0000 indicates that an employer's actual incurred losses are less than expected.

(c) New firms and some firms qualifying for transition rating adjustments are assigned a base experience factor of 1.0000. Self-insured employers will be assigned a modification factor of less than 1.0000.

(7) "Industry" shall mean a group of businesses classified by standard industrial classification (SIC) code according to the type of activity in which they are engaged.

(8) "Investigative report" as used in RCW 49.17.260 shall include any memorandum, document, or report prepared by a departmental employee pertaining to an investigation or inspection performed pursuant to the Washington Industrial Safety and Health Act. However, investigative reports do not include the identity or any information that would reveal the identity of a confidential source who furnished information to the department under an express promise that the identity of such source would be held in confidence.

(9) "Repeat violation" includes any violation of a standard or order when a violation has previously been cited to the same employer when it identifies the same type of hazard.

(10) "Serious violation" shall be deemed to exist in a workplace if there is a substantial probability that death or serious physical harm could result from a condition which exists, or from one or more practices, means, methods, operations, or processes which have been adopted or are in use in such workplace, unless the employer did not, and could not with the exercise of reasonable diligence, know of the presence of the violation.

(11) "Willful violation" is one involving a voluntary action, done either with an intentional disregard of, or plain indifference to, the requirements of the applicable Washington Administrative Code (WAC) rule(s).

Note: When management has knowledge that resistance to a specific WAC rule or rules exists within its work force, which results in a serious or imminent danger violation, and management fails to institute efforts to overcome that resistance, which are effective in practice, there shall be a rebuttable presumption that such failure constitutes voluntary action. This presumption may be rebutted by the employer's demonstration of good faith efforts to overcome resistance to the specific WAC rule or rules.

(12) "WISHA" shall mean the Washington Industrial Safety and Health Act.

(13) "Working hours" shall mean those times that an employer assigns an employee or employees to work at the work place.

(14) "Work place," "work site," and "job site" may be used interchangeably in the text of this chapter and shall mean any plant, yard, premises, room, or other place where

an employee or employees are employed for the performance of labor or service over which the employer has the right of access or control. Work place shall include temporary labor camps.

[Statutory Authority: Chapter 49.17 RCW, 96-17-056, § 296-27-16001, filed 8/20/96, effective 10/15/96; 91-24-017 (Order 91-07), § 296-27-16001, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16001, filed 1/12/87; 81-14-006 (Order 81-13), § 296-27-16001, filed 6/22/81.]

WAC 296-27-16002 Inspection hours. An inspection shall be made during the normal working hours of the work place being inspected, unless:

- (1) The inspection is of a fatality;
- (2) The inspection is of a catastrophe;
- (3) The inspection is of a complaint alleging imminent danger;
- (4) The inspector needs to remain at the work place outside of working hours to ensure that the inspection is effective.

Note: RCW 49.17.190(1) prohibits an employer from receiving advance notice of an inspection, except as authorized by the director or an authorized representative.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16002, filed 1/12/87.]

WAC 296-27-16003 Inspection format. (1) Upon arrival, the inspector shall present credentials to the highest available management official or designated company representative at the work place and explain the nature and purpose of the visit.

(a) The inspector may sign a visitors' register, plant pass or other book or form used to control the entry and movement of persons.

(b) If a governmental security clearance is required for entry, the inspector shall obtain it before the inspection.

(2) Before beginning an inspection, the inspector should conduct a joint opening conference with the employer and employee representatives.

(a) The employee representative is the employee designated by the union, safety committee, or employees to accompany the inspector during the inspection.

(b) If the inspector determines that an employee representative is not available at the work place, separate conferences with the employer and employee representatives may be held.

(3) A representative of the employer and a representative authorized by the employees shall have the opportunity to accompany the inspector during the inspection.

(4) During the inspection, the inspector may interview in private any employee who wants to discuss a possible violation.

(a) If the inspector determines that an interview would unduly hinder an employer's operations the inspector will interview the employee during a break or after working hours.

(b) To determine whether an interview would unduly hinder an employer's operations, the inspector may consider such factors as:

(i) The time the employee would spend away from the work station;

(ii) The effects on other workers;

(iii) The effect on the work process.

(5) If the inspector receives a complaint during an inspection, the alleged violation will be investigated during the inspection.

(6) The inspector may photograph a violation, take samples, conduct tests, use sampling devices worn by employees, and employ other reasonable investigative techniques. A technique shall not be used if it reasonably could be believed to cause a hazard.

(7) The inspector shall determine that the employer has posted the WISHA notice informing employees of their rights and obligations.

(8) Inspectors should examine the log and summary of recordable occupational injuries and illnesses, supplementary records of occupational injuries and illnesses, records of employee exposure to toxic chemicals and harmful physical agents, and other records relating to employee safety and health.

(9) An employer may correct violations during the inspection.

(10) A violation remains the basis for a citation and a penalty, if warranted, whether it is corrected immediately or at a later date.

(11) The inspector will record the conditions and corrections to help judge the employer's good faith and cooperation.

(12) At the end of the inspection, the inspector will conduct a joint closing conference with the employer and employee representatives. If it is impractical to hold a joint conference or at the request of the employer or employee representative, separate conferences will be held.

(13) Complaints.

(a) Complaints shall be reduced to writing or typing on complaint forms prior to the inspections.

(b) A copy of the complaint shall be provided to the employer at the time of inspection.

(c) The complainants name shall not appear on the employer's copy or on any record published, released, or made available without written and signed authorization by the complainant.

(14) The inspector and all concerned employees of the department shall preserve the confidentiality of trade secrets.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16003, filed 1/12/87; 81-14-006 (Order 81-13), § 296-27-16003, filed 6/22/81.]

WAC 296-27-16004 Interprogram referrals. (1) A safety inspector observing potential health hazards that indicate an industrial hygiene inspection is necessary, will report the hazards and request a health inspection.

(2) A health inspector observing potential safety hazards that indicate a safety inspection is necessary, will report the hazards and request a safety inspection.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16004, filed 1/12/87.]

WAC 296-27-16007 Citations, penalty assessments and notices of violations. (1) The inspector shall record the violations observed on a compliance worksheet.

(2) The compliance worksheet, the photographs, and sample tests, will be used to prepare:

- (a) A citation; and
- (b) A proposed penalty assessment; and
- (c) A notice of violation.

(3) The citation and the proposed penalty assessment will be sent to the employer. The citation and notice will set an abatement date for each violation. This is the date by which the employer must correct the violation.

(4) The inspector may give a notice of violation at the end of inspection with the employers consent instead of the department issuing a citation and notice. The notice of violation sets short abatement dates and is issued only for general violations and contains no penalties. The notice of violation, shall be given to the highest available management official or designated company representative at the work place or sent to the employer.

(5) For a period of three years following the issuance of a final order which cites any violation of a safety standard, order of RCW 49.17.060, the department may issue a citation for a repeat violation. A repeat violation may incur a penalty based solely upon the repeat nature of the violation, without regard to the seriousness of the hazard being cited.

[Statutory Authority: Chapter 49.17 RCW, 91-24-017 (Order 91-07), § 296-27-16007, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16007, filed 1/12/87; 81-14-006 (Order 81-13), § 296-27-16007, filed 6/22/81.]

WAC 296-27-16011 Refusal or limitation of inspection. When the employer:

(1) Refuses to permit an inspection:

(a) The inspector will attempt to ascertain the reason(s) for refusal and report to their immediate supervisor.

(b) The department may seek an inspection warrant or other compulsory process from a court to gain entrance.

(i) If refusal to permit an inspection is anticipated, the department may seek a warrant prior to the inspection.

(ii) The department will not seek an inspection warrant in response to a complaint unless:

(A) The complaint is written and signed by a complainant; or,

(B) The complainant alleges a hazard which could cause serious injury or death.

(2) Permits an inspection but interferes with, or limits the process:

(a) The inspector will attempt to ascertain the reason for interference or limitation, report to their immediate supervisor, and will:

(i) End the inspection;

(ii) Continue the inspection noting areas of interferences or limitations.

(b) The department may seek an inspection warrant or other compulsory process from a court to revisit the areas where interference or limitation occurred. The department will not seek an inspection warrant in response to a complaint unless:

(i) The complaint is written and signed by a complainant;

(ii) The complaint alleges imminent danger to the safety or health of an individual.

[Title 296 WAC—p. 940]

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16011, filed 1/12/87; 83-24-013 (Order 83-34), § 296-27-16011, filed 11/30/83; 81-14-006 (Order 81-13), § 296-27-16011, filed 6/22/81.]

WAC 296-27-16018 Compliance inspections. (1) Inspection types.

(a) Unprogrammed. Inspections are in response to suspected or alleged hazardous working conditions at a specific work site. This type of inspection addresses:

- (i) Imminent danger;
- (ii) Fatalities;
- (iii) Catastrophies;
- (iv) Complaints;
- (v) Referrals;
- (vi) Follow-up inspections;
- (vii) "High hazard" industries.

(b) Programmed. Programmed inspections are inspections of worksites which have been selected based upon objective criteria. The worksites are selected and scheduled according to state-wide scheduling plans for:

- (i) Safety compliance;
- (ii) Health compliance;
- (iii) Compliance special-emphasis programs.

(2) Inspection scope. Unprogrammed and programmed inspections may be:

(a) Comprehensive inspection. This category includes a complete walkaround inspection of the entire establishment.

(b) Partial. This category includes any inspection in which the walkaround is limited to specific areas, operations or conditions within the establishment but does not include all potentially hazardous areas of the establishment.

(3) Inspection priorities. The priority of inspections and assignment of resources within the inspection classifications shall be as follows:

- (a) Imminent danger including complaints or referrals which allege imminent danger;
- (b) Fatalities or catastrophies;
- (c) Complaints not alleging imminent danger or referrals;
- (d) "High hazard" industries;
- (e) Programmed inspections.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16018, filed 1/12/87.]

WAC 296-27-16020 Inspection selection, scheduling criteria, and limit on number of inspections. (1) Inspection selection criteria.

(a) WISHA's priority system for inspection scheduling is intended to distribute available resources as efficiently as possible to ensure that the maximum protection is effectively provided to the working men and women of this state.

(b) The assistant director of the consultation and compliance division shall ensure that inspections are scheduled within the framework of this chapter and are consistent with the objectives of chapter 49.17 RCW, the Washington Industrial Safety and Health Act of 1973, as currently amended, or as amended in the future.

(c) The assistant director shall not permit more than two scheduled comprehensive inspections at the same fixed site

location of an individual employer within any period of twelve consecutive months.

(2) Employer contacts. Employer requests for information or voluntary compliance services will not initiate compliance inspection.

(a) Such employer requests shall not protect the establishment from compliance inspections conducted pursuant to the guidelines established by this chapter.

(b) If an employer or their representative indicates that an imminent danger exists or that a fatality or catastrophe has occurred, the assistant director shall ensure that action is taken in accordance with the inspection priority procedures established by this chapter.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-27-16020, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16020, filed 1/12/87.]

WAC 296-27-16022 Unprogrammed inspections, follow-up inspections, monitoring inspections, and "high hazard" inspections. (1) Unprogrammed inspections. Inspections conducted in response to evidence of hazardous conditions at a worksite are considered unprogrammed inspections. Unprogrammed inspections (excluding follow-ups) shall normally be scheduled according to the following priorities:

(a) Reports of alleged imminent danger situations from any source including referrals and complaints regardless of formality;

(b) Fatalities/catastrophes;

(c) Complaints;

(d) "High hazard" industries.

(2) "High hazard" industry. The following industries which have nonfixed worksites are all considered to be "high hazard": Construction, logging, maritime, and electrical utilities and communications.

(a) The "high hazard" industries require a distinctly different method of inspection scheduling, not only because of their nonfixed worksites but also because the work being performed is almost always inherently dangerous and because the worksite character, conditions and work functions are dynamically and frequently changing.

(b) Inspections within the "high hazard" industries will be conducted throughout the year, whenever such work activity becomes known to the department. Within the limits of WISHA jurisdiction, inspections will be conducted without regard to the size or scope of the activity of the employer being inspected.

(3) Follow-up inspections. The seriousness of the original hazards or conditions requiring action shall be considered in assigning a priority to follow-up inspections. Follow-up inspections normally shall be conducted within ten days following the abatement date and shall take priority over programmed inspections.

(a) Follow-up inspections shall be conducted in the following situations:

(i) Willful citations;

(ii) Citations related to an imminent danger situation;

(iii) Whenever an employer fails to respond to a request for notification of compliance action by letter or other means; and

(iv) Whenever the assistant director or designee believes that circumstances indicate the need for a follow-up inspection.

(b) Follow-up inspections shall be deemed optional if the following circumstances exist:

(i) When the inspecting compliance officer has observed and documented that abatement has been achieved before completing the inspection and leaving the premises;

(ii) When the employer or a knowledgeable source such as the complainant or referring party submits in writing that compliance has been achieved.

(4) Monitoring inspections. A monitoring inspection may be conducted for any reason including:

(a) An employer's request for a variance; or

(b) An employer's request for an extension of an abatement date.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16022, filed 1/12/87.]

WAC 296-27-16026 Programmed inspections. A programmed inspection generally is a comprehensive inspection of the worksite but may be a partial inspection if required by resource availability or other enforcement priorities. A programmed inspection shall be scheduled pursuant to one of the following general scheduling systems unless the establishment is within a "high hazard" industry.

(1) General scheduling system. The state-wide general scheduling system is not specific to any individual industry. Both safety and health general scheduling systems include the following factors:

(a) An objective criteria which includes but is not limited to one or more of the following:

(i) Available data concerning injuries or illnesses which could be reduced by an inspection which eliminates the hazards;

(ii) The industrial insurance modification factor of a particular business establishment;

(iii) The number or type of contaminants present at a worksite as well as the relative toxicity of those contaminants;

(iv) The degree of exposure to hazards;

(v) The number of employees exposed.

(b) A random selection process which utilizes a computer program to ensure statistical randomness;

(c) A regular evaluation and review including:

(i) A yearly analytical review comparing the current program with the objective criteria;

(ii) An annual comparison between compiled inspection results and reported injuries or illnesses.

(d) A general scheduling system programmed for no more than a twelve-month operating cycle with a maximum permissible extension of no more than one month before appropriate adjustments are implemented.

(2) Special emphasis targeting system. A special emphasis targeting system is a regional and/or industry-specific system which will be based on either one of the following:

(a) Scheduling system which includes:

- (i) An objective criteria;
- (ii) A random selection process;
- (iii) An evaluation and review; or
- (iv) An operating cycle.

(b) A scheduling program required of state plan states by the Federal Occupational Safety and Health Administration.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 87-03-011 (Order 86-48), § 296-27-16026, filed 1/12/87.]

WAC 296-27-210 Abatement verification.

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-210, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21001 What is the purpose of this rule?

Among other purposes, our inspections are expected to result in the elimination of violations under the Washington Industrial Safety and Health Act (WISHA), chapter 49.17 RCW. This section describes how we will make sure that cited violations have been abated. It also describes your obligations as an employer to certify abatement and, in some cases, to provide additional documentation.

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21001, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21005 When does this rule apply? The

provisions of WAC 296-27-210 through 296-27-21045 apply to you if we cite you for a WISHA violation.

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21005, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21010 What definitions apply to this rule? Abatement means correcting the cited violation.

Abatement date means the date by which you must correct a violation. It is established by any final order or by an extension of abatement date(s), granting additional time to correct the violation. However, the abatement date established as a result of an order of the board of industrial insurance appeals remains in effect during any appeal to a court unless the court specifically orders the date to be stayed.

Affected employees means those employees who are exposed to the hazard(s) identified as violation(s) in a citation.

Certification means your written statement describing when and how abatement was achieved.

Department means those portions of the department of labor and industries responsible for enforcing the Washington Industrial Safety Act (WISHA). When this rule refers to "we" or "us," it means the department.

Documentation means material you submit that shows that abatement is complete. This includes, but is not limited to, photographs, receipts for materials and/or labor.

Employer means a business entity having one or more employees. Also, any person, partnership, or business entities with no employees but having industrial insurance coverage is both an employer and an employee. When this rule refers to "you," it means the employer or a designated representative.

Final order means any of the following documents unless you or another party files a timely appeal:

- A citation and notice;

- A corrective notice of redetermination;
- A decision and order from the board of industrial insurance appeals;
- A denial of petition for review from the board of industrial insurance appeals; or
- A decision from a Washington state superior court, court of appeals, or the state supreme court.

Final order date means the issue date of a final order.

Movable equipment means a hand-held or nonhand-held machine or device, powered or unpowered, that can be moved within or between worksites.

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21010, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21015 What must an employer do when

asked to abate a violation? (1) Within ten calendar days after the abatement date, you must certify to us that each violation has been abated. **Exception:** You do not need to certify abatement if our compliance officer indicates in the citation that he or she observed abatement.

(2) Your certification that abatement is complete must include the following:

- Your name and address;
- The inspection number to which your certification applies;
- The citation and item numbers to which your certification applies;
- The date and method of abatement of each violation;
- A statement that affected employees and their representatives have been informed of the abatement of each violation;
- A statement that the information submitted is accurate; and
- Your signature (or that of your authorized representative).

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21015, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21020 When must an employer submit

additional documentation of abatement? For each willful or repeat violation, you must submit to us additional documentation demonstrating that abatement is complete. You must also submit this documentation for any serious violation when we require you to do so in the citation. Such documentation may include, but is not limited to, evidence of the purchase or repair of equipment, photographic or video evidence of abatement, or other written records.

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21020, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21025 When must an employer provide

abatement plans? (1) When the time permitted for abatement is more than ninety calendar days, we may require you to submit an abatement plan for each cited violation other than general violations. If we require an abatement plan, the citation must say so.

(2) When the citation indicates that an abatement plan is required, you must submit the plan within twenty-five calendar days from the final order date.

(3) Your abatement plan must:

- Identify the violation;
- List the steps you will take to correct the violation;

- Include a schedule to complete the steps; and
- Describe how employees will be protected until abatement is complete.

(4) If we find your plan inadequate, we must inform you in writing and indicate how your plan is inadequate.

[Statutory Authority: RCW 49.17.040. 99-02-019, § 296-27-21025, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21030 When must an employer submit progress reports? (1) If you are required to submit an abatement plan, we may also require you to submit periodic progress reports for each cited violation. Our citation will include:

- The citation items for which periodic progress reports are required;
- The date on which an initial progress report must be submitted (no sooner than thirty calendar days after you submit an abatement plan);
- Whether additional progress reports are required; and
- The date(s) on which you must submit any additional progress reports.

(2) For each violation, your progress report must briefly identify the action taken to achieve abatement and the date the action was taken. A single sentence should normally be adequate for each violation.

[Statutory Authority: RCW 49.17.040. 99-02-019, § 296-27-21030, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21035 What must an employer do to keep employees informed about abatement activities? (1) You must inform affected employees and their representative(s) about abatement activities covered by this section by posting a copy of each document you submit to us or a summary of the document near the place where the violation occurred.

(2) Where such posting does not effectively inform employees and their representatives about abatement activities (for example, if you have mobile work operations), you must:

- Post each document or a summary of the document in a location where it will be readily observable by affected employees and their representatives; or
- Take other steps to communicate fully to affected employees and their representatives about abatement activities.

(3) You must inform employees and their representatives of their right to examine and copy all abatement documents submitted to the department.

(4) You must comply with any request by an employee or employee representative to examine and copy abatement documents within five days of receiving the request, if the employee or employee representative makes the request within three working days of receiving notice that the documents have been submitted to us.

(5) You must ensure that notice to employees and employee representatives is provided on or before the date you provide the information to us.

(6) You must ensure that these abatement documents remain posted for at least three working days after you submit them to us and that they are not altered, defaced, or covered by other material.

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[Statutory Authority: RCW 49.17.040. 99-02-019, § 296-27-21035, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21040 How will the department determine the date that documents are submitted? The date of postmark is the date of submission for documents you send by mail. For documents you transmit by other means, the date we receive the document is the date of submission.

[Statutory Authority: RCW 49.17.040. 99-02-019, § 296-27-21040, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21045 What are the requirements related to movable equipment? (1) For serious, repeat, and willful violations involving movable equipment, you must attach a warning tag or a copy of the citation to the operating controls or to the cited component of equipment if the violation has not already been abated. You must do this for hand-held equipment immediately after you receive the citation, and you must do this for other equipment before moving it within the worksite or between worksites.

(2) You must use a warning tag that properly warns employees about the nature of the violation involving the equipment and that tells them where the citation is posted. Nonmandatory Appendix A contains a sample tag that you may use to meet this requirement.

(3) For the construction industry, a tag designed and used in accordance with WAC 296-155-300(8) and 296-24-14011 meets the requirements of this section when the information required by subsection (2) of this section is included on the tag.

(4) You must make sure that the tag or copy of the citation attached to movable equipment is not altered, defaced, or covered by other material.

(5) You must make sure that the tag or copy of the citation attached to movable equipment remains attached until:

- You have abated the violation and you have submitted all abatement verification documents required by this regulation to us;
- You have permanently removed the cited equipment from service;
- You no longer have control over the cited equipment; or
- A final order vacates the violation.

[Statutory Authority: RCW 49.17.040. 99-02-019, § 296-27-21045, filed 12/29/98, effective 7/1/99.]

WAC 296-27-21050 Appendix A (Nonmandatory). What can a warning tag for movable equipment involved in serious, repeat, or willful violations look like? You may use a warning tag similar to the sample shown below. You must make sure the warning tag meets the requirements of and is used in accordance with the requirements of WAC 296-27-21045.

[Title 296 WAC—p. 943]

○

WARNING:

**EQUIPMENT HAZARD
CITED BY L & I**

EQUIPMENT CITED:

HAZARD CITED:

**FOR DETAILED INFORMATION
SEE L & I CITATION POSTED AT:**

BACKGROUND COLOR—ORANGE
MESSAGE COLOR—BLACK

[Statutory Authority: RCW 49.17.040, 99-02-019, § 296-27-21050, filed 12/29/98, effective 7/1/99.]

**Chapter 296-28 WAC
CLEARANCE RULES—RAILROADS IN PRIVATE
YARDS AND PLANTS**

WAC

296-28-001	Foreword.
296-28-005	Beginning of order.
296-28-010	Exemptions.
296-28-015	Definitions.
296-28-020	Overhead clearances.
296-28-025	Side clearances.
296-28-030	Track clearances.
296-28-035	Marking of cars.
296-28-040	Operation of excess dimension loads.
296-28-045	Narrow gauge railroads transporting freight cars.
296-28-050	Illustrations.

WAC 296-28-001 Foreword. These clearance rules and regulations for common carrier railroads are issued under and by the authority of RCW 81.44.010. Formerly, certain portions of these rules were by law administered by the department of labor and industries. In 1955 jurisdiction over matters treated by these rules was placed in the Washington public service commission (now the Washington utilities and transportation commission) (RCW 43.53.055).

These rules and regulations are intended to prevent accidents which may result in either damage of equipment or injury to human beings. They are intended to protect the railroads and their employees and the general public.

[Foreword, filed 4/3/61.]

WAC 296-28-005 Beginning of order. (1) Hearing was originally held in this cause at Seattle, Washington, on the 7th

[Title 296 WAC—p. 944]

day of September, 1950, pursuant to notice duly given before representatives of both the Washington public service commission and the department of labor and industries.

(2) At the time of the original hearing the Washington public service commission was vested by law with jurisdiction over the safety of railroad passengers, while jurisdiction over the safety of railroad employees was in the department of labor and industries. In 1955, as stated in the foreword, jurisdiction over the safety of railroad employees was also placed in the Washington public service commission.

(3) In order to bring the clearance rules up to date and to delete the various references to the department of labor and industries so that confusion may be avoided, these amended rules are being published.

(4) All interested parties were represented at the original hearing and their appearances are listed in our original order in this cause dated and effective December 1, 1950.

(5) In pursuance of its rule-making power, the Washington public service commission hereby determines as follows:

(a) It is ordered that subsequent to December 1, 1950, in all construction and reconstruction of tracks or structures adjacent thereto, on all railroads over which freight cars are transported or proposed to be transported, the following minimum clearances shall be allowed.

(b) It is further ordered that a railroad company shall not operate freight cars, locomotives or other rolling equipment over tracks constructed subsequent to December 1, 1950, or tracks adjacent to buildings and structures constructed or reconstructed subsequent to that date, wherein the clearances are less than those prescribed in this order.

(c) It is further ordered that where specific authority has been issued for deviation from these clearances for construction occurring subsequent to December 1, 1950, but prior to the effective date of this order, authority so issued shall remain in effect.

(6) Overhead clearances authorized in this order are applicable to tracks on which freight cars having a height to running board of fifteen feet six inches or less are transported. In the case of cars or loads exceeding fifteen feet six inches, WAC 296-28-035 and 296-28-040 must be complied with.

(7) Side clearances authorized in this order are applicable to tracks on which freight cars having an overall width not greater than ten feet ten inches are transported. In the case of cars or loads exceeding ten feet ten inches, WAC 296-28-035 and 296-28-040 must be complied with.

[Opening paragraphs, filed 4/3/61.]

Reviser's note: As stated above, the control of safety of railroad employees is vested in the Washington public service commission (now the Washington utilities and transportation commission). However, many non-railroad enterprises have railroad tracks and some railroad equipment. To safeguard employees of these enterprises, the department of labor and industries adopted the same railroad clearance rules enacted by the public service commission and filed the same with the code reviser's office. The filing date appears in the bracketed history note at the end of each section.

WAC 296-28-010 Exemptions. (1) When the overhead or side clearances between a track and any building, structure or facility are less than the minimum prescribed in this order, but where lawfully created prior to the effective date thereof,

the minimum clearances prescribed herein shall be provided whenever the building, structure or facility is relocated or reconstructed; however, the public service commission will consider specific requests for the future continuance of heretofore lawful clearances at such reconstructed building, structure or facility when application thereof has been made as provided in subsection (3) of this section.

(2) Where restricted clearances are necessary nothing herein shall be construed as preventing the movement of material over tracks when such material is necessary in the construction or maintenance of such tracks, nor in the movement of special work equipment used in the construction, maintenance or operation of the railroad, provided such movements shall be carried on under the conditions as are necessary to provide for the safety of all concerned; nor shall these rules be applicable, provided reasonable safety precautions are observed, during periods of actual emergency due to wrecks, derailments, washouts and like conditions.

(3) If in any particular case, exemption from any of the requirements herein is deemed necessary by the carrier concerned, the public service commission will consider the application of such carrier for such exemption when accompanied by a full statement of the conditions existing and the reason why such exemption is asked. Any exemption so granted will be limited to the particular case covered by the application.

(4) The public service commission reserves the right to modify any of the provisions of these regulations in specific cases, when, in its opinion, safety of railroad employees, public safety, convenience or necessity would be served by so doing.

(5) Logging railroads, or any operation directly incident to logging, now subject to the provisions of the safety standards for logging operations, published by the division of safety of the department of labor and industries of the state of Washington, are exempted from this order.

[Exemptions section, filed 4/3/61.]

WAC 296-28-015 Definitions. (1) The overhead clearance is that distance measured along a line which is perpendicular to and joins a horizontal plane passing through the top of the highest rail and the lowest point of the overhead structure or obstruction.

(2) The side clearance is the shortest distance from centerline of track to a structure or obstruction at the side of the track.

(3) The track clearance is the shortest distance between the centerlines of adjacent tracks.

(4) Height of a freight car is the distance between the top of rail and the top of running board.

(5) Width of a freight car is twice the distance from the centerline of the car to the extreme outside part thereof.

(6) Icing platforms: The term "icing platform" shall include structures used in performing the service of icing, precooling, heating, ventilating and servicing of cars used in the handling of commodities requiring the above services.

(7) Constituted authority shall mean the public service commission.

(8) Undercrossing when used in this order means any point or place where a highway crosses a railroad by passing

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above the same. Clearances shall be as specified in WAC 296-28-020 (1) and (3).

(9) Undercrossing when used in this order means any point or place where a highway crosses a railroad by passing under the same. Existing laws pertaining to highways shall prevail.

[Section 1, filed 4/3/61.]

WAC 296-28-020 Overhead clearances.

- (1) Overhead clearance in general 22' 6"
- (2) Overhead clearance in buildings 18' 0"

The overhead clearance inside of entirely enclosed buildings may be reduced to eighteen feet, provided that this clearance shall apply only to tracks terminating within the building, and further provided, that when an overhead clearance of less than twenty-two feet six inches is established therein, all cars, locomotives or other equipment shall be brought to a stop before entering such enclosed building, the conditions provided to require such stop to be approved by constituted authority.

Note: Engine houses and car shops are exempt from these regulations.

(3) Overhead clearance in tunnels and bridges.

Minimum overhead clearance in tunnels and through bridges may be decreased to the extent defined by the half-circumference of a circle having a radius of eight feet and tangent to a horizontal line twenty-two feet six inches above top of rail at a point directly above the centerline of track.

(4) Overhead clearance - all other structures.

Minimum overhead clearance as prescribed in subsection (1) above may be decreased to the extent defined by the half-circumference of a circle having a radius of eight feet six inches and tangent to a horizontal line twenty-two feet six inches above top of rail at a point directly over the centerline of track.

(5) Overhead clearance of wires.

All wires in general shall have a minimum vertical clearance of not less than that specified by the safety rules for the installation and maintenance by electric supply and communication lines as provided by the rules for electrical construction and the electrical and communication workers safety rules of the state of Washington.

[Section 2, filed 4/3/61.]

WAC 296-28-025 Side clearances.

- (1) Side clearance in general 8' 6"

Note: To further reduce operational hazards, it is recommended that, wherever practicable, all posts, pipes, warning signs and other small obstructions be given a side clearance of ten feet.

(2) Side clearance at platforms:

- (a) Platforms—8" or less above top of rail 4' 8"
- (b) Platforms—4' 0" or less above top of rails 5' 9"
- (c) Platforms—4' 6" or less above top of rail—

when used principally for loading or unloading refrigerator cars 8' 0"

- (d) Icing platforms and supports 5' 9"

- (e) Platforms—Other than above 8' 6"

Note: Retractable platforms, either sliding or hinged, which are attached to a permanent structure shall be so designed that when not in use no part of such retractable platform shall fall within the clearance limits herein prescribed for a platform of that height above the top of the rail.

(f) Platforms—Combinations of any above.

Note: Platforms defined under subsection (2)(a) above may be combined with either subsection (2)(c) or subsection (2)(b) provided that the lower platform presents a level surface from a point not more than four feet eight inches from centerline of track to the face of the wall of the platform with which it is combined. No other combinations will be permitted.

(g) Platforms—Extension of existing platforms.

Note: Platforms which were constructed at lawful clearances prior to the effective date of this order may be extended at existing clearances upon approval of constituted authority.

(3) Side clearance—Bridges and tunnels 8' 0"

(4) Bridges and tunnels—Upper section (see WAC 296-28-020(3))

Side clearance in through bridges and tunnels may be decreased to the extent defined by the half circumference of a circle having a radius of eight feet and tangent to a horizontal line twenty-two feet six inches above top of rail directly above centerline of track.

(5) Bridges—Lower section and structures 4' high or less.

Through bridges supporting track affected, hand rails, water barrels and refuge platforms on bridges and trestles, water columns, oil columns, block signals, cattle guards and cattle chutes, or portions thereof, four feet or less above top of rail may have clearances decreased to the extent defined by a line extending diagonally upward from a point level with the top of rail and five feet distant laterally from centerline of track to a point four feet above top of rail and eight feet distant laterally from centerline of track: *Provided*, That the minimum clearance for hand rails and water barrels shall be seven feet six inches and the minimum clearance for fences of cattle guards shall be six feet nine inches.

Note: Unless previously approved, the clearances authorized in this subsection, except as provided for hand rails and water barrels, are not permitted on through bridges where the work of trainmen or yardmen requires them to be upon the decks of such bridges for the purpose of coupling or uncoupling cars in the performance of switching service on a switching lead.

(6) Side clearance—Cattle guards and cattle chutes. (See subsection (5) above.)

(7) Side clearance—Engine house and car repair shop doors. 7' 6"

(8) Side clearance—Hand rails on bridges and trestles (see subsection (5)).

(9) Side clearance—Interlocking mechanism, switch boxes, etc. 3' 0"

Switch boxes, switch operating mechanism necessary for the control and operation of signals and interlockers projecting four inches or less above top of rail.

(10) Side clearance—Mail cranes and train order stands when not in operative position. 8' 6"

(11) Side clearance—Oil columns (see subsection (5)). 8' 0"

(12) Side clearance—Poles supporting trolley contact. 8' 3"

Conductors supplying motive power to track affected—of bracket construction.

(13) Side clearance—Poles other than trolley poles. 8' 6"

(14) Side clearance—Signals and switch stands 3' high or less when located between tracks where not practicable to provide clearances otherwise prescribed in this order 6' 0"

(15) Side clearance—Signals and switch stands other than above 8' 0"

(16) Side clearance—Tunnels (see subsection (4)). 8' 0"

(17) Side clearance—Water barrels on bridges (see subsection (5)).

(18) Side clearance—Water columns (see subsection (5)). 8' 0"

(19) Side clearances on curved track.

Note: Side clearances on all structures adjacent to curved track shall be increased as necessary to give the equivalent of tangent track clearances.

(20) Side clearances—Material or merchandise adjacent to tracks. 8' 6"

Note: No merchandise, material or other articles shall be placed or stored on ground or platforms adjacent to any track at a distance less than eight feet six inches from the centerline of track, except in cases of maintenance or emergency when such material is to be used within a reasonable period of time or where local conditions make compliance with this note impossible.

[Section 3, filed 4/3/61.]

WAC 296-28-030 Track clearances.

(1) Track clearances—In general 14' 0"

The minimum distance between the centerlines of parallel standard gauge railroad tracks, which are used or proposed to be used for transporting cars, engines, motors or like equipment, shall be fourteen feet, except as hereinafter prescribed.

(2) Track clearances—Main and subsidiary tracks 15' 10"

The centerline of any standard gauge track, except a main track or a passing track, parallel and adjacent to a main track or a passing track, shall be at least fifteen feet from the centerline of such main track or passing track: *Provided, however*, That where a passing track is adjacent to and at least fifteen feet distant from the main track, any other track may be constructed adjacent to such passing track with clearance prescribed in subsection (1) above.

(3) Track clearances—Parallel team, house or industry tracks. 13' 0"

Minimum clearances between centerlines of parallel team, house or industry tracks shall be thirteen feet.

(4) Track clearances—Parallel ladder or ladder and other track 20' 0"

The centerline of any standard gauge ladder track, constructed parallel to any other track, shall have a clearance of not less than twenty feet from the centerline of such other track.

(5) Track clearances—Existing tracks

Note: Existing tracks may be extended at clearances lawfully prescribed prior to the effective date of this order.

[Section 4, filed 4/3/61.]

WAC 296-28-035 Marking of cars. (1) Cars exceeding 15' 6" in height.

Each car of a height exceeding fifteen feet six inches from top of rail to top of running board, the movement of which is hereby authorized, shall be marked, stenciled or placarded, and such markings maintained in a legible condition to read:

"This car
EXCESS
HEIGHT"

The words "EXCESS HEIGHT" to occupy the greater portion of a rectangular space 7" x 10" enclosed within a 3/4" solid border. The markings required shall be made permanent on owned cars as soon as practicable. Lettering and border of signs shall be of colors contrasting to that of the car body. All such required marking and placarding shall be placed on the side adjacent to the ladder or handholds near the floor line of the car at each of the four corners.

(2) Cars exceeding 10' 10" in width.

Each car of a width exceeding ten feet ten inches, the movement of which is hereby authorized, shall be marked, stenciled or placarded, and such markings maintained in a legible condition to read:

"This car
EXCESS
WIDTH"

The words "EXCESS WIDTH" to occupy the greater portion of a rectangular space 7" x 10" enclosed within 3/4" solid border. The markings required shall be made permanent on owned cars as soon as practicable. Lettering and border of signs shall be of colors contrasting to that of the car body. All such required marking and placarding shall be placed on the side adjacent to the ladder or handholds near the floor line of the car at each of the four corners.

[Section 5, filed 4/3/61.]

WAC 296-28-040 Operation of excess dimension loads. (1) Cars containing lading in excess of 15' 6" high and/or 5' 5" from centerline of car.

Each open top car containing lading of a height exceeding fifteen feet six inches above top of rail, or which extends laterally more than five feet five inches from the centerline of the car, the movement of which is hereby authorized, shall be marked, stenciled or placarded, and such markings maintained in a legible condition to read:

"This car "This car
EXCESS or EXCESS
HEIGHT" WIDTH"

The words "EXCESS HEIGHT" or "EXCESS WIDTH" to occupy the greater portion of a space 7" x 10" enclosed within a 3/4" solid border. Letters and border to be of contrasting colors. All such required markings and placarding shall be placed on the side adjacent to the ladder or handholds near the floor line of the car at each of the four corners where practicable, and in addition one each of such signs shall be placed on each side of the load in a conspicuous position.

(1999 Ed.)

(2) Cars containing lading which extends laterally in excess of 5' 5".

The movement of open top cars containing lading which extends laterally in excess of five feet five inches is hereby authorized only if the lading is of such a nature that it cannot practically be reduced in dimensions.

(3) Lading higher than 15' 6" or extending laterally more than 5' 5 1/2".

(a) The movement of all open top cars having lading in excess of fifteen feet six inches in height, or which extends laterally in excess of five feet five and one-half inches from centerline of car will be authorized by written notice stating the total number of such cars and advising that no member of the train crew is required to ride on top of such high car or the side of any such wide car.

(b) A written notice shall be delivered to every train containing any car, the lading of which extends laterally in excess of 5' 5 1/2" from the centerline of the car or in excess of 15' 6" in height above top of rails, informing the crew of the train that the train includes such car or cars, stating the total number thereof and advising that no member of the train crew is required to ride on the side of any such wide car or top of any such high car.

(4) Notice to yard supervisors.

Yard supervisors shall be given notification sufficiently in advance of the arrival of such wide loads as described in subsection (3)(a) above as to enable them to take necessary precautions to safeguard employees in yard.

(5) Loads which cannot be passed over by employees.

Open top cars containing lading having an overall height in excess of fifteen feet six inches above top of rail, if otherwise in compliance with these requirements, and the nature of which precludes the possibility of employees passing over the cars, are exempt from the provisions of subsections (3)(a), (3)(b) and (4), but written notice must be given to all members of train crew informing them of the presence of such loads.

(6) Exemptions.

The common carrier railroads are hereby authorized to move excess height loads and width loads, as described in subsection (1) over roads or portions thereof, without complying with the provisions of WAC 296-28-040, provided that clearances equivalent to the minimum herein prescribed for cars having a height of fifteen feet six inches and width of ten feet ten inches are maintained.

[Section 6, filed 4/3/61.]

WAC 296-28-045 Narrow gauge railroads transporting freight cars. (1) Overhead and side clearances.

For the operation of equipment on narrow gauge tracks, the minimum overhead clearance shall provide a distance above the top of the highest car operated not less than that provided in this order for cars fifteen feet six inches in height operated on standard gauge tracks; the side clearances and distances between centerlines of tracks shall provide a distance from the sides of, or between the widest cars operated not less than those distances herein provided for cars ten feet ten inches in width operated on standard gauge tracks.

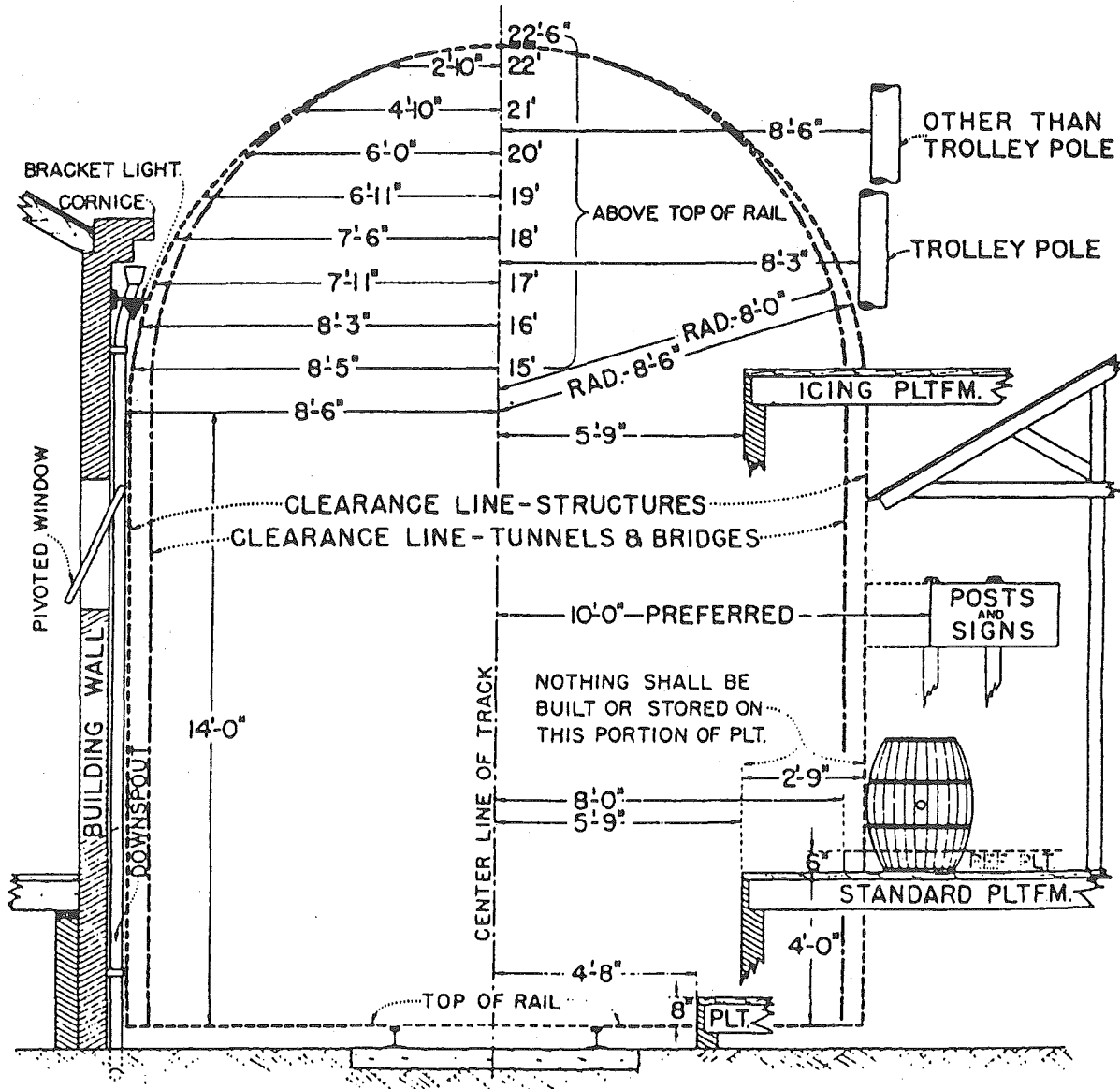
(2) All other requirements of this order where applicable shall be observed by narrow gauge railroads.

[Section 7, filed 4/3/61.]

WAC 296-28-050 Illustrations.

(1)

TYPICAL CLEARANCE
OF STRUCTURES FROM RAILROAD TRACKS



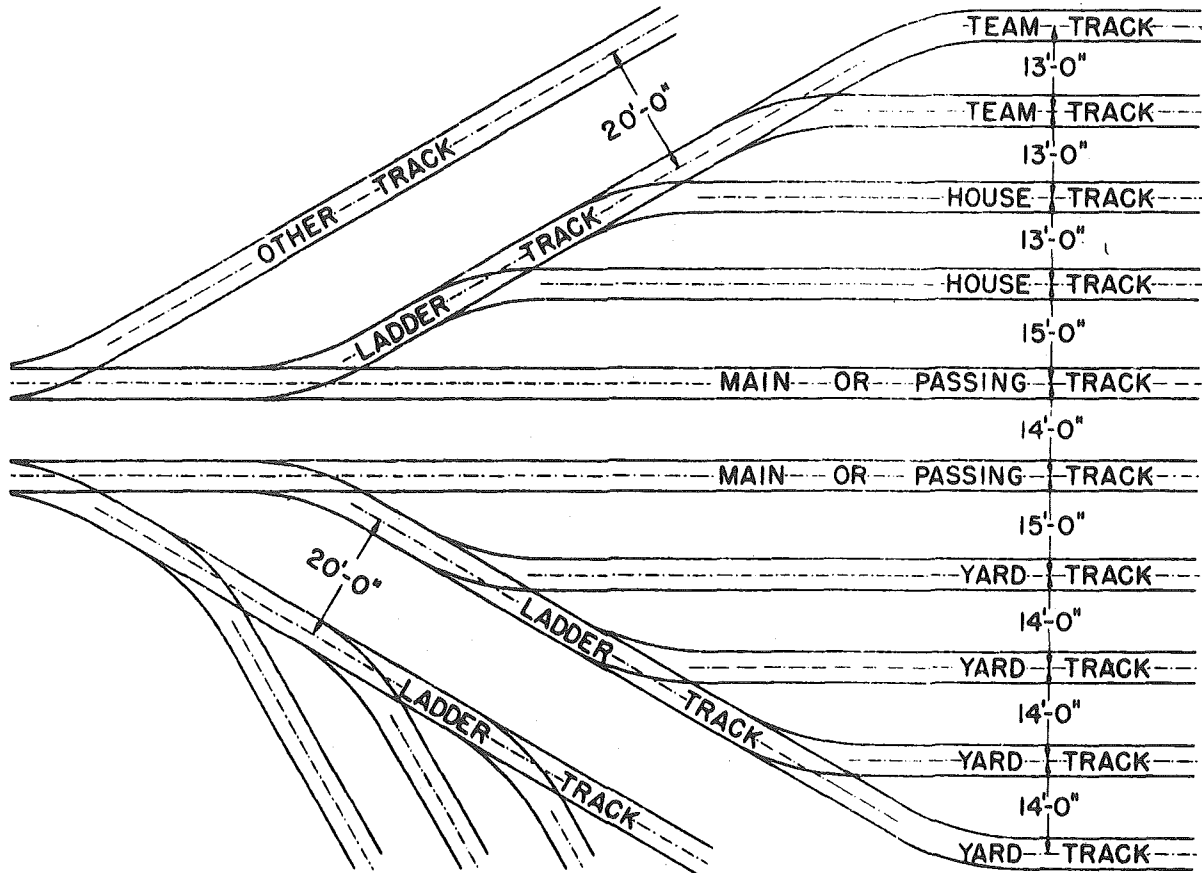
NOTES

OVERHEAD WIRE CLEARANCES SHALL CONFORM TO THE ELECTRICAL AND COMMUNICATION WORKERS SAFETY RULES OF THE STATE OF WASHINGTON

SIDE CLEARANCES ON ALL STRUCTURES ADJACENT TO CURVED TRACK SHALL BE INCREASED TO GIVE THE EQUIVALENT OF TANGENT TRACK CLEARANCES

(2)

TYPICAL TRACK SPACING



NOTE

EXISTING TRACKS MAY BE EXTENDED AT CLEARANCES LAWFULLY PRESCRIBED PRIOR TO THE EFFECTIVE DATE OF THIS ORDER.

CLASS OF HIGHWAY																																	
	CLASS I			CLASS II			CLASS III			CLASS IV			CLASS V			CLASS VI			FRONTAGE ROADS (c)														
	LEVEL	ROLLING	MOUNT.	LEVEL	ROLLING	MOUNT.	LEVEL	ROLLING	MOUNT.	LEVEL	ROLLING	MOUNT.	LEVEL	ROLLING	MOUNT.	LEVEL	ROLLING	MOUNT.	CLASS I*	CLASS II*	CLASS III*												
TERRAIN	LEVEL			ROLLING			MOUNT.			LEVEL			ROLLING			MOUNT.			CLASS I*			CLASS II*			CLASS III*								
ADT IN 20 YEARS	OVER 1,000			OVER 7,000			10,000 MAX. 15,000 MAX. 20,000 MAX.			Refer to Design Capacity Table			Refer to Design Capacity Table			600 TO 200			UNDER 200			1,000 TO 600			400 TO 100			UNDER 100					
DHV IN 20 YEARS	OVER 1,000			OVER 1,150			OVER 1,300			1,500 MAX. 1,750 MAX. 2,000 MAX.			Refer to Design Capacity Table			Refer to Design Capacity Table			90 TO 30			UNDER 30			100 TO 30			50 TO 15			UNDER 15		
TRUCK ADT IN 20 YEARS	OVER 600			OVER 450			OVER 300			UNDER 200			UNDER 150			UNDER 100																	
SEPARATION OF ALL CROSS TRAFFIC REQUIRED	YES			Separate Wharves Cross Traffic Warrants			Separate Wharves Cross Traffic Warrants			NO			NO			NO			NO			NO			NO			NO					
CONTROL OF ACCESS REQUIRED	FULL			According to Master Plan			According to Master Plan			According to Master Plan			NO			NO			NO			NO			NO			NO					
NUMBER OF TRAFFIC LANES	4 or more (Divided)			4 (Divided)			2			2			2			2			2			2			2			1					
DESIGN SPEED M.P.H.	70	60	50	70	60	50	70	60	50	70	60	50	60	50	40	35	25	40	30	25	40	30	25	40	30	25							
CURVATURE	Desirable			4°			3°			2°			1°			1/2°			1/4°			1/8°			1/4°			1/8°					
GRADIENT	Desirable			3%			2.5%			2%			1.5%			1%			3/4%			1/2%			1/4%			1/8%					
SIGHT DISTANCE	600'			475'			350'			2,300'			2,000'			1,700'			2,300'			2,000'			1,700'			2,000'			1,700'		
TRAFFIC LANE WIDTH	12'			12'			12'			11'			10'			9'			10'			9'			12'			12'					
SMOULDER WIDTH	10'			10'(a)			10'			10'(a)			8'			8'(a)			4'			3'			4'			3'					
MIN. MEDIAN WIDTH	15'			4'			15'			4'			150'			150'			100'			60'			60'			40'					
PAVEMENT TYPE (b)	High			High			High			Intermediate or (High)			Low or (Intermediate)			Low or (None)			Low or (None)			Low or (None)			Low or (None)			Low or (None)					
MIN. RIGHT OF WAY WIDTH	65' (See Notes)			65' (See Notes)			65' (See Notes)			150'			150'			100'			60'			60'			60'			40'					
ILLUMINATION	As Required			As Required			As Required			As Required			As Required			As Required			As Required			As Required			As Required			As Required					

NOTES:
 (a) Shoulder width may be reduced to 4 feet for short sections in heavy rock excavation.
 (b) Definitions of Pavement Types:
 *High - Com. Conc. 8" Min. on Adequate Base
 *Low - Com. Conc. 5" Min. on Com. Graded Base
 *Inter. - Asphalt - Under 3" On 8" Road, Max. 1" Min. Adequate Base
 *Road Mts. - 1" Min.
 *Low - L.A.S.T. - 3/4" Min.
 *Exceptions are possible in arid areas.
 Types in () should be secondary choice.
 (c) Frontage Roads: For volumes over 1,000 ADT, use Class III Highway for 50 mph design speed.
 Interstate Routes: Interstate Standards will apply.

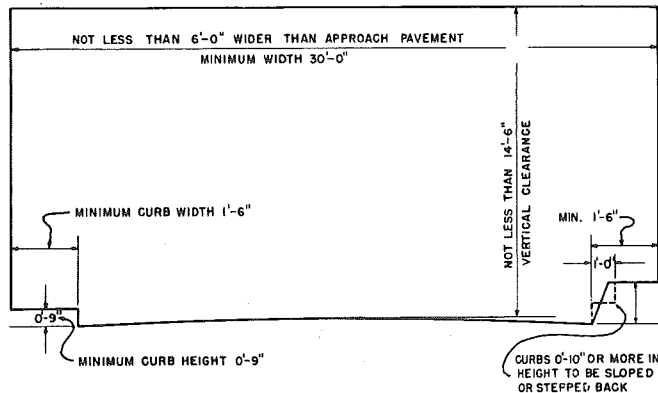
DESIGN CAPACITY TABLE																																											
MAXIMUM DHV FOR CLASS OF HIGHWAY SHOWN																																											
TERRAIN	PER CENT SIGHT DIST. RESTRICTED	0% TRUCKS						5% TRUCKS						10% TRUCKS						15% TRUCKS						20% TRUCKS						25% TRUCKS						30% TRUCKS					
		CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV	CLASS III	CLASS IV														
LEVEL	0	900	770	840	720	780	670	740	630	690	590	660	560	620	530																												
	20	860	740	800	690	750	640	700	610	660	570	630	540	590	510																												
	40	800	690	740	640	700	600	650	560	620	530	580	500	550	480																												
	60	720	620	670	580	630	540	590	510	550	480	530	450	500	430																												
ROLLING	0	900	770	750	640	640	550	560	480	500	430	450	390	410	350																												
	20	860	740	720	620	610	530	510	460	480	410	430	370	390	340																												
	40	800	690	670	580	570	490	500	430	450	380	400	250	360	310																												
	60	720	620	600	520	510	440	450	390	400	340	360	310	330	280																												
MOUNT.	0	900	770	620	530	470	410	380	330	320	280	260	240	210	210																												
	20	860	740	590	510	450	390	370	320	310	260	270	230	230	200																												
	40	800	690	550	480	420	360	340	290	290	250	250	210	210	190																												
	60	720	620	500	430	380	330	310	260	260	220	220	190	190	170																												

NOTES ON DESIGN CAPACITY TABLE:
 Procedure in use of table.
 1. Determine: (a) type of terrain, (b) % of length that sight distance is restricted to less than 1500 feet, (c) % of trucks, (d) DHV estimated for 20 years hence.
 2. Select the class of highway required from the table using the above four conditions.
 3. When the truck ADT requires a higher class of highway than the findings from this table indicate, the truck ADT shall govern.
 Ratio of ADT to DHV varies with every case. DHV generally averages 10% to 15% of ADT.
 Consideration should be given to climbing lanes as compared with going to a higher class of highway.
 Reference: Highway Capacity Manual.

STANDARD
 GEOMETRIC DESIGN STANDARDS
 FOR RURAL STATE HIGHWAYS
 WASHINGTON STATE HIGHWAY COMMISSION
 DEPARTMENT OF TRANSPORTATION
 OLYMPIA, WASHINGTON
 APPROVED FEB. 11, 1956
 [Signature]

(4)

**CLEARANCE DIAGRAM FOR UNDERPASSES
TWO-WAY HIGHWAY TRAFFIC**



REFERENCE:

STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES - THE AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.

[Illustrations, filed 4/3/61.]

Chapter 296-30 WAC

**RULES FOR THE ADMINISTRATION OF THE
CRIME VICTIM COMPENSATION PROGRAM**

WAC

296-30-010	Definitions.
296-30-020	Vehicular assault.
296-30-025	Medical assistance eligibility.
296-30-060	Requirement to report criminal acts.
296-30-080	Counseling for sexual assault.
296-30-081	Acceptance of rules and fees for medical and mental health services.
296-30-120	Factors considered in order to modify debt due department.
296-30-130	Lump sum benefits.
296-30-170	Payment for medical examination of victims of sexual assault.
296-30-180	Payment of benefits to prevent unjust enrichment.
296-30-900	Effective date of amendatory acts.

**DISPOSITION OF SECTIONS FORMERLY
CODIFIED IN THIS CHAPTER**

296-30-050	Distribution of third party recoveries. [Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-050, filed 12/23/93, effective 1/24/94; 86-01-028 (Order 85-37), § 296-30-050, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-050, filed 1/15/85.] Repealed by 98-14-076, filed 6/30/98, effective 7/31/98. Statutory Authority: RCW 7.68.030.
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WAC 296-30-010 Definitions. Whenever used in these rules, the following words mean:

- (1) "Victim" means any person whose injury was not the direct, proximate result of his or her consenting to, provoking, or inciting the criminal act that resulted in the injury.
- (2) "Bodily injury" means any harmful or offensive touching, and includes severe emotional distress where no touching takes place when:
 - (a) Claimant is not the object of the criminal act and:
 - (i) The distress is intentionally or recklessly inflicted; and
 - (ii) The distress is inflicted by extreme or outrageous conduct; and

(1999 Ed.)

(iii) The claimant has a reasonable apprehension of imminent bodily harm; and

(iv) The claimant is in the immediate vicinity of the criminal act at the time the criminal act takes place.

(b) Claimant is the victim of the criminal act and:

(i) The distress is intentionally inflicted; and

(ii) The distress is inflicted by outrageous or extreme conduct; and

(iii) The claimant had a reasonable apprehension of imminent bodily harm.

(3) "Private insurance" means sources of recompense available by contract, such as life or disability insurance.

(4) "Public insurance" means any state or federal statutory welfare and insurance plan that compensates victims or their beneficiaries as a result of the claimed injury or death. This does not include state, federal, or private deferred income retirement plans.

(5) The test used to define "the result of" as used in RCW 7.68.070 (3)(a) is two pronged. First, it must be determined that cause in fact exists, and second, it must then be determined that proximate cause exists.

(a) Cause in fact exists if "but for" the acts of the victim the crime that produced the injury would not have occurred.

(b) Proximate cause exists if, once cause in fact is found, it is determined that the acts of the victim:

(i) Resulted in a foreseeable injury to the victim;

(ii) Played a substantial role in the injury; and

(iii) Were the direct cause of the injury.

(6) "Institutions maintained and operated by department of social and health services or the department of corrections" means those institutions in which the department of social and health services or the department of corrections assumes responsibility for medical coverage of the institution's residents.

(7) "Reasonable cooperation" generally exists when the claimant is:

(a) Willing to talk to police and give information to aid in the investigation; and

(b) Willing to assist in the prosecution of the alleged criminal.

(8) A person is "unjustly enriched" within the meaning of RCW 7.68.070(15) when it would be deficient in justice and fairness, or inequitable, to allow that person to obtain, or have control of or access to, benefits or compensation paid as a result of an injury to a victim of crime.

(9) "Department" means the department of labor and industries.

(10) "Services provided" means services covered under chapter 74.09 RCW or Title XIX of the Federal Social Security Act that are:

(a) Provided by health services providers with credentials recognized by the department for purposes of payment under chapter 51.36 or 7.68 RCW; and

(b) Available and equivalent to those services covered by the department under Title 51 or chapter 7.68 RCW.

(11) "Criminal act" means an act defined in RCW 7.68.020, the occurrence of which can be verified by the department or which is reasonably credible. Physically impossible acts, highly improbable acts for which verification is not available, or unverified memories of acts occurring

prior to the age of two will not be accepted as reasonably credible. In evaluating evidence to determine verification of claimed criminal acts, the department will give greater weight to the quality, than to the quantity, of evidence. Evidence that can be considered for verification of claimed criminal acts includes, but is not limited to, one or more of the following:

- (a) Police or other investigation reports.
- (b) Child protective services or other government agency reports.
- (c) Diaries or journals kept by victims and others.
- (d) Third party reports from school counselors, therapists and others.
- (e) Current medical examinations.
- (f) Medical or psychological forensic evaluations. In the absence of other adequate forensic evaluation reports, independent assessments per WAC 296-31-069 (2) and (3) may be conducted when indicated.
- (g) Legal and historical reports.
- (h) Current and past medical and mental health records.
- (i) Reports of interviews with the victim's family members, friends, acquaintances and others who may have knowledge of pertinent facts. When such interviews are necessary to determine eligibility, the victim will be given the choice of whether to allow the interviews to be conducted. The victim will also be given the understanding that eligibility may be denied if the interviews are not conducted. The department will act according to the victim's choice.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-30-010, filed 12/31/96, effective 1/31/97. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-010, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 7.68.030, 7.68.070 (12) and (16) and 51.04.030. 89-23-004, § 296-30-010, filed 11/3/89, effective 11/10/89. Statutory Authority: Chapter 7.68 RCW. 86-01-028 (Order 85-37), § 296-30-010, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-010, filed 1/15/85.]

WAC 296-30-020 Vehicular assault. Chapter 7.68 RCW shall cover those people killed or injured as a result of a vehicular assault that occurred after July 24, 1983 if there has been a conviction for the vehicular assault. Eligibility occurs when the claimant's injury results in the assailant's conviction for vehicular assault, or when the claimant's injury is a direct result of the collision that led to the vehicular assault conviction. The claimant's injury need not be the one that led to the conviction.

[Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-020, filed 12/23/93, effective 1/24/94; 86-01-028 (Order 85-37), § 296-30-020, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-020, filed 1/15/85.]

WAC 296-30-025 Medical assistance eligibility. The benefits provided under chapter 7.68 RCW that are available and equivalent to those services provided under chapter 74.09 RCW or Title XIX of the Federal Social Security Act are not available to persons eligible for services provided under chapter 74.09 RCW or Title XIX of the Federal Social Security Act, except to the extent that costs for such services exceed service limits established by the department of social and health services. Accordingly:

- (1) Applicants for benefits provided under chapter 7.68 RCW shall provide, concurrent with their application for

crime victims' benefits, information requested by the department to determine the applicant's probable eligibility for services provided under chapter 74.09 RCW and Title XIX of the Federal Social Security Act. The applicant, or a person on behalf of the applicant, shall send the application and other requested information to the offices of the crime victims' compensation program in Olympia.

(2) The department shall provide application forms for crime victims' benefits, any forms used to determine probable eligibility for services provided under chapter 74.09 RCW or Title XIX of the Federal Social Security Act, and a pamphlet describing the crime victims' compensation program to hospitals, law enforcement agencies, community organizations, prosecutor based victim/witness units and, as requested, to other service groups. The pamphlet shall (a) explain the limitations of benefits provided under chapter 7.68 RCW; (b) provide assistance for an applicant in completing the forms; and (c) provide an applicant information about where additional assistance is available if the instructions for completing the forms are not understood or if unusual circumstances exist.

(3) Any claimant who is eligible for benefits provided under chapter 7.68 RCW and who the department determines may be eligible for services provided under chapter 74.09 RCW and Title XIX of the Federal Social Security Act, based upon the completed eligibility form referenced above, shall apply to the department of social and health services for a conclusive determination of eligibility for such services.

(4) The department shall not provide benefits for services provided under chapter 74.09 RCW and Title XIX of the Federal Social Security Act to persons who refuse or who otherwise fail to cooperate or comply in good faith with the requirements of this section, except to the extent that the costs for such services exceed service limits established by the department of social and health services.

(5) Except for claims submitted pursuant to RCW 7.68.170 for sexual assault examinations, the department shall not consider applications for benefits under chapter 7.68 RCW until the information requested to determine probable eligibility for services provided under chapter 74.09 RCW and Title XIX of the Federal Social Security Act is received by the department.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-30-025, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 7.68.030, 7.68.070 (12) and (16) and 51.04.030. 89-23-004, § 296-30-025, filed 11/3/89, effective 11/10/89.]

WAC 296-30-060 Requirement to report criminal acts. (1) The following are examples under which the twelve-month reporting requirement in RCW 7.68.060 (1)(b) may be tolled:

- (a) Unconsciousness or coma of victim.
- (b) Youth of victim (because of age the victim is unaware that a crime has been committed against her).
- (c) Rape trauma syndrome or medical condition affecting the victim's capacity to act.
- (d) A report of an assault against a child made to children's protective services when the report is made within twelve months of when it reasonably could have been made.

(2) This list is not and should not be considered exhaustive but is for illustrative purposes.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120, 97-02-090, § 296-30-060, filed 12/31/96, effective 1/31/97. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-060, filed 12/23/93, effective 1/24/94; 86-01-028 (Order 85-37), § 296-30-060, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-060, filed 1/15/85.]

WAC 296-30-080 Counseling for sexual assault. (1) Pursuant to RCW 7.68.070(12), the department shall pay for counseling for victims of sexual assault and, when appropriate, for members of a victim's immediate family. An immediate family member shall be defined as the victim's parents, spouse, child(ren), siblings, grandparents, and those members of the same household who have assumed the rights and duties commonly associated with a family and who hold themselves out as a family unit.

(2) Counseling for the above defined family members is appropriate when:

- (a) The counseling is for the spouse, child, parent, or sibling of the victim who suffers psychological trauma as a result of the sexual assault; or
- (b) The family member and victim live in the same household and the family member suffers psychological trauma as a result of the sexual assault; or
- (c) The family member sees the assault; or
- (d) Counseling of the family member will aid in the victim's recovery.

[Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-080, filed 12/23/93, effective 1/24/94; 86-01-028 (Order 85-37), § 296-30-080, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-080, filed 1/15/85.]

WAC 296-30-081 Acceptance of rules and fees for medical and mental health services. Providing medical or counseling services to an injured crime victim whose claim for crime victims compensation benefits has been accepted by the department constitutes acceptance of the department's medical aid rules and compliance with its rules and fees. Maximum allowable fees shall be those fees contained in the publications entitled *Medical Aid Rules and Fee Schedules and Crime Victims Compensation Program Mental Health Treatment Rules and Fees*, less any available benefits of public or private collateral resources, except as follows:

The percentage of allowed charges authorized by WAC 296-23A-105: Payment for hospital inpatient and outpatient services, WAC 296-23A-155: New hospitals, WAC 296-23A-160(3): Excluded and included services, and WAC 296-23A-165: Out-of-state hospitals shall be equal to the percentage of allowed charges established by the department of social and health services under Title 74 RCW and WAC 388-87-070(6): Payment hospital inpatient services.

If any of the maximum allowable fees in the publications entitled *Medical Aid Rules and Fee Schedules and Crime Victims Compensation Program Mental Health Treatment Rules and Fees* is lower than the maximum allowable fees for those procedures established by the department of social and health services under Title 74 RCW, the Title 74 RCW fees are the maximum allowable fees for those procedures.

Prior to the establishment or amendment of the fee schedules, the department will give at least thirty calendar

days notice by mail to interested persons who have made timely request for advance notice of the establishment or amendment of the fee schedules. To request advance notice of the establishment or amendment of the medical fee schedules, interested persons must contact the department at the following address:

Department of Labor and Industries
Health Services Analysis
P.O. Box 44322
Olympia, WA 98504-4322

To request advance notice of the establishment or amendment of the mental health fee schedules, interested persons must contact the department at the following address:

Department of Labor and Industries
Crime Victims Compensation Section
P.O. Box 44520
Olympia, WA 98504-4520

An injured victim shall not be billed for his or her accepted injury. The department shall be billed only after available benefits of public or private insurance have been determined. Bills must be submitted within ninety days from the date of service to be considered for payment. If insurance or public agency collateral resources exist, bills must be received within ninety days following payment or rejection by the resource. A copy of the payment or rejection must accompany the bill.

If the service provider has billed the injured victim and is later notified that the department has accepted the victim's claim, the provider shall refund to the injured victim any amounts paid, and bill the department for services rendered at their usual and customary fees if such rates are in excess of the public or private insurance entitlements.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120, 97-02-090, § 296-30-081, filed 12/31/96, effective 1/31/97. Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030, 95-15-004, § 296-30-081, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-081, filed 12/23/93, effective 1/24/94; 92-23-034, § 296-30-081, filed 11/13/92, effective 12/14/92; 92-16-033, § 296-30-081, filed 7/30/92, effective 8/30/92; 86-01-028 (Order 85-37), § 296-30-081, filed 12/11/85.]

WAC 296-30-120 Factors considered in order to modify debt due department. RCW 7.68.120 allows the department in the interest of justice or rehabilitation, to waive, modify, or adjust the debt owed to the department by any person found to have committed the criminal act for which crime victim benefits were paid. To determine whether or not the debt should be modified, waived or adjusted, the department shall consider the following factors:

- (1) The gravity of the offense;
- (2) Extent of injury to victim;
- (3) Type of crime;
- (4) Circumstances surrounding the criminal act;
- (5) The assailant's attempts at rehabilitation:
 - (a) Rehabilitation program involvement;
 - (b) Employment efforts;
 - (c) Community involvement;
- (6) Ability to pay:
 - (a) Income;

- (b) Necessary expenses;
- (c) Number and ages of dependents;
- (7) Sentence imposed by the court;
- (8) The impact on the victim of reducing the debt.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-30-120, filed 12/31/96, effective 1/31/97. Statutory Authority: Chapter 7.68 RCW. 86-01-028 (Order 85-37), § 296-30-120, filed 12/11/85.]

WAC 296-30-130 Lump sum benefits. (1) Lump sum benefits paid to the survivor(s) of an unemployed victim shall be paid on a monthly basis if the survivor(s) is entitled to private or public death benefits. The death benefit payments shall be deducted each month from the crime victim's death benefits. Crime victim's benefit payments shall continue until the combined public or private death benefits and the crime victim's death benefits equal the total amount that the survivor(s) is eligible for under chapter 7.68 RCW.

(2) The amount of the monthly payments is based on the state's average monthly wage and are determined by the percentages established in RCW 51.32.050.

(3) This lump sum payment shall be adjusted upward by a factor of 8% to reflect the present and future value of the money.

(4) The survivor(s) of an employed victim are entitled to the maximum in death benefits prescribed by RCW 7.68.070(13). These benefits shall be paid in the same manner as the benefits paid to the survivor(s) of an unemployed victim except that the monthly rate shall be determined by the deceased's regular rate of pay.

(5) This procedure was adopted to ensure equal treatment of survivor(s) in like circumstances.

[Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-30-130, filed 12/23/93, effective 1/24/94; 86-01-028 (Order 85-37), § 296-30-130, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-130, filed 1/15/85.]

WAC 296-30-170 Payment for medical examination of victims of sexual assault. A victim of sexual assault is entitled to payment for the costs of a medical examination under RCW 7.68.170 regardless of whether she or he qualifies for benefits under chapter 7.68 RCW, if the hospital or emergency medical facility proves to the department that:

- (1) The care was provided; and
- (2) The examination was performed at least in part to gather medical evidence for possible prosecution of the assailant.

[Statutory Authority: Chapter 7.68 RCW. 86-01-028 (Order 85-37), § 296-30-170, filed 12/11/85; 85-03-060 (Order 85-3), § 296-30-170, filed 1/15/85.]

WAC 296-30-180 Payment of benefits to prevent unjust enrichment. RCW 7.68.070(15) prohibits the department from paying any benefits or compensation to the person who caused a crime victim's injuries, or to any other person if that person would be unjustly enriched by the benefits. In some situations, as when a child is injured by a parent or a spouse by the other spouse, there is a danger that the injuring person will divert to his or her own use the benefits or compensation intended for the victim.

To prevent this possibility, the department may on its own motion or the motion of the victim or his or her guardian,

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request that the victim or other responsible adult establish (1) a trust for which the trustee shall be a neutral third person; or (2) a savings or checking account for which a neutral third person must cosign all withdrawals or checks. Crime victims compensation benefits shall then be deposited in the established account.

The department shall continue to pay medical providers directly.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-30-180, filed 12/31/96, effective 1/31/97. Statutory Authority: Chapter 7.68 RCW. 86-01-028 (Order 85-37), § 296-30-180, filed 12/11/85.]

WAC 296-30-900 Effective date of amendatory acts. The statute in effect at the time the criminal act occurred is the controlling law.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-30-900, filed 12/31/96, effective 1/31/97. Statutory Authority: Chapter 7.68 RCW. 85-03-060 (Order 85-3), § 296-30-900, filed 1/15/85.]

Chapter 296-31 WAC

CRIME VICTIMS COMPENSATION MENTAL HEALTH TREATMENT RULES AND FEES

WAC

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DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-31-095	Consultation fees. [Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-095, filed 11/13/92, effective 12/14/92.] Repealed by 94-02-015, filed 12/23/93, effective 1/24/94. Statutory Authority: Chapter 7.68 RCW.
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WAC 296-31-010 Mental health treatment overview. (1) The crime victim compensation program provides mental health treatment to victims of crime, except for the provisions of WAC 296-30-025 (6)(b), secondary to treatment available from any other public or private insurance, who are eligible for compensation under the provisions of chapter 7.68 RCW. Eligible claimants are entitled to receive proper and necessary mental health treatment.

(2) Services and treatment are limited to those procedures which are proper and necessary, and at the least cost, consistent with accepted standards of mental health care which will enable the claimant to obtain maximum recovery and/or:

(3) In the case of a permanent partial disability, treatment or services are not to extend beyond the date when permanent

partial impairment or disability compensation is awarded. No treatment or services will be authorized beyond the point that the accepted condition is fixed and stable.

(4) In the case of a permanent total disability, treatment is not to extend beyond the date on which the claimant is placed upon a permanent pension roll except that in the sole discretion of the department continued treatment for conditions previously accepted by the department may be allowed when such treatment is deemed necessary to protect the claimant's life or to provide for the administration of therapeutic measures. This includes payment of prescription medications necessary to alleviate continuing pain resulting from the accepted condition but does not include those controlled substances scheduled by the state board of pharmaceuticals as schedule I, II, III, IV substances under chapter 69.50 RCW.

(5) Mental health treatment requiring preauthorization:

Inpatient hospitalization;

Individual therapy exceeding one hour per week;

Group therapy exceeding one session per week;

Concurrent treatment;

Family therapy to family members of sexual assault victims beyond twelve sessions;

Therapy for survivors of victims of homicide beyond twelve sessions;

Electroconvulsive therapy;

Neuropsychological evaluation (testing);

Day treatment for seriously ill persons less than eighteen years of age;

Referrals to special programs.

Requests for authorization must be in writing and include a statement of:

(a) The condition(s) diagnosed;

(b) ICD-9-CM and/or DSM-III-R or DSM-IV codes;

(c) The relationship of the condition(s) diagnosed to the assault, if any;

(d) An outline of the proposed treatment program, its length and components, procedure codes, and expected prognosis.

(6) Rejected and closed claims. Therapy for eligible survivors of victims of homicide can be provided on closed claims:

No payment will be made for treatment or medication on rejected claims or for services rendered after the date of closure of a claim.

When the department has denied responsibility for an alleged crime victim injury or condition, the only services which will be paid are those which were carried out at the specific request of the department and/or those assessment or diagnostic services which served as a basis for the adjudication decision. Following the date of the order and notice of claim closure, the department will be responsible only for those services specifically requested or those assessments and/or diagnostic services necessary to complete and file a reopening application.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120, 97-02-090, § 296-31-010, filed 12/31/96, effective 1/31/97. Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030, 95-15-004, § 296-31-010, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050, 92-23-033, § 296-31-010, filed 11/13/92, effective 12/14/92.]

(1999 Ed.)

WAC 296-31-020 Definitions. This section explains the department's definitions of terms used throughout the sections as they apply to claimants.

Acceptance, accepted condition: Determination, in writing, by a qualified representative of the department, that reimbursement for the diagnosis and rehabilitative treatment of a claimant's mental health condition are the responsibility of the department. The condition being accepted must be specified by one or more diagnostic codes from the current edition of the International Classification of Diseases, Clinically Modified (ICD-CM), or by DSM III-R, or DSM IV and by use of words to describe the symptoms connected to or citing ICD-CM or DSM III-R or DSM IV diseases.

Authorization: Notification, in writing or by telephone, by a qualified representative of the department, that specific necessary treatment, services, or equipment recommended by a provider for the diagnosis or rehabilitative treatment of an accepted condition will be reimbursed by the department. Providers must insure they maintain records indicating the name of the qualified representative who authorizes treatment or equipment.

Claimant: A person who submits, or on whose behalf is submitted, an application for benefits under the Crime Victims Act.

Consultation: The services rendered by a mental health provider whose opinion or advice is requested by the attending (treating) mental health provider, or agency, or by the department in the evaluation and/or treatment of a claimant. Case management or case staffing does not constitute a consultation. Treatment of a claimant is not a consultation.

Crisis intervention: Therapy to alleviate the most pressing problems and attempt to use the crisis as an opportunity for positive change; the vital mental and safety functions of the client are stabilized by providing support, structure and, if necessary, restraint.

Disability awards for mental health conditions: Direct monetary compensation that may be provided to an eligible claimant who is either totally temporarily disabled, permanently partially disabled, or totally permanently disabled resulting from an accepted condition. Under Washington law, permanent disability awards are based solely on mental impairment due to the accepted injury or conditions without consideration of economic factors. Disability rating exams must be provided by a physician.

Elective nonemergent hospital admission: Placement of the claimant in an acute care hospital or residential treatment facility for mental health treatment of a claim related mental health condition which may be safely scheduled in advance without jeopardizing the claimant's health or treatment outcome.

Emergent hospital admission: Placement of the claimant in an acute care hospital, psychiatric hospital, or residential treatment facility for treatment of a claim related mental health condition of an unforeseen or rapidly progressing nature which, if not treated in an inpatient setting, is likely to jeopardize the claimant's health or treatment outcome.

Family therapy: Therapy involving the therapist, and one or more members of the claimant's family (excluding the perpetrator if also a family member) and which centers on

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issues resulting from the claimant's sexual assault pursuant to WAC 296-30-080.

Group therapy: Therapy involving the claimant, the therapist, and one or more clients who are not related to the claimant and which includes issues both related to the claimant's assault and pertinent to other group members, not necessarily related to the claimant's assault.

Homicide survivor: An immediate family member of a homicide victim as the result of a criminal act committed on or after July 1, 1992. Homicide survivors may receive appropriate counseling to assist them with the immediate, near term consequences of the related effects of the homicide. Family members applying for survivor counseling benefits must complete and submit a Request for Homicide Survivor Counseling Benefits Form (F800-057-000) once a claim has been established and allowed by the department. Maximum allowable fees shall be those fees contained in the publication entitled *Crime Victims Compensation Program Mental Health Treatment Rules and Fees*, less any benefits of public or private collateral resources available to each eligible family member.

Immediate family members: Any claimant's parents, spouse, child(ren), siblings, grandparents, and those members of the same household who have assumed the rights and duties commonly associated with a family and who hold themselves out as a family unit.

Individual therapy: Therapy provided on a one to one basis between a therapist and claimant.

Mental health services provider: Any person, firm, corporation, partnership, association, agency, institution, or other entity providing any kind of mental health services related to the treatment of a claimant. This includes, but is not limited to, hospitals, psychiatrists, psychologists, advanced registered nurse practitioners with a specialty in psychiatric and mental health nursing, registered and/or certified master level counselors, and other qualified service providers licensed, registered and/or certified with the department of health and registered with the crime victims program. (Refer to WAC 296-31-030 for specific details.)

Modified work status: When the claimant is not able to return to previous work, but is capable of carrying out work of a lighter, or otherwise different nature.

Necessary treatment: Those health services or treatments which, in the opinion of the director or his or her designee are:

Proper and necessary for the diagnosis or rehabilitative treatment of an accepted condition;

Reflective of accepted standards of good practice within the scope of the provider's license, certification, or registration;

Not delivered primarily for the convenience of the claimant, the claimant's attending provider, or any other provider; and

Provided at the least cost and in the least intensive setting of care consistent with accepted standards of care/accepted therapeutic practice and with the other provisions of this definition. Services which are inappropriate to the accepted condition, or which present hazards in excess of the expected mental health benefits, are not considered necessary. Services which are obsolete are not authorized. Services

which are controversial, experimental, or investigational are presumed not to be consistent with accepted standards of care and shall only be authorized on an individual case basis with written authorization for the service from the department.

Office notes: Written records of treatment, or other work products, documenting specific charges billed, as opposed to reports of evaluation and progress independently submitted to the department or to other parties.

Permanent partial disability: Providers are required to notify the department of any claimant's accepted condition where permanent functional impairment or loss is indicated after maximum rehabilitation has been achieved, which is determined to be stable and fixed at the time the evaluation is made. The department will arrange to have impairments rated using the category system under WAC 296-20-200 et al.

Prohibited treatment: The department will not allow or pay for any therapies which focus on the recovery of repressed memory or recovery of memory which focuses on memories of physically impossible acts, highly improbable acts for which verification should be available, but is not, or unverified memories of acts occurring prior to the age of two.

Regular work status: When the injured claimant is capable of returning to his/her regular work, the attending provider must notify the claimant and the department of the specific date of release to return to regular work. Time loss compensation will be terminated on the release date. Further treatment may be allowed as requested by the attending provider if the condition is not stable or fixed and treatment is needed for the accepted condition.

Repressed memory: A condition of not having or had conscious memory of an act. For the purpose of these rules describing this condition under this section the definition means that a claimant regained conscious memory of victimization caused by a criminal act committed against them as a minor.

Temporary partial disability: Partial time loss may be paid when the claimant can return to work on a limited basis, or, return to a lesser paying job is necessitated by the accepted condition. However, the claimant must have a reduction in wages of at least five percent before loss of earning power can be paid.

Termination of treatment: When treatment is no longer required because the accepted condition for which the claim was allowed has become stable, the provider must submit a report indicating the date the condition became stable to the department. This is necessary to initiate closure of the crime victim's compensation claim.

Time loss certification: Certification from a physician, or mental health professional qualified to treat under the Crime Victims Act, based upon findings which are specific symptoms that an accepted condition of a claimant either partially or totally incapacitates the claimant from returning to work. Such symptoms may include, but are not limited to: Anxiety, depression, loss of appetite, weight loss, flat affect, inability to concentrate, inability to complete tasks.

Total permanent disability: A condition permanently incapacitating a claimant from performing any work at any gainful occupation.

Total temporary disability (time loss): The claimant is temporarily unable to return to any type of reasonably contin-

uous gainful employment as a direct result of an accepted condition. Time loss compensation will be paid if the victim was employed on the date of their criminal injury, or, if not, if the victim was employed three or more consecutive months during the twelve months immediately preceding the date of the assault.

Utilization review: The assessment of a claimant's mental health care for assurance that it is necessary and of good quality. Assessments typically consider the appropriateness of the place of care, level of care, and the duration, frequency or quantity of services provided in relation to the accepted condition being treated.

Victim: A person who suffers bodily injury or death as the proximate result of a criminal act of another person, the claimant's own good faith and reasonable effort to prevent a criminal act, or his or her good faith effort to apprehend a person reasonably suspected of engaging in a criminal act. For the purposes of receiving benefits, "victim" is interchangeable with "employee" or "worker" as defined in the Industrial Insurance Act. For the purpose of these rules "bodily injury" means any harmful or offensive touching, and includes severe emotional distress where no touching takes place as defined and under the conditions outlined in WAC 296-30-010(2).

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-31-020, filed 12/31/96, effective 1/31/97. Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-020, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-31-020, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-020, filed 11/13/92, effective 12/14/92.]

WAC 296-31-030 General provider requirements—

Who may treat. (1) Mental health providers who may treat claimants under the Crime Victims Act must register with the crime victims compensation program and qualify as an approved provider under these rules. The department must register the mental health provider before the mental health provider is eligible for payment for services.

(2) Washington permanently licensed psychiatrists, psychologists and advanced registered nurse practitioners with a specialty in psychiatric and mental health nursing, and registered and/or certified master level counselors whose master's degree is in a field of study related to mental health services including but not limited to, social work, marriage and family therapy or mental health counseling, who are registered with the crime victims program are authorized to provide treatment in accordance with these rules to claimants.

Out-of-state providers must be licensed, registered and/or certified in accordance to the licensing requirements within the state in which they practice. Copies of license, registration and/or certification must be provided when applying for approval to treat Washington state crime victims.

In areas where the department has determined licensed, registered and/or certified providers are not available, the department may consider registration exceptions on an individual case basis.

(3) The department has a duty to supervise provision of proper and necessary mental health care that is delivered promptly, efficiently, and economically. The department may

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deny, revoke, suspend, limit, or impose conditions on a mental health care provider's authorization to treat victims under the Crime Victims Act. Reasons for imposing any of the above restrictions include, but are not limited to the following:

(a) Negligence or incompetence which results in injury to a claimant or which creates an unreasonable risk that a claimant may be harmed.

(b) The illegal possession, use, prescription for use, or distribution of controlled substances, legend drugs, or addictive, habituating, or dependency-inducing substances in any way other than for therapeutic purposes.

(c) Any temporary or permanent probation, suspension, revocation, or other relevant type of limitation of a provider's license, certification or registration to practice by any court, board, or administrative agency.

(d) The commission of any act involving moral turpitude, dishonesty, or corruption relating to the practice of the provider's profession. The act need not constitute a crime. If a conviction or finding of such an act is reached by a court or other tribunal pursuant to plea, hearing, or trial, a certified copy of the conviction or finding is conclusive evidence of the violation.

(e) Failure to comply with the department's orders, rules, or policies.

(f) Failure, neglect, or refusal to:

(i) Submit copies of license, certification and/or registration and degree to the department.

(ii) Maintain and provide records requested by the department pursuant to a health care services review or an audit.

(iii) Submit complete, adequate, and detailed reports or additional reports requested or required by the department regarding the treatment and condition of a claimant.

(g) The submission of, or collusion in the submission of, false or misleading reports or bills to any government agency.

(h) Billing a claimant for:

(i) Treatment of a condition for which the department has accepted responsibility; or

(ii) Any amount more than the amount paid by the department under the maximum allowable fee set forth in these rules and any other charge with the exception of "no show" appointment charges. The department has no provision to pay charges for missed appointments, except for independent assessments arranged by the department. Claimants may be billed directly for missed or "no show" appointments.

(i) Repeated failure to recognize emotional and social factors impeding recovery of a claimant who is being treated under the Crime Victims Act.

(j) Repeated unreasonable refusal to comply with the recommendations of board certified or qualified consultants who have examined or reviewed a claim for the department.

(k) Repeated use of:

(i) Treatment of controversial or experimental nature;

(ii) Contraindicated or hazardous treatment; or

(iii) Treatment past stabilization of the condition or after maximum mental health improvement has been obtained.

(l) Declaration of mental incompetency by a court or other tribunal.

(m) Failure to comply with the applicable code of professional conduct or ethics.

(n) Failure to inform the department of any disciplinary action issued by order or formal letter taken against the provider's license, certification or registration to practice.

(o) The finding of any peer group review body of reason to take action against the provider's practice privileges.

(p) Misrepresentation or omission of any material information in the application for authorization to treat claimants.

(q) Repeated billing of the department for services that are available to claimants from public or private insurance sources. The crime victims compensation program is a secondary insurer. Providers should bill the department only after all benefits available to the claimant from public or private insurance are exhausted.

(4) If the department finds reason to take corrective action, the department may also order one or more of the following:

(a) Recoupment of payments made to the provider, including interest; at the rate of one percent per month or portion of a month beginning on the thirty-first day after payment was made.

(b) Denial or reduction of payment;

(c) Placement of the provider on a prepayment review status requiring the submission of supporting documents prior to payment;

(d) Requirement to satisfactorily complete education courses and/or programs; and

(e) Imposition of other appropriate restrictions or conditions on the provider to include revocation of the privilege to be reimbursed for treating victims under the Crime Victims Act.

(5) The department shall forward a copy of any corrective action taken against a provider to the applicable disciplinary authority.

(6) Appeal and protest rights: A provider may file a written protest to any department order, decision, or award. An appeal or protest to an order or decision demanding repayment of sums must be submitted to the department or the board of industrial insurance appeals within twenty days from receipt of the order or decision. An appeal or protest to an order or decision regarding other issues, e.g., ongoing treatment or provider eligibility, must be filed within sixty days from receipt of the order or decision. Appeal and protest rights are governed under chapter 51.52 RCW and RCW 7.68.110.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-030, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-030, filed 11/13/92, effective 12/14/92.]

WAC 296-31-040 Special programs. (1) The department may enter into special agreements for services or special treatment modalities or services provided by community based mental health treatment centers, rape crisis centers, domestic violence shelters, medical facilities, and medical facility based sexual assault treatment centers, provided under the direction of registered providers authorized to bill the department. Special agreements are for services or treatment modalities other than routine services or treatment modalities covered under the fee schedule, and may include,

but are not limited to, group counseling, crisis counseling, and emergency assistance and referral programs, or multidisciplinary or inter-disciplinary programs such as day treatment, drug, alcohol, and chemical dependency treatment.

(2) The department shall establish payment rates for special agreements or treatment modalities, and may establish outcome criteria, measures of effectiveness, minimum staffing levels, certification requirements, special reporting requirements, and such other criteria as will ensure that claimants receive good quality and effective services treatment at the least cost, consistent with necessary services.

(3) Special agreements shall be purchased or authorized at the discretion of the department. The department may terminate special programs from the crime victims compensation program upon thirty days notice to the provider.

[Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-040, filed 11/13/92, effective 12/14/92.]

WAC 296-31-050 Initial treatment and application for benefits. (1) It is the responsibility of the crime victim to notify the provider if the claimant has reason to believe his or her condition is related to a criminal assault. If the attending provider discovers a condition which he or she believes to be crime related or has reason to believe a condition is crime related, he or she must so notify the claimant. It is the provider's responsibility to ascertain whether he or she is the first attending provider. If so, the following action shall be taken by the attending provider:

(a) Provide crisis intervention if necessary.

(b) Immediately complete the provider portion of the application for benefits.

(c) Instruct and give assistance to the crime victim in completing his or her portion of the application for benefits.

In completing a claim or application, the following information is necessary so there is no delay in adjudication of the claim or payment of compensation:

(i) Complete history of the condition, physical findings if appropriate, and symptomatology resulting from the crime.

(ii) Specific diagnosis with ICD-9-CM or DSM III-R or DSM IV code(s), including axes 1 through 5, or a description of symptoms, consistent with and connected to the diagnostic criteria contained within DSM III-R, or DSM IV, relating to the injury.

(iii) Type of treatment rendered.

(iv) Known emotional, or social conditions which may influence recovery or cause complications.

(v) Estimate of time loss (if any) due to the injury.

(2) If the claimant remains under the provider's care, continue with necessary treatment in accordance with mental health rules.

If the provider is not the original attending provider, he or she should question the claimant to determine whether an application for benefits has been filed for the condition. If no application has been previously filed, it should be completed immediately and forwarded to the department with information as to the name and address of the original provider if known, so that he/she may be contacted for necessary information. If an application has been filed, it is necessary to have the claimant submit in writing a request for transfer as

outlined in WAC 296-31-065, if the claimant and provider agree that a change of provider is desirable.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-050, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-050, filed 11/13/92, effective 12/14/92.]

WAC 296-31-060 Reporting requirements. The department may require reports at any time as is necessary in order to determine initial or continued authorization of benefits or services. However, the department requires the following reports at various stages of a claim in order to authorize mental health treatment or services, time loss compensation, and bill payments for innocent victims of crime:

(1) **Initial report of injury:** To establish a claim, an application for benefits must be completed and submitted to the department. The provider may bill under code 1040M for the filing of the application. In addition, the examination or assessment charge may be billed. Reimbursement of these services will be paid if the claim is allowed by the department. Billing for an extended or comprehensive visit of more than one hour may require submission of additional reports.

(2) **Initial evaluation report:** This report must be submitted by the provider no later than thirty days from the date of first treatment or the date the claim is allowed, whichever is later. The report must include the preliminary diagnosis and symptoms, proposed treatment plan and treatment goals, including the treatment modality or modalities to be employed, and expected length of treatment. It must also include a diagnosis of any preexisting conditions and their potential effect on the condition resulting from the assault. Any change in the treatment plan must be addressed either in a modified treatment plan submitted to the department or in a ninety-day narrative report. Absence of a response from the department to the proposed treatment plan or modification within fourteen days shall constitute authorization to proceed with the plan as long as the treatment plan does not contain measures requiring preauthorization per WAC 296-31-010(5).

(3) **Office notes and follow-up visits:** Legible copies of office or progress notes or other work products may be, as determined by the department, required documentation to substantiate all follow-up visits or treatment following the initial evaluation. Office notes are not acceptable in lieu of requested narrative reports.

(4) **Ninety-day narrative reports:** When treatment is to continue beyond ninety days from the first date of treatment, submission of a narrative report is required every ninety days to substantiate the need for continued care. A narrative report must contain the basic information outlined in these rules. A narrative report should be billed under code 0100C and described as a ninety-day report. Treatment in excess of ninety days may be authorized by the department only after receipt and review of the ninety-day narrative report. Absence of a response from the department to a report shall constitute authorization for continued treatment. When treatment beyond ninety days will not be authorized or is authorized with limits on frequency or provider type, notification will be sent by the department giving a thirty-day transition period. In the case of a contested decision, a claimant or a provider may file a written protest to the department or

appeal to the board of industrial insurance appeals. Ninety-day progress reports must include current DSM III, DSM IV, and/or ICD-9-CM diagnosis(es), their relationship (if any) to the conditions sustained as the result of the criminal act, a summary of the progress made toward therapy goals or issue resolutions established in the initial evaluation, an estimate of the duration and frequency of further sessions and an updated prognosis for recovery.

(5) **Hospital reports:** When the claimant is hospitalized, it is the responsibility of the attending mental health provider to submit his or her reports to the hospital for submission with the hospital billing. The attending mental health provider may bill for hospital visits without attaching copies of the reports.

(6) **Consultation reports:** To substantiate treatment of more than one hundred eighty days, a consultation with a consultant chosen by the attending mental health provider is required. The department may require the claimant to be examined by the consultant as part of the consultation process with supervisory approval. Although no prior authorization is required for such consultations, the consultant must meet crime victims compensation program's provider registration requirements and the department must be notified when such consultation is arranged. The consultant is responsible for submitting a copy of the report, following guidelines developed by the department, within fifteen days from the date of the consultation. Treatment may only be authorized to extend beyond one hundred eighty days in mental health cases after the department has received this report. Absence of response, by the department upon receipt of the report shall constitute authorization for additional treatment. When extended treatment will not be authorized or will be terminated, notification will be sent by the department giving a thirty-day transition period. The department may request additional consultations and/or independent assessments as warranted by the individual case.

(7) **Termination reports:** When a mental health practitioner discontinues treatment of a claimant because the condition for which treatment was provided is fixed and stable or for any other reason, a termination report shall be completed and provided to the program within sixty days of the last visit.

(8) **Reopening application:** On claims closed over sixty days, the department will pay for completion of a reopening application (Code 1041M), an office visit and diagnostic studies necessary to complete the application. No other benefits will be paid until the adjudication decision is rendered. When reopening is granted, the department can pay benefits for a period not to exceed sixty days prior to the date the reopening application is received by the department.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-060, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-31-060, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-060, filed 11/13/92, effective 12/14/92.]

WAC 296-31-065 Ongoing treatment. (1) Cases that remain open more than one hundred eighty days: When the claimant requires treatment beyond one hundred eighty days, a consultation with another mental health provider who meets the department's provider registration requirements, is necessary to determine and/or establish the need for continued

treatment and/or payment of time-loss compensation. A detailed consultation report must be provided to the department.

Three levels of consultation are recognized: Limited, extensive and complex. Detailed descriptions of each type of consultation are included under procedure codes 0108C, 0109C and 0110C in the publication entitled *Crime Victims Compensation Mental Health Treatment Rules and Fees*.

(2) Procedures and/or continued treatment requiring consultation: In the event of complication, controversy, or dispute over the treatment aspects of any claim, the department will not authorize continued treatment until the complication, controversy, or dispute has been resolved and the department has received notification of any findings and reviewed any recommendations.

(a) The department may consider claims as complicated, controversial or disputed when involving treatment or conditions as follows:

(i) All counseling or psychotherapy, pertaining to immediate family members, requiring treatment sessions of more than twelve visits.

(ii) All family therapy visits, not including the claimant, requiring more than twelve visits.

(iii) All conditions not related to the accepted condition involving emotional, psychiatric, or social problems which are likely to complicate recovery.

(iv) All therapeutic procedures of a controversial nature or type not in common use for the specific condition.

(v) Cases where there are complications or unfavorable circumstances such as age, preexisting conditions, or, because of occupational requirements, etc.

(vi) Elective nonemergent hospital admission.

(vii) Any other circumstance that the department may define.

(b) The department may resolve issues of claim complication, controversy, or dispute using consultants, independent assessments and/or requesting a review of policies or procedures by the department's mental health advisory committee. The committee may recommend courses of action to resolve these issues to including, but not limited to, recommendation of an independent assessment.

(c) In cases presenting diagnostic or therapeutic problems difficult to resolve to the attending mental health provider (psychiatrist, psychologist and/or counselor), consultation with a specialist will be allowed without prior authorization. The consultant must submit his or her findings and recommendations immediately to the attending provider and the department.

(i) Whenever possible, the referring mental health provider should make his or her records available to the consultant to avoid unnecessary duplication. Consultants may proceed with indicated and reasonable diagnostic studies as permitted within their scope of practice.

(ii) Consultations must be held within the local geographic area of the claimant's residence, if possible, and with a consultant not having a mutual proprietary or business interest with the attending mental health provider. Exceptions to this requirement may be made only with department preauthorization. The department does not prohibit the use of members of the same professional or social associations.

(iii) The mental health provider will not arrange a consultation if notification has been received that an independent assessment is being arranged by the department. If a recent consultation has been completed and the attending mental health provider is notified that the department is arranging an assessment, the department must be advised immediately of the consultation.

(iv) The consultation fee will be paid only if a consultation report is complete and contains all psychological findings as well as all pertinent negative or normal findings. The report must be received in the department within fifteen days from the date of the consultation. No fee may be paid to the consultant, by the department, if the claimant misses/fails to attend the appointment. However, the claimant may be billed directly.

(v) The consultant may not order, prescribe, or provide treatment without the consent of the claimant. No transfer will be made to the consultant without the written request of the claimant.

(3) Concurrent treatment: In some cases, treatment by more than one provider may be allowed. The department will consider authorization of concurrent treatment when the accepted condition requires specialty or multidisciplinary care. (Individual and group counseling sessions provided by more than one provider is not concurrent treatment.) When requesting consideration of concurrent treatment, the attending mental health provider must provide the department with the following: The name, address, discipline, and specialty of all other providers requested to assist in the treatment of the claimant and an outline of their responsibility in the case and an estimate of the length of the period of concurrent care. When concurrent care is allowed, the department will recognize one primary attending mental health provider, who will be responsible for directing the over-all treatment program; providing copies of all reports and other data received from the involved providers and, in time loss cases, providing the adequate certification evidence of the claimant's inability to work. The department will approve concurrent care on an individual case basis.

(4) Transfer of attending provider: All transfers from one provider to another must be approved by the department. Normally transfers will be allowed only after the claimant has been under the care of the attending mental health provider for sufficient time for the provider to: Complete the necessary diagnostic studies, establish an appropriate treatment regimen, and evaluate the efficacy of the therapeutic program. Under RCW 51.36.010 claimants are entitled to free choice of attending provider subject to the limitations of RCW 7.68.130. Except as provided under (a) through (g) of this subsection, no reasonable request for transfer will be denied. The claimant must be advised when and why a transfer is denied. The department reserves the right to require a claimant to select another provider for treatment, under the following conditions:

(a) When more conveniently located providers, qualified to provide the necessary treatment, are available.

(b) When the attending provider fails to cooperate in observance and compliance with the department rules.

(c) In time loss cases where reasonable progress towards return to work is not shown.

(d) Cases requiring specialized treatment, which the attending provider's authority is not qualified to render, or is outside the scope of the attending provider's authority to practice.

(e) Where the department finds a transfer of provider to be appropriate and has requested the claimant to transfer in accordance with this rule, the department may select a new attending provider if the claimant unreasonably refuses or delays in selecting another attending provider.

(f) In cases where the attending provider is not qualified to treat each of several accepted conditions. This does not preclude concurrent care where indicated.

(g) No transfer will be approved to a consultant without the written request of the claimant. Transfers will be authorized for the foregoing reasons or where the department in its discretion finds that a transfer is in the best interest of returning the claimant to a productive role in society.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-065, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-31-065, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-065, filed 11/13/92, effective 12/14/92.]

WAC 296-31-069 For what reasons may independent mental health or independent medical assessments be obtained? What is required in independent assessment reports?

(1) Independent medical and mental health assessments may be obtained when requested by the provider, or on the department's initiative, for the following reasons:

(a) To rate permanent impairment when treatment has been concluded; or

(b) To evaluate an application to reopen a claim; or

(c) To determine if there are conditions related to the effects of the crime or preexisting conditions aggravated by the crime for which the claim was filed and if treatment remains necessary for those conditions; or

(d) To determine if crime-related treatment is still necessary and if present treatment is effective; or

(e) To determine if treatment is still leading to recovery; or

(f) To obtain other information that may be necessary for the department to make decisions on the victim's claim.

(2) Practitioners participating in an independent mental health assessment ordered by the department must provide us with a report within thirty days following the last assessment date. The report must:

(a) Be identified as an independent assessment report;

(b) Be specific and factual;

(c) Specify the mental health condition(s) and symptoms found and their relationship to the crime for which the claim was filed. Use the codes contained in the currently accepted DSM;

(d) Provide specific conclusions drawn from the assessment and state opinions that respond to the questions included in the examination request;

(e) If applicable, include the category of permanent impairment that the assessor finds most nearly describes his or her findings.

(3) Independent medical assessment reports are governed by WAC 296-23-260.

(1999 Ed.)

[Statutory Authority: RCW 7.68.030, 7.68.070, 51.32.110, 51.04.020(1) and 51.04.030. 98-24-095, § 296-31-069, filed 12/1/98, effective 1/1/99. Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-069, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-069, filed 11/13/92, effective 12/14/92.]

WAC 296-31-070 Provider obligations—Acceptance of rules and fees.

(1) The filing of a crime victims compensation claim, or the rendering of treatment to a victim who comes under the department's jurisdiction constitutes acceptance of the department's crime victims compensation mental health rules and mental health fees and compliance with its rules and fees. In accordance with RCW 7.68.060(1) of the Crime Victims Act, when a mental health provider renders treatment to a victim entitled to benefits under the law, it shall be the duty of the mental health provider to inform the victim of his or her rights under this title and to lend all necessary assistance in making the application for compensation and such proof of other matters as required by the rules of the department without charge to the victim; a victim shall not be billed for treatment rendered for his or her accepted condition. The department may be contacted to obtain brochures and copies of the act.

When there is questionable eligibility, (e.g., service is not usually allowed for crime victims when a investigation or claim determination is pending), the provider may require the claimant to pay for the treatment rendered. In cases of questionable eligibility where the provider has billed the claimant or other insurance, and the claim is subsequently allowed, the provider shall refund the claimant in full within thirty days of notification of allowance of claim and bill the department for services rendered at usual and customary charges. Cases in which there is a question of ethics or quality of care will be referred to the department of health.

(2) The department must be notified immediately when an unrelated condition is being treated concurrently with an accepted condition.

(3) Penalties. The reporting requirements and penalty provision for physicians contained in RCW 51.36.060 and 51.48.060 shall be the same for physicians under these rules pursuant to RCW 7.68.100.

(4) Conditions preexisting the accepted condition are not the responsibility of the department. When an unrelated condition is being treated concurrently with the accepted condition, the attending practitioner must notify the department immediately and submit the following:

(a) Diagnosis and/or nature of unrelated condition.

(b) Treatment being rendered.

(c) The effect, if any, on accepted condition.

Temporary treatment of an unrelated condition may be allowed, upon prior approval by the department, provided these conditions directly retard recovery of the accepted condition. The department will not approve or pay for treatment for a known preexisting unrelated condition for which the claimant was receiving treatment prior to his or her crime victims claim, which is not retarding recovery from his or her accepted condition.

A thorough explanation of how the unrelated condition is affecting the accepted condition must be included with the request for authorization.

The department will not pay for treatment of an unrelated condition when it no longer exerts any influence upon the accepted condition. When treatment of an unrelated condition is being rendered, reports must be submitted monthly outlining the effect of treatment on both the unrelated and the accepted conditions.

The department will not pay for treatment of unrelated conditions unless specifically authorized, including purchases of drugs or medicines.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-070, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-070, filed 11/13/92, effective 12/14/92.]

WAC 296-31-071 Keeping of records. A provider who requests payment from the department for services shall maintain all patient and billing records necessary for the director's authorized auditors to audit the provision of services. A provider shall keep all records necessary to disclose the extent of services furnished to claimants or their family members. These records shall be provided to department representatives upon request and at a minimum, these records shall include specific documentation of the level and type of service for which payment is sought. Records must be maintained for audit purposes for a minimum of five years from the date of the last treatment of the claimant.

The confidentiality concerning the safeguarding and release of claimant personal information is governed under RCW 7.68.140 and 7.68.145 of the Crime Victims Act. The department may be contacted for brochures and copies of the act.

[Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-071, filed 11/13/92, effective 12/14/92.]

WAC 296-31-072 Review of mental health services providers. (1) The department may review providers' patient and billing related records to ensure claimants are receiving proper and necessary care and to ensure providers' compliance with the department's rules, fee schedules, and policies. A records review may be the basis for corrective action against the provider.

(2) The department may review records before, during, or after delivery of services. Records reviews may be conducted for cause or at random and may include the utilization of statistical sampling methodologies and projections based upon sample findings. Records reviews may be conducted at or away from the provider's places of business, at the department's discretion.

(3) The department will give ten working days written notification to any provider, except as authorized in WAC 296-18A-460, that the provider's patient and billing related records will be reviewed by an auditor at the provider's place(s) of business to determine compliance with mental health rules and standards.

(4) The provider shall provide, in lieu of originals, legible copies of providers' records if requested by the department. Providers shall furnish copies of the requested records within thirty calendar days of receipt of the request.

(5) The department will not remove original records from provider's premises.

[Title 296 WAC—p. 962]

(6) For information regarding the formal appeals process, refer to chapter 51.52 RCW.

[Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-072, filed 11/13/92, effective 12/14/92.]

WAC 296-31-073 Utilization management. The department, as a trustee of funds appropriated by legislature, has a duty to supervise the provision of proper and necessary mental health care that is delivered promptly, efficiently, and economically. Toward this end, the department uses utilization management programs. These programs are designed to monitor and control the proper and necessary use and cost of services.

These programs include, but are not limited to, managed care contracting, prior authorization for services, and alternative reimbursement systems.

[Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-073, filed 11/13/92, effective 12/14/92.]

WAC 296-31-075 Excess recoveries. In cases where a recovery has been made resulting in an excess recovery subject to offset from the future benefits or compensation due, the department is not liable for payment for services rendered by providers. The claimant is responsible for payment at department fee schedule rates. The claimant should be treated and the department billed in accordance with these mental health treatment rules and instructions. When bills are processed against the amount of the excess recovery, the department will notify the provider. The department will resume financial responsibility to or on behalf of the claimant when the amount of such excess has been reduced to zero. Charges for reports, consultations and other actions required of providers by the department solely for the purpose of the department's management of claims will be paid by the department during the period within which the excess recovery is being reduced.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-075, filed 7/5/95, effective 8/5/95. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-075, filed 11/13/92, effective 12/14/92.]

WAC 296-31-080 Billing procedures. (1) All services rendered must be in accordance with these mental health treatment rules. The department may reject bills for services rendered in violation of these rules. The claimant may not be billed for services rendered in violation of these rules. However, claimants may be billed if they fail to keep or miss a properly scheduled appointment.

Providers shall bill their usual and customary fee for services. If a usual and customary fee for any particular service is lower to the general public than listed in the fee schedules, the practitioner shall bill the department at the lower rate.

(a) Bills must be itemized on department forms or other forms which have been approved by the department. Physicians, advanced registered nurse practitioners, psychologists, and masters level mental health counselors may use the National Standard HCFA 1500 Health Insurance Claim Form or the department's statement for crime victim services. When billing for treatment of a family member other than the claimant, you must identify the family member by name and relationship to the claimant. Hospitals use the UB-92 billing

form for institution services and the National Standard HCFA 1500 Health Insurance Claim Form for professional services.

(b) Bills must specify the date and type of service, the appropriate procedure code, the condition treated, and the charges for each service.

(c) Every bill submitted to the department must be completed to include the following:

- (i) Claimant's name and address;
- (ii) Claimant's claim number;
- (iii) Date of injury;
- (iv) Referring provider's name;
- (v) Dates of service;
- (vi) Place of service;
- (vii) Type of service;
- (A) Psychiatrists and psychologists use type of service 3.
- (B) Master level counselors use type of service M.
- (C) Advanced registered nurse practitioners (ARNP) use type of service N.

(viii) Appropriate procedure code or hospital revenue code;

(ix) Description of service; if mental health patient is not the claimant, give name and relationship to the claimant;

- (x) Charge;
- (xi) Units of service;
- (xii) Total bill charge;
- (xiii) Provider of service;
- (xiv) Group, clinic, center, or facility name;
- (xv) Billing address;
- (xvi) Federal tax information;
- (A) Federal tax identification number; or
- (B) Social Security number.

(xvii) Date of billing;

(xviii) Submission of supporting documentation required under (f) of this subsection;

(xix) Private or public insurance eligibility and amounts paid.

(d) Responsibility for the completeness and accuracy of the description of services and charges billed rests with the provider rendering the service, regardless of who actually completes the bill form.

(e) Providers are urged to bill on a monthly basis. Bills must be submitted within ninety days from the date of service to be considered for payment. If insurance or public agency collateral resources exist bills must be received within ninety days following payment or rejection by the resource. A copy of the payment or rejection must accompany the bill.

(f) The following supporting documentation must be maintained and submitted when billing for services, as may be appropriate:

- (i) Intake evaluation;
- (ii) Progress reports;
- (iii) Consultation reports;
- (iv) Special or diagnostic study reports;
- (v) Independent assessment or closing exam reports;
- (vi) For BR procedures - see WAC 296-31-090 for requirements;

(vii) Claimant public or private insurance information.

(g) The claim number must be placed in the upper right hand corner on each bill and on each page of reports and other correspondence.

(h) Rebills. If a provider does not receive payment or notification from the department within ninety days, services may be rebilled. Rebills must be submitted for services denied if a claim is closed or rejected and subsequently reopened or allowed. Rebills should be identical to the original bill: Same charges, codes, and billing date. The statement "rebill" must appear on the bill.

(i) Any inquiries regarding adjustment of charges must be submitted within ninety days from the date of payment to be considered.

(j) Any denied charge may be protested in writing to the department or appealed to the board of industrial insurance appeals.

(2) Allowance and payment for medication. The department will pay for medications or supplies dispensed for the treatment of conditions resulting from a crime victim injury and/or conditions which are retarding the recovery from the claimant's condition, for which the department has accepted temporary responsibility. Specific information governing allowance and payment for medication is contained in WAC 296-20-17001.

(3) Payment of out-of-state providers.

(a) Providers of mental health services located outside of the state of Washington shall bill their usual and customary fees and will be paid according to the Washington state crime victims compensation program mental health treatment rules and fees.

(b) Independent medical exams (independent assessments) shall be billed and paid according to the examiner's usual and customary fee.

(c) In all cases these payment levels are the maximum allowed to providers of services to claimants. Should a provider's charge exceed the payment amount allowed under the state of Washington crime victim compensation program rules, the provider is prohibited from charging the claimant for the difference between the provider's charge and the allowable rate. Providers violating this provision are ineligible to treat claimants as provided by these mental health rules and are subject to other applicable penalties.

(d) Only those diagnostic and treatment services authorized under the state of Washington mental health rules may be allowed by the department. As determined by the department, the scope of practice of providers in bordering states may be recognized for payment purposes, except that in all cases WAC 296-20-03002 (treatment not authorized) shall apply. Specifically, services permitted under crime victims compensation programs in the provider's place of business, but which are not allowed chapters 296-20, 296-30, and 296-31 WAC of the state of Washington, may not be reimbursed. When in doubt, the provider should verify coverage of a service with the department.

(e) Out-of-state hospitals will be paid according to WAC 296-30-081.

[Statutory Authority: RCW 51.36.010, 7.68.030, 51.04.020 (1) and (4), 51.04.030, 7.68.080 and 7.68.120. 97-02-090, § 296-31-080, filed 12/31/96, effective 1/31/97. Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-080, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-31-080, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-080, filed 11/13/92, effective 12/14/92.]

WAC 296-31-090 Mental health fees. (1) Rules and billing procedures are presented in detail in the previous sections, some commonalities are repeated here for the convenience of mental health providers referring to the mental health fee section. Definitions and items unique to billing procedures and fees are also included.

Psychiatric care may be billed without time dimensions according to the procedure or service as are medical or surgical procedures. In billing psychotherapy procedures, time is only one aspect and may be expressed as is customary in the local area. For example, the usual appointment length of an individual psychotherapy procedure may be signified by the procedure code alone. The modifier '-52' may be used to signify a service that is reduced or less extensive than the usual procedure. The modifier '-22' may be used to indicate a more extensive service. Thus, psychotherapy procedures may be reported by the procedure code alone or by the procedure code with a modifier.

Facility charges are not payable when a provider elects to use hospital facilities or other outpatient facilities in lieu of maintaining a private practice office.

(2) Definitions.

By report - BR (by report) in the value column indicates that the value of this service is too unusual, variable or new to be assigned a unit value. The report shall provide an adequate definition or description of the services or procedures that explain why the services or procedures are too unusual, variable, or complex to be assigned a relative value unit, using any of the following as indicated:

- (a) Diagnosis - ICD9 - DSM III or DSM IV.
- (b) Whenever possible, list the nearest similar procedure by number according to this schedule.

The department may adjust BR procedures when such action is indicated.

Maximum fees - The maximum allowable fee for a procedure is the fee contained in the publication entitled *Crime Victims Compensation Program Mental Health Treatment Rules and Fees*. Prior to the establishment or amendment of the fee schedules, the department will give at least thirty calendar days notice by mail to interested persons who have made timely request for advance notice of the establishment or amendment of the fee schedules. To request advance notice of the establishment or amendment of the fee schedules, interested persons must contact the department at the following address:

Department of Labor and Industries
 Crime Victims Compensation Section
 P.O. Box 44520
 Olympia, WA 98504-4520

No fee is payable by the department for missed appointments unless the appointment is for an examination arranged by the department. Claimants may be billed directly for missed or "no show" appointments.

Mental health modifiers - Listed values for most procedures may be modified under certain circumstances. When applicable, the modifying circumstance should be identified by the addition of the appropriate "modifier code number" after the usual procedure number. The value should be listed as a single modified total for the procedure.

Report required - The values for procedures for which a report is required include the report fee. **Do not bill separately for these reports.**

Unusual or unlisted procedure - Value of unlisted services or procedures should be substantiated "by report" (BR). Refer to the definition of **By report** for reporting requirements.

(3) Advanced registered nurse practitioners are reimbursed at ninety percent of values listed for psychologists or psychiatrists.

(4) Mental health services. The following graduated listing of services is an attempt to reflect the relative values of the time and skills required at the various service levels. The listed values apply only when performed by mental health providers registered with and authorized by the department to provide services to claimants through this program.

Modifier		Unit Value
-22	UNUSUAL SERVICES: When the services provided are greater than those usually required for the listed procedure, identify by adding this modifier to the usual procedure number. Requires written justification	BR
-52	REDUCED VALUES: Under certain circumstances, the listed value for a procedure is reduced or eliminated because of ground rules, common practice, or at the mental health provider's election. Under these or similar circumstances, the services provided can be identified by their usual procedure numbers and the use of a reduced value indicated by adding this modifier to the procedure number. (Use of this modifier provides a means of reporting services at a reduced charge without disturbing usual relative values.)	BR
-8N	CONCURRENT CARE, SERVICES RENDERED BY MORE THAN ONE PROVIDER: When the claimant's condition requires the additional services of more than one provider, each provider may identify his or her services by adding this modifier to the service procedure code	BR
-96	SPECIAL AGREEMENT WITH CRIME VICTIMS COMPENSATION PROGRAM: This modifier is to be used by providers who have a special agreement with the crime victims compensation program for certain designated procedures. Any request for special agreement should be directed to:	

Crime Victims Compensation Program
 Special Claim Unit
 PO Box 44523
 Olympia WA 98504-4523

THE VALUES FOR PROCEDURES FOR WHICH A REPORT IS REQUIRED INCLUDE THE REPORT FEE. DO NOT BILL SEPARATELY FOR THESE REPORTS.

[Statutory Authority: RCW 7.68.030, 51.04.020(1) and 51.04.030. 95-15-004, § 296-31-090, filed 7/5/95, effective 8/5/95. Statutory Authority: Chapter 7.68 RCW. 94-02-015, § 296-31-090, filed 12/23/93, effective 1/24/94. Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-090, filed 11/13/92, effective 12/14/92.]

WAC 296-31-100 Severability. If any provision of these rules, or their application to any person or circumstance is held invalid, the remainder of the rules, or the application of the provision to other persons or circumstances is not affected.

[Statutory Authority: RCW 43.22.050. 92-23-033, § 296-31-100, filed 11/13/92, effective 12/14/92.]

**Chapter 296-32 WAC
SAFETY STANDARDS FOR
TELECOMMUNICATIONS**

WAC

- 296-32-200 Scope and application.
- 296-32-210 Definitions.
- 296-32-215 Safe place standard.
- 296-32-220 General.
- 296-32-230 Training.
- 296-32-240 Employee protection in public work areas.
- 296-32-250 Tools and personal protective equipment—General.
- 296-32-260 Rubber insulating equipment.
- 296-32-270 Personal climbing equipment.
- 296-32-280 Ladders.
- 296-32-290 Vehicle-mounted material handling devices and other mechanical equipment.
- 296-32-300 Materials handling and storage.
- 296-32-310 Cable fault locating and testing.
- 296-32-320 Grounding for employee protection—Pole lines.
- 296-32-330 Overhead lines.
- 296-32-340 Underground lines and cable vaults.
- 296-32-350 Microwave transmission.
- 296-32-360 Tree trimming—Electrical hazards.
- 296-32-370 Buried facilities—Communications lines and power lines in the same trench.

**DISPOSITION OF SECTIONS FORMERLY
CODIFIED IN THIS CHAPTER**

- 296-32-001 Foreword—Effective date. [Foreword, effective 4/1/66.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-010 Statements of fact—Construction of rules. [Rules (part), effective 4/1/66; Regulations 1.3, 1.4, 1.7, 1.8, 1.9, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-011 Procedure for settling controversy. [Rules (part), effective 4/1/66; Regulation 1.6, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-020 Causes of accident. [Rules (part), effective 4/1/66; Regulation 1.10, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-030 Causes of accident—Safety. [Rules (part), effective 4/1/66; Regulation 1.11, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-040 Definitions. [Definitions, effective 4/1/66; Regulations 1.12—1.25, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-050 Employer's responsibility. [Rules (part), effective 4/1/66; Regulations 2.1—2.11, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-060 Foreman's responsibility. [Rules (part), effective 4/1/66; Regulations 2.12—2.23, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-070 Employee's responsibility. [Rules (part), effective 4/1/66; Regulations 2.24—2.31, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.

- 296-32-080 First-aid. [Rules (part), effective 4/1/66; Regulations 3.1—3.4, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-090 Industrial hygiene. [Rules (part), effective 4/1/66; Regulations 3.5—3.7, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-094 Overhead work. [Rules (part), effective 4/1/66.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-098 Molten solder handling. [Rules (part), effective 4/1/66.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-100 Aerial plant. [§ VI, Rules 6.010—6.100, effective 4/1/66; Regulations 4.1—4.15, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-110 Underground plant. [§ VII, Rules 7.010—7.120, effective 4/1/66; Regulations 5.1—5.12, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-120 Central office plant. [§ IV, Rules 4.010—4.060, effective 4/1/66; Regulations 6.1—6.7, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-130 Tools and protective devices. [§ II, Rules 2.010—2.460, effective 4/1/66; Regulations 7.1—7.50, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-140 Motor vehicles, work equipment and transportation. [§ III, Rules 3.010—3.160, effective 4/1/66; Regulations 8.1—8.14, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-150 Power exposures. [§ VIII, Rules 8.010—8.200, effective 4/1/66; Regulations 9.1—9.20, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-160 General safety requirements. [§ I, Rules 1.010—1.120, effective 4/1/66; Rules 10.2—10.7, 10.10, 10.11, 10.14, 10.15, 10.16, 10.17, filed 3/23/60.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-170 Manlift equipment. [§ V, Rules 5.010—5.090, effective 4/1/66.] Repealed by Order 77-12, filed 7/11/77.
- 296-32-180 Electronic communication equipment. [§ IX, Rules 9.010—9.120, effective 4/1/66.] Repealed by Order 77-12, filed 7/11/77.

WAC 296-32-200 Scope and application. (1) This chapter sets forth safety and health standards that apply to the work conditions, practices, means, methods, operations, installations and processes performed at telecommunications centers and at telecommunications field installations, which are located outdoors or in building spaces used for such field installations. "Center" work includes the installation, operation, maintenance, rearrangement, and removal of communications equipment and other associated equipment in telecommunications switching centers. "Field" work includes the installation, operation, maintenance, rearrangement, and removal of conductors and other equipment used for signal or communication service, and of their supporting or containing structures, overhead or underground, on public or private rights of way, including buildings or other structures.

(2) These standards do not apply:

(a) To construction work, as defined in chapter 296-155 WAC, nor

(b) To installations under the exclusive control of electric utilities used for the purpose of communications or metering, or for generation, control, transformation, transmission, and distribution of electric energy, which are located in buildings used exclusively by the electric utilities for such purposes, or located outdoors on property owned or leased by the electric utilities or on public highways, streets, roads, etc., or outdoors by established rights on private property.

(3) Operations or conditions not specifically covered by this chapter are subject to all the applicable standards contained in chapter 296-24 WAC, general safety and health standards. Operations which involve construction work, as defined in chapter 296-155 WAC are subject to all the appli-

cable standards contained in chapter 296-155 WAC, safety standards for construction work.

(4) This standard shall augment the Washington state general safety and health standards, general occupational health standards, electrical workers safety rules, and any other standards which are applicable to all industries governed by chapter 80, Laws of 1973, Washington Industrial Safety and Health Act. In the event of any conflict between any portion of this chapter and any portion of any of the general application standards, the provisions of this chapter 296-32 WAC, shall apply.

(5) In exceptional cases where compliance with specific provisions of this chapter can only be accomplished to the serious detriment and disadvantage of an operation, variance from the requirement may be permitted by the director of the department of labor and industries after receipt of application for variance which meets the requirements of WAC 296-24-010, general safety and health standards.

[Order 76-38, § 296-32-200, filed 12/30/76; Order 75-41, § 296-32-200, filed 12/19/75.]

WAC 296-32-210 Definitions. (1) The terms used in these standards shall be interpreted in the most commonly accepted sense consistent with the communications industry. The words "shall" and "must," are used to indicate the provisions which are mandatory.

(2) "Aerial lifts." Aerial lifts include the following types of vehicle-mounted aerial devices used to elevate personnel to jobsites above ground:

- (a) Extensible boom platforms,
- (b) Aerial ladders,
- (c) Articulating boom platforms,
- (d) Vertical towers,

(e) A combination of any of the above defined in ANSI A92.2-1969. These devices are made of metal, wood, fiberglass, reinforced plastic (FRP), or other material; are powered or manually operated and are deemed to be aerial lifts whether or not they are capable of rotating above a substantially vertical axis.

(3) "Aerial splicing platform." This consists of a platform, approximately 3 feet x 4 feet, used to perform aerial cable work. It is furnished with fiber or synthetic ropes for supporting the platform from aerial strand, detachable guy ropes for anchoring it, and a device for raising and lowering it with a handline.

(4) "Aerial tent." A small tent usually constructed of vinyl coated canvas which is usually supported by light metal or plastic tubing. It is designed to protect employees in inclement weather while working on ladders, aerial splicing platforms, or aerial devices.

(5) "Alive or live (energized)." Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of the earth in the vicinity. The term "live" is sometimes used in the place of the term "current-carrying," where the intent is clear, to avoid repetition of the longer term.

(6) "Barricade." A physical obstruction such as tapes, cones, or "A" frame type wood and/or metal structure intended to warn and limit access to a work area.

(7) "Barrier." A physical obstruction which is intended to prevent contact with energized lines or equipment, or to prevent unauthorized access to work area.

(8) "Bond." An electrical connection from one conductive element to another for the purpose of minimizing potential differences or providing suitable conductivity for fault current or for mitigation of leakage current and electrolytic action.

(9) "Cable." A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

(10) "Cable sheath." A protective covering applied to cables.

Note: A cable sheath may consist of multiple layers of which one or more is conductive.

(11) "Circuit." A conductor or system of conductors through which an electric current is intended to flow.

(12) "Clearance."

(a) The certification by the proper authority that a specified line or piece of equipment is de-energized; that the proper precautionary measures have been taken and that the line or equipment is being turned over to the workers.

(b) Separation or protection by the use of protective devices to prevent accidental contact by persons or objects on approach to a point of danger.

(13) "Climbing space." The vertical space reserved along the side of poles or structures to permit ready access for line-workers to equipment and conductors located on poles or structures.

(14) "Communication lines." The conductors and their supporting or containing structures for telephone, telegraph, railroad signal, data, clock, fire, police-alarm, community television antenna and other systems which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. When communications lines operate at less than 150 volts to ground, no limit is placed on the capacity of the system. Specifically designed communications cables may include communication circuits not complying with the preceding limitations, where such circuits are also used incidentally to supply power to communication equipment.

(15) "Communication plant." The conductors and their associated equipment required to provide public or private signals or communicative service.

(16) "Competent or qualified person." A person who is familiar with the construction of, or operation of, such lines and/or equipment that concerns their position and who is fully aware of the hazards connected therewith OR one who has passed a journeyman's examination for the particular branch of the trades with which they may be connected. In case of dispute, competency shall be established by a committee appointed by the director or assistant director of the department of labor and industries consisting of representatives of all interested parties.

(17) "Conductor." A material, usually in the form of a wire, cable, or bus bar, suitable for carrying an electric current.

(18) "Effectively grounded." Intentionally connected to earth through a ground connection or connections of sufficiently low impedance and having sufficient current-carrying capacity to prevent the build-up of voltages which may result in undue hazard to connected equipment or to persons.

(19) "Emergency." When an unusual condition exists that endangers life and/or property.

(20) "Energized." Electrically connected to a source of potential difference or electrically charged so as to have a potential different from that of the earth or different from that of adjacent conductors or equipment. For the purpose of these rules, potential differences less than 100 volts shall not apply. This definition does not include communication lines of less than 300 volts.

(21) "Equipment." A general term which includes materials; fittings, devices, appliances, fixtures, apparatus, and similar items used as part of, or in connection with, a supply or communications installation.

(22) "Crewleader or person-in-charge." That person directly in charge of workers doing the work regardless of title.

(23) "Ground (reference)." That conductive body usually earth, to which an electric potential is referenced.

(24) "Ground (as a noun)." A conductive connection, whether intentional or accidental, by which an electric circuit or equipment is connected to reference ground.

(25) "Ground (as a verb)." The connecting or establishment of a connection, whether by intention or accident, of an electric circuit or equipment to reference ground.

(26) "Grounding." The act of placing shorts and grounds on conductors and equipment for the purpose of protecting workers from dangerous voltages while working on such lines or equipment.

(27) "Ground tent." A small tent usually constructed of vinyl coated canvas supported by a metal or plastic frame. Its purpose is to protect employees from inclement weather while working at buried cable pedestal sites or similar locations.

(28) "Grounded conductor." A system or circuit conductor which is intentionally grounded.

(29) "Grounded systems." A system of conductors in which at least one conductor or point (usually the middle wire, or the neutral point of transformer or generator windings) is intentionally grounded, either solidly or through a current-limiting device (not a current-interrupting device).

(30) "Grounding electrode conductor (grounding conductor)." A conductor used to connect equipment or the grounded circuit of a wiring system to a grounding electrode.

(31) "Guard or guarded." Covered, shielded, fenced, enclosed, or otherwise protected by means of suitable covers, casings, barriers, rails, screens, mats, platforms, or warning signs or devices to remove the possibility of dangerous contact on approach by other persons or objects to a point of danger.

(32) "Insulated." Separated from other conducting surfaces by a dielectric substance (including air space) offering a high resistance to the passage of current.

Note: When any object is said to be insulated, it is understood to be insulated in suitable manner for the conditions to which it is subjected. Otherwise, it is, within the purpose of these

standards, uninsulated. Insulating coverings of conductors is one means of making the conductor insulated.

(33) "Insulation (as applied to cable)." That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

(34) "Joint use." The sharing of a common facility, such as a manhole, trench or pole, by two or more different kinds of utilities, (e.g., power and telecommunications).

(35) "Ladder platform." A device designed to facilitate working aloft from an extension ladder. A typical device consists of a platform (approximately 9" x 18") hinged to a welded pipe frame. The rear edge of the platform and the bottom crossmember of the frame are equipped with latches to lock the platform to ladder rungs.

(36) "Ladder seat." A removable seat used to facilitate work at an elevated position on rolling ladders in telecommunication centers.

(37) "Manhole." A subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment and/or cable.

(38) "Manhole platform." A platform consisting of separate planks which are laid across steel platform supports. The ends of the supports are engaged in the manhole cable racks.

(39) "Manlift equipment." Such types of portable truck-mounted equipment as mechanical, electric or hydraulic ladders and boom-mounted buckets or cages.

(40) "Microwave transmission." The act of communicating or signaling utilizing a frequency between 1 GHz (gigahertz) and 300 GHz inclusively.

(41) "Nominal voltage." The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The actual voltage may vary above or below this value.

(42) "Pole balcony or seat." A balcony or seat used as a support for workers at pole-mounted equipment or terminal boxes. A typical device consists of a bolted assembly of steel details and a wooden platform. Steel braces run from the pole to the underside of the balcony. A guard rail (approximately 30" high) may be provided.

(43) "Pole platform." A platform intended for use by a worker in splicing and maintenance operations in an elevated position adjacent to a pole. It consists of a platform equipped at one end with a hinged chain binder for securing the platform to a pole. A brace from the pole to the underside of the platform is also provided.

(44) "Protection from hazardous voltage." The isolation from or de-energizing of equipment to prevent accidental contact by persons or objects on approach to point of danger.

(45) "Protective devices." Those devices such as rubber gloves, rubber blankets, line hose, rubber hoods or other insulating devices, which are specially designed for the protection of workers.

(46) "Public highway." Every way, land, road, street, boulevard, and every way or place in the state open as matter of right to public vehicular travel, both inside and outside the limit of cities and towns.

(47) "Qualified employee." Any worker who by reason of their training and experience has demonstrated an ability to safely perform their duties.

(48) "Qualified line-clearance tree trimmer." A tree worker who through related training and on-the-job experience is familiar with the special techniques and hazards involved in line clearance.

(49) "Qualified line-clearance tree-trimmer trainee." Any worker regularly assigned to a line-clearance tree-trimming crew and undergoing on-the-job training who, in the course of such training, has demonstrated their ability to perform duties safely at their level of training.

(50) "Sheath." As applied to sharp tools that effectively covers the tool.

(51) "System operator/owner." The person or organization that operates or controls the electrical conductors involved.

(52) "Telecommunications center." An installation of communication equipment under the exclusive control of an organization providing telecommunications service, that is located outdoors or in a vault, chamber, or a building space used primarily for such installations.

Note: Telecommunication centers are facilities established, equipped and arranged in accordance with engineered plans for the purpose of providing telecommunications service. They may be located on premises owned or leased by the organization providing telecommunication service, or on the premises owned or leased by others. This definition includes switch rooms (whether electromechanical, electronic, or computer controlled), terminal rooms, power rooms, repeater rooms, transmitter and receiver rooms, switchboard operating rooms, cable vaults, and miscellaneous communications equipment rooms. Simulation rooms of telecommunication centers for training or developmental purposes are also included.

(53) "Telecommunications derricks." Rotating or nonrotating derrick structures permanently mounted on vehicles for the purpose of lifting, lowering, or positioning hardware and materials used in telecommunications work.

(54) "Telecommunication line truck." A truck used to transport workers, tools, and material, and to serve as a traveling workshop for telecommunication installation and maintenance work. It is sometimes equipped with a boom and auxiliary equipment for setting poles, digging holes, and elevating material or workers.

(55) "Telecommunication service." The furnishing of a capability to signal or communicate at a distance by means such as telephone, telegraph, police and fire-alarm, community antenna television, or similar system, using wire, conventional cable, coaxial cable, wave guides, microwave transmission, or other similar means.

(56) "Unvented vault." An enclosed vault in which the only openings are access openings.

(57) "Vault." An enclosure above or below ground which personnel may enter, and which is used for the purpose of installing, operating, and/or maintaining equipment and/or cable which need not be of submersible design.

(58) "Vented vault." An enclosure as described in subsection (57) of this section, with provision for air changes using exhaust flue stack(s) and low level air intake(s), operating on differentials of pressure and temperature providing for air flow.

(59) "Voltage communications." Voltage used for electronic communications equipment to which workers or protective equipment may be subjected.

(a) *High* means over 600 volts to ground—RMS AC or DC or over 1,000 volts RMS across bare parts.

(b) *Medium high* means 151 to 600 volts to ground—RMS AC or DC or 301 to 1,000 volts RMS AC across any bare parts.

(60) "Voltage electric supply." The maximum effective line voltage to which the workers or protective equipment may be subjected.

(a) *Low* includes voltages from 100 to 750 volts.

(b) *High* means those voltages in excess of 750 volts.

(61) "Voltage of an effectively grounded circuit." The voltage between any conductor and ground unless otherwise indicated.

(62) "Voltage of a circuit not effectively grounded." The voltage between any two conductors. If one circuit is directly connected to and supplied from another circuit of higher voltage (as in the case of an autotransformer), both are considered as of the higher voltage, unless the circuit of lower voltage is effectively grounded, in which case its voltage is not determined by the circuit of higher voltage. Direct connection implies electric connection as distinguished from connection merely through electromagnetic or electrostatic induction.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-210, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-210, filed 12/30/76; Order 75-41, § 296-32-210, filed 12/19/75.]

WAC 296-32-215 Safe place standard. (1) No employer shall require any employee to go or be in any employment or place of employment which is not safe.

(2) No employer shall fail or neglect:

(a) Provide safe access to the work site.

(b) To provide and use safety devices and safeguards.

(c) To adopt and use methods and processes to render the employment and place of employment safe.

(d) To do every other thing reasonably necessary to protect the life and safety of employees.

[Order 76-38, § 296-32-215, filed 12/30/76.]

WAC 296-32-220 General. (1) Buildings containing telecommunications centers.

(a) *Illumination.* Lighting in telecommunication centers shall be provided in an amount such that continuing work operations, routine observations, and the passage of employees can be carried out in a safe and healthful manner.

(b) Specific tasks in centers, such as splicing cable and the maintenance and repair of equipment frame lineups, the employer shall install permanent lighting or portable supplemental lighting to attain a higher level of illumination.

(c) Refer to WAC 296-62-09003 (general occupational health standards) which shall apply as minimum standards of illumination for industrial interiors.

(d) *Illumination of field work.* Whenever natural light is insufficient to illuminate the worksite, artificial illumination shall be provided to enable the employee to perform the work safely.

(2) *Working surfaces.*

(a) Working surfaces shall be in conformance with the latest edition of the general safety and health standard WAC 296-24-735 through 296-24-76523.

(b) Guard rails and toe boards may be omitted on distribution frame mezzanine platforms to permit access to equipment. This exemption applies only on the side or sides of the platform facing the frames and only on those portions of the platform adjacent to equipped frames.

(3) Working spaces.

(a) Space shall be provided for access to all medium high and high voltage equipment.

(b) Every structure, new or old, designed for human occupancy shall be provided with exits to permit the prompt escape of occupants in case of fire or other emergency. The means of egress shall be a continuous and unobstructed way of exit travel from any point in a building or structure to a public way and consist of three separate and distinct parts; the way of exit access, the exit and the way of exit discharge. A means of egress comprises the vertical and horizontal ways of travel and shall include intervening room spaces, doorways, hallways, corridors, passageways, balconies, ramps, stairs, enclosures, lobbies, escalators, horizontal exits, courts and yards.

(c) "Maintenance aisles, " or "wiring aisles, " between equipment frame lineups are working spaces and are not a means of egress for purposes of WAC 296-24-550.

(4) Special doors.

(a) When blastproof or power actuated doors are installed in specially designed hardsite security buildings and spaces, they shall be designed and installed so that they can be used as a means of egress in emergencies.

(b) When high voltage apparatus is isolated in a supplementary enclosure, interlocks shall be provided on all access doors. Warning signs shall be provided, which are visible both when the guard or cover is in place or removed.

(5) Equipment, machinery and machine guarding.

(a) When power plant machinery in telecommunications centers is operated with commutators and couplings uncovered, the adjacent housing shall be clearly marked to alert personnel to the rotating machinery.

(b) All power switches on power panels shall be in an open position when they are not controlling an operating circuit. Before opening any power circuit, the load shall be reduced. "Men working" signs, or similar wording shall be placed on switches associated with motors or generators under repair.

(c) When working on the brushes of a machine in operation, employees shall use care not to break a circuit. When it is necessary to remove a brush from the holder, the machine shall be shut down.

(d) Only fuse pullers specifically designed for that purpose shall be used when replacing cartridge type fuses.

(6) Battery handling.

(a) Eye protection devices which provide side as well as frontal eye protection for employees shall be provided when measuring storage battery specific gravity or handling electrolyte, and the employer shall ensure that such devices are used by the employees.

(b) The employer shall also ensure that acid resistant gloves and aprons shall be worn for protection against splattering.

(c) Facilities for quick drenching or flushing of the eyes and body shall be provided unless the storage batteries are of

the enclosed type and equipped with explosion proof vents, in which case sealed water rinse or neutralizing packs may be substituted for the quick drenching or flushing facilities.

(d) Employees assigned to work with storage batteries shall be instructed in emergency procedures such as dealing with accidental acid spills.

(e) Electrolyte (acid or base, and distilled water) for battery cells shall be mixed in a well ventilated room. Acid or base shall be poured gradually, while stirring, into the water. Water shall never be poured into concentrated (greater than 75 percent) acid solutions. Electrolyte shall never be placed in metal containers nor stirred with metal objects.

(f) When taking specific gravity readings, the open end of the hydrometer shall be covered with an acid resistant material while moving it from cell to cell to avoid splashing or throwing the electrolyte.

(g) Ventilation, shall be provided to ensure diffusion of the gasses from the battery to prevent the accumulation of an explosive type mixture.

(h) Racks and trays shall be substantial and treated to be resistant to the electrolyte.

(i) Floors shall be of acid resistant construction or be protected from acid accumulation.

(7) Hazardous materials.

(a) Highway mobile vehicles and trailers stored in garages in accordance with WAC 296-24-47513 (4)(b) may be equipped to carry more than one LP-gas container, but the total capacity of LP-gas containers per work vehicle stored in garages shall not exceed 100 pounds of LP-gas.

(b) All container valves shall be closed when not in use.

(8) Compressed gas.

(a) When using or transporting nitrogen cylinders, special compartments, racks, or blocking shall be provided to prevent cylinder movement.

(b) Regulators shall be removed or guarded before a cylinder is transported.

(9) Support structures.

(a) No employee, or any material or equipment, shall be supported or permitted to be supported on any portion of a pole structure, platform, ladder, walkway or other elevated structure or aerial device unless the employer ensures that the support structure is first inspected by a competent person and it is determined to be strong, in good working condition and properly secured in place.

(b) Workers shall not throw anything from pole to ground, from pole to pole or from ground to pole.

(10) Power exposures.

(a) The employer shall ensure that no employee approaches or takes any conductive object closer to any electrically energized overhead power lines and parts than prescribed in Table 1 unless:

(i) The employee is insulated or guarded from the energized parts (insulating gloves rated for the voltage involved shall be considered adequate insulation), or

(ii) The energized parts are insulated or guarded from the employee and any other conductive object at a different potential, or

(iii) The power conductors and equipment are deenergized and grounded.

(b) While handling communication wires, metal sheaths, or communication equipment, contact shall be avoided with street lamp brackets, trolley span wires, power guys, transformer cases and any other power equipment that may be energized. The safest possible working position shall be assumed before starting work.

(c) Communication employees shall never work in the pole space on jointly used poles between normal primary and secondary attachments.

(d) Where a hazard of a power contact exists, due to use of long handled tools, proper rubber equipment shall be used.

TABLE 1
APPROACH DISTANCES TO EXPOSED ENERGIZED OVERHEAD POWER LINES AND PARTS

Voltage Range (phase to phase, RMS)	Approach Distance (inches)
300 V and less _____	(1)
Over 300 V, not over 750 V _____	12
Over 750 V not over 2 kV _____	18
Over 2 kV, not over 15 kV _____	24
Over 15 kV, not over 37 kV _____	36
Over 37 kV, not over 87.5 kV _____	42
Over 87.5 kV, not over 121 kV _____	48
Over 121 kV, not over 140 kV _____	54

(1) Avoid contact

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-32-220, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-220, filed 12/30/76; Order 75-41, § 296-32-220, filed 12/19/75.]

WAC 296-32-230 Training. (1) Employers shall provide training in the various precautions and safe practices described in this section and shall insure that employees do not engage in the activities to which this chapter applies until such employees have received proper training in the various precautions and safe practices required by this section. However, where the employer can demonstrate that an employee is already trained in the precautions and safe practices required by this section prior to their employment, training need not be provided to that employee in accordance with this section.

(2) Where training is required, it shall consist of on-the-job training or classroom-type training or a combination of both.

(3) The training program shall include a list of the subject courses and the types of personnel required to receive such instruction. A written description of the training program and a record of employees who have received such training shall be maintained for the duration of the employee's employment and shall be made available upon request to the director of the department of labor and industries, or his/her authorized representative.

(4) Such training shall, where appropriate, include the following subjects:

(a) Recognition and avoidance of dangers relating to encounters with harmful substances, and animal, insect, or plant life.

(b) Procedures to be followed in emergency situations, and

(c) First aid training, including instruction in artificial respiration.

(5) It shall be the responsibility of the employer to hold monthly safety meetings at practical points throughout the operation and insist upon employees attending said meetings. Minutes shall be kept of each safety meeting and retained for a period of one year.

(6) It shall be the responsibility of management to develop and maintain a hazard communication program as required by chapter 296-62 WAC, Part C which will provide information to all employees relative to hazardous chemicals or substances to which they are exposed, or may become exposed, in the course of their employment.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-32-230, filed 7/20/94, effective 9/20/94; 89-11-035 (Order 89-03), § 296-32-230, filed 5/15/89, effective 6/30/89; Order 76-38, § 296-32-230, filed 12/30/76; Order 75-41, § 296-32-230, filed 12/19/75.]

WAC 296-32-240 Employee protection in public work areas. (1)(a) Before work is begun in the vicinity of vehicular or pedestrian traffic which may endanger employees, warning signs and/or flags or other traffic control devices shall be placed conspicuously to alert and channel approaching traffic. Where further protection is needed, barriers shall be utilized.

(b) At night, warning lights shall be prominently displayed, and excavated areas shall be enclosed with protective barricades.

(2) When work exposes energized or moving parts that are normally protected, danger signs shall be displayed and barricades erected to warn other personnel in the area.

(3) The employer shall insure that an employee finding any crossed or fallen wires which create or may create a hazardous situation at the work area:

(a) Remains on guard or adopts other adequate means to warn other employees of the danger, and

(b) Has the proper authority notified at the earliest practical moment.

[Order 76-38, § 296-32-240, filed 12/30/76; Order 75-41, § 296-32-240, filed 12/19/75.]

WAC 296-32-250 Tools and personal protective equipment—General. (1) Personal protective equipment, protective devices and special tools needed for the work of employees shall be provided and the employer shall ensure that they are used by employees.

(a) Before each day's use the employer shall ensure that these personal protective devices, tools, and equipment are carefully inspected by a competent person to ascertain that they are in good condition.

(b) Tools found to be defective shall be taken out of service.

(2) Head protection. Class B protective helmets shall be provided whenever there is exposure to overhead hazards and/or possible high voltage electrical contact.

(a) Employees working in areas where there is a possible danger of head injury from impact, falling or flying objects, shall be protected by protective helmets.

(b) Criteria for protective helmets.

(i) Protective helmets purchased after February 20, 1995, shall comply with ANSI Z89.1-1986, "American National Standard for Personnel Protection—Protective Headwear for Industrial Workers—Requirements," which is incorporated by reference, or shall be demonstrated to be equally effective.

(ii) Protective helmets purchased before February 20, 1995, shall comply with the ANSI standard "American National Standard Safety Requirements for Industrial Head Protection," ANSI Z89.1-1969, or shall be demonstrated by the employer to be equally effective.

(3) Eye protection. Protective eye and face equipment shall be required where there is a possibility of injury that can be prevented by such equipment. In such cases, employers shall make conveniently available a type of protector suitable for the work to be performed, and employees shall use such protectors.

Note: See chapter 296-24 WAC, Part A-2, for additional personal protective equipment requirements.

(4) Tent heaters, torches and open flame. Open flames shall not be used within ground tents or on platforms within aerial tents unless:

(a) The tent covers are constructed of fire resistant materials, and

(b) Ventilation is provided to maintain safe oxygen levels and avoid harmful buildup of combustion products and combustible gases.

(5) Portable power equipment.

(a) All portable power equipment used in the telecommunications industry shall be grounded.

(b) Nominal 120V, or less, portable generators used for providing power at work locations do not require grounding if the output circuit is completely isolated from the frame of the unit.

(c) Grounding shall be omitted when using soldering irons, guns or wire-wrap tools on telecommunication circuits.

(6) Vehicle-mounted utility generators. Vehicle-mounted utility generators used for providing nominal 240V AC or less for powering portable tools and equipment need not be grounded to earth if all of the following conditions are met:

(a) One side of the voltage source is solidly strapped to the metallic structure of the vehicle;

(b) Grounding-type outlets are used, with a "grounding" conductor between the outlet grounding terminal and the side of the voltage source that is strapped to the vehicle;

(c) All metallic encased tools and equipment that are powered from this system are equipped with three-wire cords and grounding-type attachment plugs, except as designated in subsection (7) of this section.

(7) Portable lights, tools and appliances. When operated from commercial power such metal parts of these devices shall be grounded, unless these tools or appliances are protected by a system of double insulation, or its equivalent. Where such a system is employed, the equipment shall be distinctively marked to indicate double insulation.

(8) Lead work. When operated from commercial power the metal housing of electric solder pots shall be grounded. Electric solder pots may be used with the power equipment described in this subsection, without a grounding conductor.

The employer shall ensure that wiping gloves or cloths and eye protection are used in lead wiping operations. A drip pan to catch hot lead drippings shall also be provided and used.

(9) Fire extinguishers.

(a) Fire extinguishers shall be provided for the protection of both the building structure and the occupancy hazards contained therein.

(b) Employees shall be familiar with the location and operation of fire extinguishers.

(c) Any fire extinguishers showing defects shall be removed from service.

(d) Fire extinguishers shall be thoroughly examined and/or recharged or repaired to insure operability and safety once every year.

(e) Each fire extinguisher shall have a durable tag securely attached to show the maintenance or recharge date and the initials or signature of the person performing this service.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-32-250, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-13-045 (Order 82-22), § 296-32-250, filed 6/11/82; Order 76-38, § 296-32-250, filed 12/30/76; Order 75-41, § 296-32-250, filed 12/19/75.]

WAC 296-32-260 Rubber insulating equipment. (1)

Rubber insulating equipment designed for the voltage levels to be encountered shall be provided and the employer shall ensure that they are used by employees as required by this section. This equipment shall meet the electrical and physical requirements contained in ANSI J6.6-1971 "Standard Specifications for Rubber Insulating Gloves," and ANSI J6.4-1971 "Standard Specifications for Rubber Insulating Blankets," with the exception that the maximum proof test current for a 14-inch Class I glove shall be no more than 14mA, and with the further exception that existing 14-inch Class I rubber gloves that meet a maximum proof test current of 14 mA and a minimum breakdown voltage of 10,000 volts (RMS) acquired prior to January 1, 1976, may be used as long as these gloves comply with the retest requirements of subsection (2) of this section.

(2) The employer is responsible for periodic retesting of all insulating gloves, blankets, and other rubber insulating equipment. This retesting shall be electrical, visual and mechanical. The following maximum retesting intervals shall apply:

Gloves, Blankets, and Other Insulating Equipment	Natural Rubber (Months)	Synthetic Rubber (Months)
New	12	18
Reissued	9	15

(3) Protector for gloves. Approved protectors must be worn at all times over rubber gloves. Inner liners may be worn if desired.

(4) Protective equipment fabricated of material other than rubber shall provide electrical and mechanical protection at least equal to that of the rubber equipment.

(5)(a) Gloves and blankets shall be marked to indicate compliance with the retest schedule and shall be marked with the date the next test date is due.

(b) Any rubber gloves found to be defective shall be removed from service and marked as being defective.

(6) Insulating gloves and blankets shall be stored away from direct sunlight, steampipes, radiators and other sources of excessive heat.

(7) Gloves and blankets shall not be folded while in storage. A separate container shall be provided for rubber blankets and blankets shall be wiped clean and rolled before placing in container.

(8) Inspect rubber goods. Before using a pair of rubber gloves or rubber blankets, workers shall personally inspect each glove for defects and give an air test, and the blanket shall be visually inspected for cracks or cuts before using.

Note: Grasp the cuff at opposite sides and twirl the gloves so as to roll it up the cuff and produce air pressure within the glove, then look for leaks and thin places in the rubber.

(9) Patching rubber goods is prohibited; rubber protective equipment shall not be vulcanized or patched.

(10) Rubber gloves for workers.

(a) A pair of rubber gloves, specifically designed for the protection of workers, shall be assigned each worker when required to work on or be exposed to energized parts.

(b) Rubber gloves when not in use shall be carried in a bag provided and designed for that purpose.

[Order 76-38, § 296-32-260, filed 12/30/76; Order 75-41, § 296-32-260, filed 12/19/75.]

WAC 296-32-270 Personal climbing equipment. (1)

General. Safety belts and straps shall be provided and the employer shall ensure their use when work is performed at positions more than 4 feet above ground, on poles, and on towers, except as provided in WAC 296-32-340 (7)(8) of this chapter. No safety belts, safety straps or lanyards acquired after January 1, 1976, may be used unless they meet the tests set forth in chapter 296-45 WAC. The employer shall ensure that all safety belts and straps are inspected by a competent person prior to each day's use to determine that they are in safe working condition.

(2) Telecommunication lineman's body belts, safety straps and lanyards, general requirements. Hardware for lineman's body belts, safety straps and lanyards shall be drop forged or pressed steel and shall have a corrosion resistant finish tested to meet the requirements of the American Society for Testing and Materials B117-64 (50-hour test).

Exception: Lineman's body belts shall be at least four inches in width.

(3) Pole climbers.

(a) Pole climbers may not be used if the gaffs are less than 1-1/4 inches in length as measured on the underside of the gaff.

(b) The gaffs of pole climbers shall be covered with safety caps when not being used for their intended use.

(c) The employer shall ensure that pole climbers are inspected by a competent person for the following conditions: Fractured or cracked gaffs or leg irons, loose or dull gaffs, broken straps or buckles. If any of these conditions exist, the defect shall be corrected before the climbers are used.

(d) Pole climbers shall be inspected as required in this subsection before each day's use and a gaff cut-out test performed at least weekly when in use.

(e) Pole climbers shall not be worn when:

(i) Working in trees (specifically designed tree climbers shall be used for tree climbing),

(ii) Working on ladders,

(iii) Working in an aerial lift,

(iv) Driving a vehicle,

(v) Walking on rocky, hard, frozen, brushy or hilly terrain.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-32-270, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-270, filed 12/30/76; Order 75-41, § 296-32-270, filed 12/19/75.]

WAC 296-32-280 Ladders. (1) The employer shall ensure that no employee nor any material or equipment shall be supported or permitted to be supported on any portion of a ladder unless it is first determined, by inspections and checks conducted by a competent person that such ladder is free of defects, in good condition and secured in place.

(2) The spacing between steps or rungs permanently installed on poles and towers shall be no more than 18 inches (36 inches on any one side). This requirement also applies to fixed ladders on towers, when towers are so equipped. Spacing between steps shall be uniform above the initial unstepped section, except where working, standing, or access steps are required. Fixed ladder rungs and step rungs for poles and towers shall have a minimum diameter of 5/8 inch. Fixed ladder rungs shall have a minimum clear width of 12 inches. Steps for poles and towers shall have a minimum clear width of 4-1/2 inches. The spacing between detachable steps may not exceed 30 inches on any one side, and these steps shall be secured when in use.

(3) After October 31, 1975, portable wood ladders intended for general use shall not be painted but may be coated with a translucent nonconductive coating. Portable wood ladders shall not be longitudinally reinforced with metal.

(4) Portable wood ladders that are not being carried on vehicles and are not in active use shall be stored where they will not be exposed to the elements and where there is good ventilation.

(5) Rolling ladders.

(a) Rolling ladders used in telecommunication centers shall have a width between the side rails, inside to inside, of at least 12 inches.

(b) Except in working spaces that are not a means of egress, the ladders shall have a minimum inside width, between the side rails, of at least eight inches.

(6) Climbing ladders or stairways on scaffolds used for access and egress shall be affixed or built into the scaffold by proper design and engineering, and shall be so located that their use will not disturb the stability of the scaffold. The rungs of the climbing device shall be equally spaced, but may not be less than 12 inches nominal nor more than 16 inches nominal apart. Horizontal end rungs used for platform support may also be utilized as a climbing device if such rungs meet the spacing requirement of this subsection, and if clearance between the rung and the edge of the platform is suffi-

cient to afford a secure handhold. If a portable ladder is affixed to the scaffold, it shall be securely attached and shall have rungs meeting the spacing requirements of this subsection. Clearance shall be provided in the back of the ladder of not less than 6 inches from center of rung to the nearest scaffold structural member.

(7) When a ladder is supported by an aerial strand, and ladder hooks or other supports are not being used, the ladder shall be extended at least 2 feet above the strand and shall be secured to it (e.g. lashed or held by a safety strap around the strand and ladder side rail). When a ladder is supported by a pole, it shall be securely lashed to the pole unless the ladder is specifically designed to prevent movement when used in this application.

(8) Portable wood straight ladders, when in use, shall be equipped with safety shoes.

(9) Ladders shall be inspected by a competent person prior to each use. Ladders which have developed defects shall be withdrawn from service for repair or destruction and tagged or marked as "dangerous do not use."

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-280, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-280, filed 12/30/76; Order 75-41, § 296-32-280, filed 12/19/75.]

WAC 296-32-290 Vehicle-mounted material handling devices and other mechanical equipment. (1) General.

(a) The employer shall ensure that visual inspections are made of the equipment by a competent person each day the equipment is to be used to ascertain that it is in good condition.

(b) The employer shall ensure that tests shall be made at the beginning of each shift by a competent person to insure the vehicle brakes and operating systems are in proper working condition.

(2) Scrapers, loaders, dozers, graders and tractors.

All mobile, self-propelled scrapers, mobile front end loaders, mobile dozers, agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders, with or without attachments, that are used in telecommunications work shall have rollover protective structures that meet the requirements of WAC 296-155-950 through 296-155-965.

(3) Aerial manlift equipment.

(a) These devices shall not be operated with any conductive part of the equipment closer to exposed energized power lines than the clearances set forth in Table 1 of this chapter.

(b) Only qualified drivers shall be permitted to operate aerial manlift equipment and shall possess a current motor vehicle operator's license.

(c) When performing work from aerial manlift equipment, the worker shall wear a safety belt attached to the boom.

(d) When any aerial manlift equipment is parked at the jobsite, the brakes shall be set. Wheel chocks shall be used to prevent uncontrolled movement. If equipped with outriggers, the outriggers shall be implanted on firm footing.

(e) Manufacturer's recommended maximum load limit shall be posted near each set of controls, kept in legible condition and the maximum load limit shall not be exceeded.

(f) Flashing warning lights shall be installed and maintained on all aerial manlift equipment used on public thoroughfares.

(4)(a) The operation of all motor vehicles and trailers shall be in conformance with the motor vehicle laws, the general safety and health standards of the state of Washington and all local traffic ordinances.

(b) When it is necessary for the worker to work in the bucket at an elevated position with the vehicle in motion, there shall be direct communication between the worker and the vehicle operator.

(5) Derrick trucks and similar equipment.

(a) This equipment shall not be operated with any conductive part of the equipment closer to exposed energized power lines than the clearances set forth in Table 1 of this chapter.

(b) When derricks are used to handle poles near energized power conductors, these operations shall comply with the requirements contained in WAC 296-32-220(10) and 296-32-330(11) of this chapter.

(c) Moving parts of equipment and machinery carried on or mounted on telecommunications line trucks shall be guarded. This may be done with barricades as specified in WAC 296-32-240(2) of this chapter.

(d) Derricks and the operation of derricks shall comply with the following requirements:

(i) Manufacturer's specifications, load ratings and instructions for derrick operation shall be strictly observed.

(ii) Rated load capacities and instructions related to derrick operation shall be conspicuously posted on a permanent weather-resistant plate or decal in a location on the derrick that is plainly visible to the derrick operator.

(iii) Prior to derrick operation the parking brake must be set and the stabilizers extended if the vehicle is so equipped. When the vehicle is situated on a grade, at least two wheels must be chocked on the downgrade side.

(iv) Only persons trained in the operation of the derrick shall be permitted to operate the derrick.

(v) Hand signals to derrick operators shall be those prescribed by ANSI B30.6-1969, "Safety Code for Derricks."

(vi) The employer shall ensure that the derrick and its associated equipment are inspected by a competent person at intervals set by the manufacturer but in no case less than once per year. Records shall be maintained including the dates of inspections, and necessary repairs made.

(vii) Modifications or additions to the derrick and its associated equipment that alter its capacity or affect its safe operation shall be made only with written certification from the manufacturer, or other equivalent entity, such as a nationally recognized testing laboratory, that the modification results in the equipment being safe for its intended use. Such changes shall require the changing and posting of revised capacity and instruction decals or plates. These new ratings or limitations shall be as provided by the manufacturer or other equivalent entity.

(viii) Wire rope used with derricks shall be of improved plow steel or equivalent. Wire rope safety factors shall be in accordance with American National Standards Institute B30.6-1969.

(ix) Wire rope shall be taken out of service, or the defective portion removed, when any of the following conditions exist:

- (A) The rope strength has been significantly reduced due to corrosion, pitting, or excessive heat, or
- (B) The thickness of the outer wires of the rope has been reduced to two-thirds or less of the original thickness, or
- (C) There are more than six broken wires in any one rope lay, or
- (D) There is excessive permanent distortion caused by kinking, crushing, or severe twisting of the rope.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-290, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-290, filed 12/30/76; Order 75-41, § 296-32-290, filed 12/19/75.]

WAC 296-32-300 Materials handling and storage. (1) Poles.

(a) When working with poles in piles or stacks, work shall be performed from the ends of the poles and precautions shall be taken for the safety of employees at the other end of the pole.

(b) During pole hauling operations, all loads shall be secured to prevent displacement. Lights, reflectors and/or flags shall be displayed on the end and sides of the load.

(c) The requirements for installation, removal, or other handling of poles in pole lines are prescribed in WAC 296-32-330 which pertains to overhead lines.

(d) In the case of hoisting machinery equipped with a positive stop load-holding device, it shall be permissible for the operator to leave their position at the controls (while a load is suspended) for the sole purpose of assisting in positioning the load prior to landing it.

(e) Prior to unloading steel, poles, crossarms, and similar material, the load shall be thoroughly examined to ascertain that the load has not shifted, that binders or stakes have not broken, and that the load is not otherwise hazardous to employees.

(2) Cable reels. Cable reels and poles in storage shall be checked or otherwise restrained to prevent uncontrollable movement.

(3) All tools and materials shall be stored in a safe and orderly manner.

(4) Workers shall not carry loose materials, tools, or equipment on or in vehicles in a manner that would constitute a hazard.

(5) All buildings, storage yards, equipment and other property shall be kept in a clean and orderly manner.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-300, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-300, filed 12/30/76; Order 75-41, § 296-32-300, filed 12/19/75.]

WAC 296-32-310 Cable fault locating and testing. (1) Employees involved in using high voltages to locate trouble or test cables shall be instructed in the precautions necessary for their own safety and the safety of other employees.

(2) Before voltage is applied to equipment not isolated, all possible precautions shall be taken to insure that no employee can make contact with the energized conductors under test.

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(3) Only trained and authorized personnel shall repair and test medium and high voltage equipment.

[Order 76-38, § 296-32-310, filed 12/30/76; Order 75-41, § 296-32-310, filed 12/19/75.]

WAC 296-32-320 Grounding for employee protection—Pole lines. (1) Power conductors. Electric power conductors and equipment shall be considered as energized until the employee can determine that they are bonded to one of the grounds as listed in subsection (4) of this section.

(2) Nonworking open wire. Nonworking open wire communications lines shall be bonded to one of the grounds listed in subsection (4) of this section.

(3) Vertical power conduit, power ground wires and street light fixtures.

(a) Metal power conduit on joint use poles, exposed vertical power ground wires, and street light fixtures which are below communications attachments or less than 20 inches above these attachments, shall be considered energized and shall be tested for voltage unless the employee can visually determine that they are bonded to the communications suspension strand or cable sheath.

(b) If no hazardous voltage is shown by the voltage test, a temporary bond shall be placed between such street light fixture, exposed vertical power grounding conductor, or metallic power conduit and the communications cable strand. Temporary bonds used for this purpose shall have sufficient conductivity to carry at least 500 amperes for a period of one second without fusing.

(4) Protective grounding. Acceptable grounds for protective grounding are as follows:

(a) A vertical ground wire which has been tested, found safe, and is connected to a power system multigrounded neutral or the grounded neutral of a power secondary system where there are at least three services connected;

(b) Communications cable sheath or shield and its supporting strand where the sheath or shield is:

(i) Bonded to an underground or buried cable which is connected to a central office ground, or

(ii) Bonded to an underground metallic piping system, or

(iii) Bonded to a power system multigrounded neutral or grounded neutral of a power secondary system which has at least three services connected;

(c) Guys which are bonded to the grounds specified in subdivisions (a) and (b) of this subsection and which have continuity uninterrupted by an insulator; and

(d) If all of the preceding grounds are not available, arrays of driven ground rods where the resultant resistance to ground will be low enough to eliminate danger to personnel or permit prompt operation of protective devices.

(5) Attaching and removing temporary bonds. When attaching grounds (bonds), the first attachment shall be made to the protective ground. When removing bonds, the connection to the line or equipment shall be removed first. Insulating gloves shall be worn during these operations.

(6) Temporary grounding of suspension strand.

(a) The suspension strand shall be grounded to the existing grounds listed in subsection (4) of this section when being placed on jointly used poles.

(b) Where power crossings are encountered on nonjoint lines, the strand shall be bonded to an existing ground listed in subsection (4) of this section as close as possible to the crossing. This bonding is not required where crossings are made on a common crossing pole unless there is an upward change in grade at the pole.

(c) Where traveling roller-type bonds are used, they shall be restrained so as to avoid stressing the electrical connections.

(d) Bonds between the suspension strand and the existing ground shall be at least No. 6AWG copper.

(e) Temporary bonds shall be left in place until the strand has been tensioned, dead-ended, and permanently grounded.

(f) The requirements of subdivision (a) through (e) of this subsection do not apply to the installation of insulated strand.

(7) Antenna work-radio transmitting stations 3-30 MHZ.

(a) Prior to grounding a radio transmitting station antenna, the employer shall insure that the rigger in charge:

(i) Prepares a danger tag signed with their signature,

(ii) Requests the transmitting technician to shutdown the transmitter and to ground the antenna with its grounding switch,

(iii) Is notified by the transmitting technician that the transmitter has been shutdown, and

(iv) Tags the antenna ground switch personally in the presence of the transmitting technician after the antenna has been grounded by the transmitting technician.

(b) Power shall not be applied to the antenna, nor shall the grounding switch be opened under any circumstances while the tag is affixed.

(c)(i) Where no grounding switches are provided, grounding sticks shall be used, one on each side of line, and tags shall be placed on the grounding sticks, antenna switch, or plate power switch in a conspicuous place.

(ii) To further reduce excessive radio frequency pickup, ground sticks or short circuits shall be placed directly on the transmission lines near the transmitter in addition to the regular grounding switches.

(iii) In other cases, the antenna lines may be disconnected from ground and the transmitter to reduce pickup at the point in the field.

(d) All radio frequency line wires shall be tested for pickup with an insulated probe before they are handled either with bare hands or with metal tools.

(e) The employer shall insure that the transmitting technician warn the riggers about adjacent lines which are, or may become energized.

(f) The employer shall insure that when antenna work has been completed, the rigger in charge of the job returns to the transmitter, notifies the transmitting technician in charge that work has been completed, and personally removes the tag from the antenna ground switch.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-320, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-320, filed 12/30/76; Order 75-41, § 296-32-320, filed 12/19/75.]

WAC 296-32-330 Overhead lines. (1) Handling suspension strand.

(1999 Ed.)

(a) The employer shall insure that when handling cable suspension strand which is being installed on poles carrying exposed energized power conductors, employees shall wear insulating gloves and shall avoid body contact with the strand until after it has been tensioned, dead-ended and permanently grounded.

(b) The strand shall be restrained against upward movement during installation:

(i) On joint-use poles, where there is an upward change in grade at the pole, and

(ii) On nonjoint-use poles, where the line crosses under energized power conductors.

(2) Need for testing wood poles. Unless temporary guys or braces are attached, the following poles shall be tested in accordance with subsection (3) of this section and determined to be safe before employees are permitted to climb them:

(a) Dead-end poles, except properly braced or guyed "Y" or "T" cable junction poles,

(b) Straight line poles which are not storm guyed and where adjacent span lengths exceed 165 feet.

(c) Poles at which there is a downward change in grade and which are not guyed or braced corner poles or cable junction poles.

(d) Poles which support only telephone drop wire, and

(e) Poles which carry less than ten communication line wires. On joint use poles, one power line wire shall be considered as two communication wires for purposes of this subdivision (2)(e).

(3) Methods for testing wood poles. The following method or an equivalent method shall be used for testing wood poles:

(a) Rap the pole sharply with a lineman's hammer, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound and/or a less pronounced hammer rebound. When decay pockets are indicated, the pole shall be considered unsafe.

(b) The pole shall be prodded as near the ground line as possible using a pole prod or a screwdriver with a single blade at least five inches long.

(c) If the pole is found unsafe, it shall be guyed or braced or supported in such a manner as to allow workers to safely perform their work.

(4) Unsafe poles or structures.

(a) Poles or structures determined to be unsafe by test or observation may not be climbed until made safe by guying, bracing or other means.

(b) Poles determined to be unsafe to climb shall, until they are made safe, be marked in a conspicuous place to alert and warn all employees of the unsafe condition.

(5) Test requirements for cable suspension strand.

(a) Before attaching a splicing platform to a cable suspension strand, the strand shall be tested and determined to have strength sufficient to support the weight of the platform and the employee. Where the strand crosses above power wires or railroad tracks it may not be tested but shall be inspected in accordance with subsection (6) of this section.

(b) The following method or an equivalent method shall be used for testing the strength of the strand: A rope, at least three-eighths inches in diameter, shall be thrown over the strand. On joint lines, the rope shall be passed over the strand using tree pruner handles or a wire raising tool. If two employees are present, both shall grip the double rope and slowly transfer their entire weight to the rope and attempt to raise themselves off the ground. If only one employee is present, one end of the rope which has been passed over the strand shall be tied to the bumper of the truck, or other equally secure anchorage. The employee then shall grasp the other end of the rope and attempt to raise himself off the ground.

(6) Inspection of strand. Where strand passes over electric power wires or railroad tracks, it shall be inspected from an elevated working position at each pole supporting the span in question. The strand may not be used to support any splicing platform, scaffold or cable car, if any of the following conditions exist:

- (a) Corrosion so that no galvanizing can be detected,
- (b) One or more wires of the strand are broken,
- (c) Worn spots, or
- (d) Burn marks such as those caused by contact with electric power wires.

(7) Outside work platforms. Unless railings are provided, safety straps and body belts shall be used while working on elevated work platforms such as aerial splicing platforms, pole platforms, ladder platforms and terminal balconies.

(8) Other elevated locations. Safety straps and body belts shall be worn when working at elevated positions on poles, towers or similar structures, which do not have guarded work areas.

(9) Installing and removing wire and cable. Before installing or removing wire or cable, the pole or structure shall be guyed, braced, or otherwise supported, as necessary, to prevent failure of the pole or structure.

(10) Avoiding contact with energized power conductors or equipment. When cranes, derricks, or other mechanized equipment are used for setting, moving, or removing poles, all necessary precautions shall be taken to avoid contact with energized power conductors or equipment.

(11) Handling poles near energized power conductors.

(a) Joint use poles may not be set, moved, or removed where the nominal voltage of open electrical power conductors exceeds 34.5 kV phase to phase or 20 kV phase to ground.

(b) Poles that are to be placed, moved or removed during heavy rains, sleet or wet snow in joint lines carrying more than 8.7 kV phase to phase voltage or 5 kV phase to ground shall be guarded or otherwise prevented from direct contact with overhead energized power conductors.

(c)(i) In joint lines where the power voltage is greater than 750 volts but less than 34.5 kV phase to phase or 20 kV phase to ground, wet poles being placed, moved or removed shall be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.

(ii) In joint lines where the power voltage is greater than 8.7 kV phase to phase or 5 kV phase to ground but less than 34.5 kV phase to phase or 20 kV phase to ground, dry poles

being placed, moved, or removed shall be insulated with either a rubber insulating blanket, a fiberglass box guide, or equivalent protective equipment.

(iii) Where wet or dry poles are being removed, insulation of the pole is not required if the pole is cut off 2 feet or more below the lowest power wire and also cut off near the ground line.

(d) Insulating gloves shall be worn when handling the pole with either hands or tools, when there exists a possibility that the pole may contact a power conductor. Where the voltage to ground of the power conductor exceeds 15 kV to ground, Class II gloves (as defined in ANSI J6.6-1971) shall be used. For voltages not exceeding 15 kV to ground, insulating gloves shall have a breakdown voltage of at least 17 kV.

(e) The guard or insulating material used to protect the pole shall meet the appropriate 3 minute proof test voltage requirements contained in the ANSI J6.4-1971.

(f) When there exists a possibility of contact between the pole or the vehicle-mounted equipment used to handle the pole, and an energized power conductor, the following precautions shall be observed:

(i) When on the vehicle which carries the derrick, avoid all contact with the ground, with persons standing on the ground, and with all grounded objects such as guys, tree limbs, or metal sign posts. To the extent feasible, remain on the vehicle as long as the possibility of contact exists.

(ii) When it is necessary to leave the vehicle, step onto an insulating blanket and break all contact with the vehicle before stepping off the blanket and onto the ground. As a last resort, if a blanket is not available, the employee may jump cleanly from the vehicle.

(iii) When it is necessary to enter the vehicle, first step onto an insulating blanket and break all contact with the ground, grounded objects and other persons before touching the truck or derrick.

(12) Working position on poles. Climbing and working are prohibited above the level of the lowest electric power conductor on the pole (exclusive of vertical runs and street light wiring), except:

(a) Where communications facilities are attached above the electric power conductors, and a rigid fixed barrier is installed between the electric power facility and the communications facility, or

(b) Where the electric power conductors are cabled secondary service drops carrying less than 300 volts to ground and are attached 40 inches or more below the communications conductors or cables.

(13) Metal tapes and ropes.

(a) Metal measuring tapes, metal measuring ropes, or tapes containing conductive strands shall not be used when working near exposed energized parts.

(b) Where it is necessary to measure clearances from energized parts, only nonconductive devices shall be used.

[Order 76-38, § 296-32-330, filed 12/30/76; Order 75-41, § 296-32-330, filed 12/19/75.]

WAC 296-32-340 Underground lines and cable vaults. The provisions of this section apply to the guarding of manholes and street openings, and to the ventilation and testing for gas in manholes and unvented vaults, where telecom-

munications field work is performed on or with underground lines.

(1) Guarding manholes and street openings.

(a) When covers of manholes or vaults are removed, the opening shall be promptly guarded by a railing, temporary cover, or other acceptable temporary barrier to prevent an accidental fall through the opening and to protect employees working in the manhole from foreign objects entering the manhole.

(b) When work is to be performed on underground plant, the immediate foreman in charge and the craftsman assigned to do the work shall make a complete evaluation of the work location in regard to the hazards that are created or that could exist prior to beginning the work in underground plant.

(c) The immediate foreman and the craftsman responsible for the job completion shall be in agreement of the proper method of eliminating or reducing any hazards that are present or could be caused by the location of the work site, before the job proceeds.

(2) Requirements prior to entry of manholes and unvented vaults.

(a) The internal atmosphere shall be tested for combustible gas.

(b) Mechanical forced air ventilation shall be in operation at all times when workers are required to be in the manhole.

(c) The mechanical forced air equipment provided shall be of a quantity to replace the exhausted air and shall be tempered when necessary.

(d) Ventilation equipment shall be designed in such a manner that workers will not be subjected to excessive air velocities.

(3) Joint power and telecommunication manholes. While work is being performed in a manhole occupied jointly by an electric utility and a telecommunication utility, an employee with basic first aid training shall be available in the immediate vicinity to render emergency assistance as required. This employee is not to be precluded from occasionally entering a manhole to provide assistance other than in an emergency. The requirement of WAC 296-32-340(3) does not preclude a qualified employee, working alone, from entering for brief periods of time, a manhole where energized cables or equipment are in service, for the purpose of inspection, housekeeping, taking readings, or similar work if such work can be performed safely.

(4) Ladders.

(a) Ladders shall be used to enter and exit manholes exceeding four feet in depth.

(b) Metal manhole ladders shall be free of structural defects and free of accident hazards such as sharp edges and burrs. The metal shall be protected against corrosion unless inherently corrosion-resistant.

(c) These ladders may be designed with parallel side rails, or with side rails varying uniformly in separation along the length (tapered) or with side rails flaring at the base to increase stability.

(d) The spacing of rungs or steps shall be on 12-inch centers.

(e) Connections between rungs or steps and side rails shall be constructed to ensure rigidity as well as strength.

(1999 Ed.)

(f) Rungs and steps shall be corrugated, knurled, dimpled, coated with skid-resistant material, or otherwise treated to minimize the possibility of slipping.

(g) Ladder hardware shall meet the ladder's component parts and shall be of a material that is protected against corrosion unless inherently corrosion-resistant. Metals shall be so selected as to avoid excessive galvanic action.

(5) Flames. When open flames must be used in manholes, the following precautions shall be taken to protect against the accumulation of combustible gas:

(a) A test for combustible gas shall be made immediately before using any open flame device, and

(b) A fuel tank (e.g., acetylene) may not be in the manhole unless in actual use.

[Order 76-38, § 296-32-340, filed 12/30/76; Order 75-41, § 296-32-340, filed 12/19/75.]

WAC 296-32-350 Microwave transmission. (1) Eye protection. Employers shall insure that employees do not look into an open waveguide which is connected to an energized source of microwave radiation.

(2) Hazardous area. Accessible areas associated with microwave communication systems where the electromagnetic radiation level exceeds the radiation protection guide given in WAC 296-62-09005 shall be posted as described in that section. The lower half of the warning symbol shall include the following:

Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

(3) Protective measures. When an employee works in an area where the electromagnetic radiation exceeds the radiation protection guide, the employer shall institute measures that insure that the employee's exposure is not greater than that permitted by the radiation guide. Such measures shall include, but not be limited to those of an administrative or engineering nature or those involving personal protective equipment.

[Order 76-38, § 296-32-350, filed 12/30/76; Order 75-41, § 296-32-350, filed 12/19/75.]

WAC 296-32-360 Tree trimming—Electrical hazards. (1) General.

(a) Employees engaged in pruning, trimming, removing, or clearing trees from lines shall be required to consider all overhead and underground electrical power conductors to be energized with potentially fatal voltages, never to be touched (contacted) either directly or indirectly.

(b) Employees engaged in line-clearing operations shall be instructed that:

(i) A direct contact is made when any part of the body touches or contacts an energized conductor, or other energized electrical fixture or apparatus.

(ii) An indirect contact is made when any part of the body touches any object in contact with an energized electrical conductor, or other energized fixture or apparatus.

(iii) An indirect contact can be made through conductive tools, tree branches, truck equipment, or other objects, or as a

result of communications wires, cables, fences, or guy wires being accidentally energized.

(iv) Electric shock will occur when an employee, by either direct or indirect contact with an energized conductor, energized tree limb, tool, equipment, or other object, provides a path for the flow of electricity to a grounded object or to the ground itself. Simultaneous contact with two energized conductors will also cause electric shock which may result in serious or fatal injury.

(c) Before any work is performed in proximity to energized conductors, the system operator/owner of the energized conductors shall be contacted to ascertain if they know of any hazards associated with the conductors which may not be readily apparent. This rule does not apply when operations are performed by the system operator/owner.

(2) Working in proximity to electrical hazards.

(a) Employers shall ensure that a close inspection is made by the employee and by the crewleader or supervisor in charge before climbing, entering, or working around any tree, to determine whether an electrical power conductor passes through the tree, or passes within reaching distance of an employee working in the tree. If any of these conditions exist either directly or indirectly, an electrical hazard shall be considered to exist unless the system operator/owner has caused the hazard to be removed by deenergizing the lines, or installing protective equipment.

(b) Only employees or trainees, familiar with the special techniques and hazards involved in line clearance, shall be permitted to perform the work if it is found that an electrical hazard exists.

(c) During all tree working operations aloft where an electrical hazard of more than 750 volts exists, there shall be a second employee or trainee qualified in line clearance tree trimming within normal voice communication.

(d) Where tree work is performed by employees qualified in line-clearance tree trimming and trainees qualified in line-clearance tree trimming, the clearances from energized conductors given in Table 2 shall apply.

TABLE 2

Minimum Working Distances From Energized Conductors For Line-Clearance Tree Trimmers and Line-Clearance Tree-Trimner Trainees

Voltage Range (Phase to Phase) (kilovolts)	Minimum Working Distance
2.1 to 15.0	2 ft. 0 in.
15.1 to 35.0	2 ft. 4 in.
35.1 to 46.0	2 ft. 6 in.
46.1 to 72.5	3 ft. 0 in.
72.6 to 121.0	3 ft. 4 in.
138.0 to 145.0	3 ft. 6 in.
161.0 to 169.0	3 ft. 8 in.
230.0 to 242.0	5 ft. 0 in.
345.0 to 362.0	7 ft. 0 in.
500.0 to 552.0	11 ft. 0 in.
700.0 to 765.0	15 ft. 0 in.

(e) Branches hanging on an energized conductor may only be removed using insulated equipment by a qualified electrical worker.

(f) Rubber footwear, including lineman's overshoes, shall not be considered as providing any measure of safety from electrical hazards.

(g) Ladders, platforms, and aerial devices, including insulated aerial devices, shall not be brought in contact with an electrical conductor. Reliance shall not be placed on their dielectric capabilities.

(h) When an aerial lift device contacts an electrical conductor, the truck supporting the aerial lift device shall be considered as energized.

(3) Storm work and emergency conditions.

(a) Since storm work and emergency conditions create special hazards, only authorized representatives of the electric utility system operator/owner and not telecommunication workers may perform tree work in these situations where energized electrical power conductors are involved.

(b) When an emergency condition develops due to tree operations, work shall be suspended and the system operator/owner shall be notified immediately.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-32-360, filed 7/20/94, effective 9/20/94; Order 76-38, § 296-32-360, filed 12/30/76; Order 75-41, § 296-32-360, filed 12/19/75.]

WAC 296-32-370 Buried facilities—Communications lines and power lines in the same trench. [Reserved.]

Chapter 296-36 WAC

SAFETY STANDARDS—COMPRESSED AIR WORK

WAC

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WAC 296-36-010 Definitions. As used herein, the following terms mean:

(1) **Approved.** In compliance with a subsisting resolution of approval adopted by the department of labor and industries, division of safety.

(2) **Adequate.** The term when applied to materials, devices, structures, methods and procedures is synonymous with effective, equal, equivalent, firm, necessary, proper, safe, secure, substantial, sufficient, suitable and shall denote such kind and quality as a reasonable and prudent man experienced in compressed air work would require in order to provide safe working conditions for himself in the performance of the work.

(3) **Bulkhead.** An upright partition in tunnels separating compartments; a structure or partition capable of resisting pressure and separating a high pressure compartment from a low pressure compartment.

(4) **Caisson.** A structure in or by means of which excavation in a predominantly vertical direction is carried on by persons working in a compressed air environment.

(5) **Compressed air worker.** A person performing any work or duty in compressed air. This term does not include divers.

(6) **Designated person.** A person selected and directed by an employer to perform a specified task or duty.

(7) **Director.** The director of the department of labor and industries, state of Washington.

(8) **Effective, equal, equivalent.** See (2), "adequate."

(9) **Firm.** See (2), "adequate."

(10) **Job.** The site, buildings, equipment and operations proximately associated with the work in compressed air.

(11) **Lock.** A chamber designed to facilitate the passage of men, materials and equipment from one ambient air pressure to another ambient air pressure.

(a) **Emergency lock.** A lock chamber designed to hold and to permit the quick passage of an entire shift of compressed air workers.

(b) **Man lock.** A lock chamber through which only men pass.

(c) **Materials lock.** A lock chamber designed and used normally for the passage of materials and equipment.

(d) **Medical lock.** A special lock chamber in which men suffering from decompression illness are placed for medical attention and treatment. Also used as a facility for preemployment physical examinations.

(12) **Necessary.** See (2), "adequate."

(13) **Owner.** The person, real or corporate, for whom the construction is being done.

(14) **Pressure.**

(a) **Absolute.** Gage pressure plus one atmosphere; viz, at sea level with a gage pressure of 30 pounds per square inch, the absolute pressure is $30+14.7=44.7$ pounds per square inch.

(b) **Ambient.** That which encompasses on all sides, surrounds. Usually taken as the gage pressure.

(c) **Atmospheric.** A pressure of one atmosphere at sea level; the pressure of air at sea level, used as a unit of measurement, equivalent to 14.7 pounds per square inch. One atmosphere of pressure is also zero pounds per square inch gage pressure.

(d) **Gage.** That pressure measured by gage and indicating the pressure in pounds per square inch exceeding one atmosphere.

(e) **Normal.** Atmospheric pressure of 14.7 pounds per square inch at sea level or zero gage pressure.

(f) **Total.** Total pressure is a pressure of one atmosphere plus gage pressure. See (14)(a), "absolute."

(15) **Safe, secure.** See (2), "adequate."

(16) **Shaft.** An excavation made from the surface of the ground the longer of axis of which forms an angle with the horizontal greater than twenty degrees.

(17) **Shafting.** An air and watertight enclosure built in the roof of a caisson and extended upward until above the ground or water level.

(18) **Shall.** The word "shall" is always mandatory.

(19) **Substantial, sufficient, suitable.** See (2), "adequate."

(20) **Supervisor.** The supervisor of safety, department of labor and industries, state of Washington.

(21) **Tunnel.** The underground excavation for a passageway including all shafts and other openings leading to or from such excavation, and all places, buildings and equipment used in connection therewith. Tunnels which are administered as distinct units constitute separate jobs.

(22) **Working chamber.** The space or compartment in which the excavating is being done in compressed air.

[Rule I, filed 12/28/62; Part One (Definitions), filed 3/23/60.]

WAC 296-36-020 Responsibility. (1) **The owner's responsibility.** There shall be on every job involving work in compressed air an owner's representative who shall be experienced in compressed air work and who shall represent the owner in all matters of joint responsibility under the Washington labor laws and the standards of safety for the work. The owner shall advise the director of the department of labor and industries in writing of the name and address of each such representative within 24 hours after starting work on the job.

(2) **The superintendent.** There shall be on every job, while work in compressed air is in progress, a superintendent experienced in compressed air work representing the employer of compressed air workers and who shall be in full charge of the job. The employer shall advise the director of the department of labor and industries in writing of the name and address of each such superintendent within 24 hours after starting work on the job.

(3) **Employees' responsibilities.** Every employee shall be responsible for carrying out all rules which immediately concern or affect his conduct and he shall use the safety devices and means furnished for his protection.

[Rules (Part II A, B, and C), filed 12/28/62; § 22, filed 3/23/60.]

WAC 296-36-030 General operating requirements—General duty to provide safety. Every reasonable precaution shall be taken to insure the safety of the workmen whether provided herein or not.

[Rules (Part III A), filed 12/28/62.]

WAC 296-36-035 General operating requirements—Safety miner. (1) A safety miner shall be selected by the crew on each shift. He shall have at least five years' experience as a practical miner and shall be the holder of an unexpired first-aid certificate from the Red Cross, U.S. Bureau of Mines, or the department of labor and industries. His duties shall be to check conditions to eliminate common work hazards such as loose rock, faulty timbers, poor rails, insufficient lighting, defective ladders and scaffolds, fan pipes, firing lines and other equipment directly related to the work of a miner. If such defects are found he shall immediately report the same to the superintendent.

(2) It shall be the duty of the superintendent, upon ascertaining such defects or hazards, to take immediate steps to remedy the same in compliance with the rules hereinafter set forth. A record of inspections made on each operation shall be kept on file and a copy thereof shall be submitted to the safety division of the department of labor and industries.

(3) In the event that disagreement arises out of the interpretation of these rules, then the question shall be referred to the division of safety of the department of labor and industries for its decision in accordance with the laws of the state, the safety standards, or rules and regulations issued hereunder, and a decision thus rendered shall be binding.

[Rules (Part III B), filed 12/28/62; § 15, filed 3/23/60.]

WAC 296-36-040 General operating requirements—Maintenance. All machinery, equipment, appliances, materials, structures and places on the job shall at all times be maintained in a safe condition and in good repair. Every person observing any defects shall immediately advise his immediate or higher superior.

[Rules (Part III C), filed 12/28/62; Rule 2203, § 22, filed 3/23/60.]

WAC 296-36-045 General operating requirements—Daily inspection. While work in compressed air is in progress, a competent person designated by the superintendent shall make a regular inspection at least once every day of all machinery, equipment, appliances, structures and places.

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Immediately upon discovery of any defect, he shall report the same in writing on forms provided by the state department of labor and industries to the person present in charge of the job. A copy of the report shall be sent immediately to the safety division of the department of labor and industries.

[Rules (Part III D), filed 12/28/62.]

WAC 296-36-050 General operating requirements—Maximum permissible pressure. No person shall be subjected to pressure exceeding 50 pounds per square inch gage except in case of emergency.

[Rules (Part III E), filed 12/28/62; § 1, filed 3/23/60.]

WAC 296-36-055 General operating requirements—Temperature in working chamber. Every effort shall be made by the best available means to prevent the wet bulb temperature exceeding 80 degrees F. A wet bulb thermometer, in good working order, shall be provided in every working chamber.

[Rules (Part III F), filed 12/28/62; § 20, Rule 2006, filed 3/23/60.]

WAC 296-36-060 General operating requirements—Bracing of working chamber, shafts and passageways. The working chamber, shafts and passageways of tunnels and caissons shall be provided with bracing as may be necessary to safely resist any superimposed loads or any forces which may cause excessive deformation of the walls.

[Rules (Part III G), filed 12/28/62; § 19, filed 3/23/60.]

WAC 296-36-065 General operating requirements—Communication. A telephone intercommunication system ready for use at all times shall be maintained between the working chamber, the power house, the source of compressed air, the place of compressed air control, the first-aid room and the superintendent's office.

Exception: Where the working chamber of a caisson is less than 150 square feet in area, such system shall be maintained between the working chamber, outside the lock and the place of compressed air control or the superintendent's office.

[Rules (Part III H), filed 12/28/62; § 8, filed 3/23/60.]

WAC 296-36-070 General operating requirements—Liquor. No person under the influence of intoxicating liquor shall be permitted to enter upon the job; nor shall any person carry any liquor on the job.

[Rules (Part III I), filed 12/28/62; § 24, Rule 2402, filed 3/23/60.]

WAC 296-36-075 General operating requirements—Identification badge. Every compressed air worker employed in the work shall wear an identification badge furnished by the employer both on and off the job. The badge shall be of durable plastic designed to be worn next to the body. The badge shall state that the wearer is employed as a compressed air worker, shall bear the address and telephone number of the medical lock, and shall contain instructions that in case of an emergency of unknown or doubtful cause or illness, the wearer shall be rushed to the medical facilities and not to a hospital.

[Rules (Part III J), filed 12/28/62; § 24, Rule 2412, filed 3/23/60.]

WAC 296-36-080 General operating requirements—Notification of civil authorities, hospitals, etc. When workmen are employed in compressed air, the owner shall see that all general hospitals, city and county health departments, local medical societies, police and fire rescue, and the county sheriff in the locality are acquainted with the fact that such work is being undertaken. These authorities and organizations shall be furnished with the names, addresses and telephone numbers of the designated medical officers as well as the location and telephone number of the medical lock. The same civil authorities shall be further notified when compressed air operations on the site are completed.

[Rules (Part III K), filed 12/28/62.]

WAC 296-36-085 General operating requirements—Instructions to be posted. The following instructions as well as supplemental instructions deemed advisable by the medical officer for the guidance of compressed air workers shall be printed and conspicuously posted in the change house and in the man locks:

- (1) Never go on shift with an empty stomach.
- (2) Avoid all alcoholic liquors.
- (3) Eat moderately.
- (4) Sleep at least seven hours daily.
- (5) Take extra outer clothing into the tunnel when going on shift and wear it during decompression to avoid chilling during that period.
- (6) Take a warm bath after each shift.
- (7) Do not give men, suffering from compressed air illness, any intoxicating liquor.
- (8) After you have had a cold, or if your ears are uncomfortable, or if you do not feel well for any reason, report at once to the medical lock for a checkup.
- (9) If you are taken sick away from the plant, communicate at once with the physician-in-charge, Dr., telephone
- (10) Wear your identification badge so it will be known what to do with you in an emergency.
- (11) See that you are reexamined as required by the rules.
- (12) Proper decompression means safety and freedom from compressed air illness.
- (13) No person shall smoke or carry lighted smoking materials in compressed air. No matches, mechanical or chemical igniters will be permitted in the working chamber except those necessary for welding or flame cutting operations.

It shall be the duty and responsibility of each employee to observe and abide by the posted instructions and regulations.

[Rules (Part III L), filed 12/28/62; Rule 2204, filed 3/23/60.]

WAC 296-36-100 Compression and decompression of workmen—General. Subject to subsections 1-5 below, compression and decompression of workmen shall be carried out in accordance with the rules hereinafter prescribed:

(1999 Ed.)

(1) Compression or decompression may be carried out in accordance with such alternative regulations as are approved by the state department of labor and industries in writing.

(2) Except in an emergency, no workman shall be compressed to a pressure exceeding 50 pounds per square inch gage unless regulations for the decompression of such workman have been approved under the foregoing paragraph of this rule.

(3) The monograph "Decompression sickness and its prevention among compressed air workers" prepared by Gerald J. Duffner, M.D. (Captain, Medical Corps, U.S. Navy) and dated 6 November 1962, establishes the criteria for and shall be the guide in the determination of decompression methods and procedures and the preparation of decompression tables. Copies of the monograph are available from the supervisor of safety, department of labor and industries, state of Washington.

(4) A special low-pressure decompression chamber of sufficient size to accommodate the entire force of workmen being decompressed at the end of a shift shall be provided under the following circumstances:

Excepting the infrequent, occasional or emergency condition, when any regularly established routine term or schedule of work includes a working period requiring a total time of decompression exceeding seventy-five minutes, the special low-pressure decompression chamber shall be provided and shall be used as a facility to accomplish the final stage or phase of decompression. The special chamber shall conform with and shall be operated in accordance with sections WAC 296-36-130 and 296-36-120(2) example No. 2 respectively.

(5) When a workman has, within the immediately preceding period of 8 hours, been exposed to a pressure greater than 13 pounds per square inch gage and has to be compressed in a man lock other than the lock in which he was last decompressed, he shall, before compression, produce to the lock attendant written particulars signed by the lock attendant of the lock where he was last decompressed indicating his last working period. For the purposes of these regulations, the term "working period" shall mean the period or the sum of the periods during which, since last subject to ordinary atmospheric pressure for at least 8 consecutive hours, a workman has been under pressure in a working chamber or chambers; the written particulars shall be specific in stating the length of time the workman was exposed to compressed air, the gage pressure to which he was subjected, the schedule of decompression used, the total length of time devoted to decompression procedures and the hour at which decompression was completed. As soon as practicable, all data shall be entered in the prescribed register or log at the lock where he is compressed and the data shall, as soon as practicable, be communicated to the attendant at any other lock from which the workman is liable to return to the open air.

[Rules (Part IV A), filed 12/28/62; § 2, filed 3/23/60.]

WAC 296-36-105 Compression and decompression of workmen—Compression. During the compression of workmen, the pressure shall not, in the first minute after starting compression, be increased to more than 3 pounds per square inch gage. When the pressure of 3 pounds per square inch gage is reached, the pressure shall not be further increased

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until after the lapse of a period sufficiently long to enable the lock attendant to ascertain whether any workman in the man lock complains of discomfort. After the lapse of that period, the pressure shall not be increased at a rate faster than 10 pounds per square inch gage per minute and a pause similar to that provided at 3 pounds per square inch gage shall also be provided at a pressure not exceeding 7 pounds per square inch gage. In all instances the pressure shall be increased gradually so as to insure, as far as practicable, that no workman suffers discomfort. If a workman complains of discomfort, and such complaint is signified to the lock attendant, any compression then proceeding shall be immediately stopped, and, unless the workman who has complained of the discomfort reports within 5 minutes that the discomfort has ceased and such report is conveyed to the lock attendant, the lock attendant shall without further delay gradually reduce the pressure in the lock until the workman reports that the discomfort has ceased; but, if he does not so report, the pressure shall be reduced gradually to atmospheric pressure and the workman released from the lock.

[Rules (Part IV B), filed 12/28/62.]

WAC 296-36-110 Compression and decompression of workmen—Decompression—General. (1) **Working period.** The "working period" shall include the time or period or the sum of periods during which, since last subject to ordinary atmospheric pressure for at least 8 consecutive hours, a workman has been under pressure in a working chamber or chambers.

(2) **Work pressure.** The "work pressure" means the highest pressure to which the workman has been exposed in the course of his working period: *Provided, That,*

(a) Sudden and exceptional variations of pressure involving excess pressure for not more than 15 minutes may be disregarded;

(b) Where, during the whole of his working period a workman about to be decompressed has been in a working chamber in which (as in tidal waters) the pressure has been gradually varied by more than 5 pounds per square inch in the course of that period, the work pressures shall be the mean of the pressures half way through that period and at the end of it.

(3) **Decompression required.** No person employed in compressed air shall be permitted to pass from the place in which the work is being done to atmospheric pressure, except after decompression in accordance with the procedures hereinafter established.

[Rules (Part IV C), filed 12/28/62; §§ 1 and 2, filed 3/23/60.]

WAC 296-36-115 Compression and decompression of workmen—Method and procedure. Decompressions shall be accomplished in accordance with the following methods and procedures:

(1) **Normal condition.** A normal condition is one during which exposure to compressed air is limited to a single continuous "working period" followed by a single decompression in any given 24 hour period; the total time of exposure to compressed air during the single continuous "working period" is not interrupted by exposure to normal atmospheric pressure; and a second exposure to compressed air does not

occur until at least 8 consecutive hours of exposure to normal atmospheric pressure has elapsed since the workman has been under pressure in a working chamber. Decompression for normal condition shall be in accordance with the decompression tables.

(2) **Multiple exposures or emergency conditions.** The appointed physician shall be responsible for the preparation and establishment of methods and procedures of decompression applicable to multiple exposures and emergency conditions. The decompression times and stages shall be calculated and the methods and procedures determined and placed into effect in accordance with the instructions contained in the monograph "Decompression sickness and its prevention among compressed air workers" referred to in WAC 296-36-100(3).

[Rules (Part IV D), filed 12/28/62.]

WAC 296-36-120 Compression and decompression of workmen—Decompression tables. (1) **Explanation.**

(a) The decompression tables are computed for working chamber pressures from 14 to 50 pounds per square inch gage inclusive by 2 pound increments and for exposure times for each pressure extending from 1/2 to over 8 hours inclusive. Decompressions will be conducted by two or more stages with a maximum of 4 stages, the latter for a working chamber pressure of 40 pounds per square inch gage or over.

(b) Stage 1, consists of a reduction in ambient pressure ranging from 10 to a maximum of 16 pounds per square inch but in no instance will the pressure be reduced below 4 pounds at the end of stage 1. This reduction in pressure in stage 1 will always take place at a rate of 5 pounds per minute.

(c) Further reduction in pressure will take place during stage 2 and subsequent stages as required at a slower rate but in no event at a rate greater than one pound per minute.

(d) Decompression table No. 1 indicates in the body of the table the total decompression time in minutes for various combinations of working chamber pressure and exposure time.

(e) Decompression table No. 2 in several sheets indicates for the same various combinations of working chamber pressure and exposure time the following:

(i) The number of stages required;

(ii) The reduction in pressure and the terminal pressure for each required stage;

(iii) The time in minutes through which the reduction in pressure is accomplished for each required stage;

(iv) The pressure reduction rate in minutes per pound for each required stage;

Important note: The pressure reduction in each stage is accomplished at a uniform rate. Do not interpolate between values shown on the tables. Use the next higher value of working chamber pressure or exposure time should the actual working chamber pressure or the actual exposure time, respectively, fall between those for which calculated values are shown in the body of the tables.

(2) Examples.

(a) Example No. 1. 4 hour working period at 20 pounds gage.

Decompression table No. 1.

20 pounds for 4 hours,
Total decompression time 43 minutes

Decompression table No. 2.

Stage 1

Reduce pressure from 20 pounds to 4 pounds at the uniform rate of 5 pounds per minute. Elapsed time stage 1:

$$\frac{16}{5} = 3 \text{ minutes}$$

Stage 2 (final stage)

Reduce pressure at a uniform rate from 4 pounds to zero pounds gage over a period of 40 minutes.

Rate= 0.10 pounds per minute or 10.00 minutes per pound Stage 2 (final) elapsed time 40 minutes
Total time 43 minutes

(b) Example No. 2. 5 hour working period at 24 pounds gage

Decompression table No. 1

24 pounds for 5 hours
Total decompression time 117 minutes

Decompression table No. 2

Stage 1

Reduce pressure from 24 pounds to 8 pounds at the uniform rate of 5 pounds per minute
Elapsed time stage 1,

$$\frac{16}{5} = 3 \text{ minutes}$$

Stage 2

Reduce pressure at a uniform rate from 8 pounds to 4 pounds over a period of 4 minutes.

Rate, 1 pound per minute
Elapsed time, stage 2 4 minutes

Transfer men to special decompression chamber maintaining the 4 pound pressure during the transfer operation

Stage 3 (Final stage)

In the special decompression chamber reduce the pressure at a uniform rate from 4 pounds to zero pounds gage over a period of 110 minutes.
Rate, 0.037 pounds per minute or 27.5 minutes per pound
Stage 3 (final stage) Elapsed time 110 minutes

Total time 117 minutes

(3)

DECOMPRESSION TABLE NO. 1

Work Pressure	Total Decompression Time - Minutes											
	Working Period Hours											
psig	1/2	1	1-1/2	2	3	4	5	6	7	8	Over 8	
0-14	6	6	6	6	6	6	6	6	6	16	16	32
16	7	7	7	7	7	7	17	33	48	48	63	

(1999 Ed.)

Work Pressure	Total Decompression Time - Minutes											
	Working Period Hours											
18	7	7	7	3	11	17	48	63	63	73	87	
20	7	7	8	15	15	43	63	73	83	103	113	
22	9	9	16	24	38	68	93	103	113	128	133	
24	11	12	23	27	52	92	117	122	127	137	151	
26	13	14	29	34	69	104	126	141	142	142	163	
28	15	23	31	41	98	127	143	153	153	165	183	
30	17	28	38	62	105	143	165	168	173	188	204	
32	19	35	43	85	126	163	178	193	203	213	226	
34	21	39	58	98	151	178	195	218	223	233	248	
36	24	44	63	113	170	198	223	233	243	253	273	
38	28	49	73	128	178	203	223	238	253	263	278	
40	31	49	84	143	183	213	233	248	258	268	288	
42	37	56	102	144	189	215	245	260	263	268	293	
44	43	64	118	154	199	234	254	264	269	269	293	
46	44	74	139	171	214	244	269	274	289	299	318	
48	51	89	144	189	229	269	299	309	319	319	-	
50	58	94	164	209	249	279	309	329	-	-	-	

(4)

DECOMPRESSION TABLE NO. 2

Working Chamber Pressure	Working Period Hours	Stage No.	Decompression Data				Total Time Decompress Minutes
			Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	
			From	To			
14	1/2	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	1	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	1-1/2	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	2	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	3	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	4	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	5	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	6	1	14	4	2	0.20	
		2	4	0	4	1.00	6
	7	1	14	4	2	0.20	

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Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
		2	4	0	14	3.50	16
8		1	14	4	2	0.20	
		2	4	0	14	3.50	16
Over 8		1	14	4	2	0.20	
		2	4	0	30	7.50	32
16	1/2	1	16	4	3	0.20	
		2	4	0	4	1.00	7
1		1	16	4	3	0.20	
		2	4	0	4	1.00	7
1-1/2		1	16	4	3	0.20	
		2	4	0	4	1.00	7
2		1	16	4	3	0.20	
		2	4	0	4	1.00	7
3		1	16	4	3	0.20	
		2	4	0	4	1.00	7
4		1	14	4	3	0.20	
		2	4	0	4	1.00	7
5		1	14	4	3	0.20	
		2	4	0	14	3.50	17
6		1	14	4	3	0.20	
		2	4	0	30	7.50	33
7		1	14	4	3	0.20	
		2	4	0	45	11.25	48
8		1	14	4	3	0.20	
		2	4	0	45	11.25	48
Over 8		1	14	4	3	0.20	
		2	4	0	60	15.00	63
18	1/2	1	18	4	3	0.20	
		2	4	0	4	1.00	7
1		1	18	4	3	0.20	
		2	4	0	4	1.00	7
1-1/2		1	18	4	3	0.20	
		2	4	0	4	1.00	7
2		1	18	4	3	0.20	
		2	4	0	5	1.25	8
3		1	18	4	3	0.20	
		2	4	0	8	2.00	11
4		1	18	4	3	0.20	
		2	4	0	14	3.50	17
5		1	18	4	3	0.20	
		2	4	0	45	11.25	48
6		1	18	4	3	0.20	
		2	4	0	60	15.00	63
7		1	18	4	3	0.20	

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
		2	4	0	60	15.00	63
8		1	18	4	3	0.20	
		2	4	0	70	17.50	73
Over 8		1	18	4	3	0.20	
		2	4	0	84	21.00	87
20	1/2	1	20	4	3	0.20	
		2	4	0	4	1.00	7
1		1	20	4	3	0.20	
		2	4	0	4	1.00	7
1-1/2		1	20	4	3	0.20	
		2	4	0	5	1.25	8
2		1	20	4	3	0.20	
		2	4	0	12	3.00	15
3		1	20	4	3	0.20	
		2	4	0	12	3.00	15
4		1	20	4	3	0.20	
		2	4	0	40	10.00	43
5		1	20	4	3	0.20	
		2	4	0	60	15.00	63
6		1	20	4	3	0.20	
		2	4	0	70	17.50	73
7		1	20	4	3	0.20	
		2	4	0	80	20.00	83
8		1	20	4	3	0.20	
		2	4	0	100	25.00	103
Over 8		1	20	4	3	0.20	
		2	4	0	110	27.50	113
22	1/2	1	22	6	3	0.20	
		2	6	0	6	1.00	9
1		1	22	6	3	0.20	
		2	6	0	6	1.00	9
1-1/2		1	22	6	3	0.20	
		2	6	0	13	2.20	16
2		1	22	6	3	0.20	
		2	6	0	21	3.50	24
3		1	22	6	3	0.20	
		2	6	0	35	5.85	38
4		1	22	6	3	0.20	
		2	6	0	65	10.83	68
5		1	22	6	3	0.20	
		2	6	0	90	15.00	93
6		1	22	6	3	0.20	
		2	6	0	100	16.67	103
7		1	22	6	3	0.20	

Working Chamber Pressure	Working Period	Decompression Data					Total Time Decompress
		Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	
			From	To			
		2	6	0	110	18.35	113
	8	1	22	6	3	0.20	128
		2	6	0	125	20.80	
	Over 8	1	22	6	3	0.20	133
		2	6	0	130	21.70	
24	1/2	1	24	3	3	0.20	11
		2	8	4	4	1.00	
		3	4	0	4	1.00	
	1	1	24	8	3	0.20	12
		2	8	4	4	1.00	
		3	4	0	5	1.25	
	1-1/2	1	24	8	3	0.20	23
		2	8	4	4	1.00	
		3	4	0	16	4.00	
	2	1	24	8	3	0.20	27
		2	8	4	4	1.00	
		3	4	0	20	5.00	
	3	1	24	8	3	0.20	52
		2	8	4	4	1.00	
		3	4	0	45	11.25	
	4	1	24	8	3	0.20	92
		2	8	4	4	1.00	
		3	4	0	85	21.25	
	5	1	24	8	3	0.20	117
		2	8	4	4	1.00	
		3	4	0	110	27.50	
	6	1	24	8	3	0.20	122
		2	8	4	4	1.00	
		3	4	0	115	28.80	
	7	1	24	8	3	0.20	127
		2	8	4	4	1.00	
		3	4	0	120	30.00	
	8	1	24	8	3	0.20	137
		2	8	4	4	1.00	
		3	4	0	130	32.50	
	Over 8	1	24	8	3	0.20	151
		2	8	4	8	1.00	
		3	4	0	140	35.00	
26	1/2	1	26	10	3	0.20	13
		2	10	4	6	1.00	
		3	4	0	4	1.00	
	1	1	26	10	3	0.20	14
		2	10	4	6	1.00	
		3	4	0	5	1.25	
	1-1/2	1	26	10	3	0.20	29
		2	10	4	6	1.00	
		3	4	0	20	5.00	
	2	1	26	10	3	0.20	1.00
		2	10	4	6	1.00	

Working Chamber Pressure	Working Period	Decompression Data					Total Time Decompress
		Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	
			From	To			
		3	4	0	25	6.25	34
	3	1	26	10	3	0.20	69
		2	10	4	6	1.00	
		3	4	0	60	15.00	
	4	1	26	10	3	0.20	104
		2	10	4	6	1.00	
		3	4	0	95	23.75	
	5	1	26	10	3	0.20	126
		2	10	4	8	1.33	
		3	4	0	115	28.80	
	6	1	26	10	3	0.20	141
		2	10	4	8	1.33	
		3	4	0	130	32.50	
	7	1	26	10	3	0.20	142
		2	10	4	9	1.50	
		3	4	0	130	32.50	
	8	1	26	10	3	0.20	142
		2	10	4	9	1.50	
		3	4	0	130	32.50	
	Over 8	1	26	10	3	0.20	163
		2	10	4	30	5.00	
		3	4	0	130	32.50	
28	1/2	1	28	12	3	0.20	15
		2	12	4	8	1.00	
		3	4	0	4	1.00	
	1	1	28	12	3	0.20	23
		2	12	4	8	1.00	
		3	4	0	12	3.00	
	1-1/2	1	28	12	3	0.20	31
		2	12	4	8	1.00	
		3	4	0	20	5.00	
	2	1	28	12	3	0.20	41
		2	12	4	8	1.00	
		3	4	0	30	7.50	
	3	1	28	12	3	0.20	98
		2	12	4	10	1.25	
		3	4	0	85	21.20	
	4	1	28	12	3	0.20	127
		2	12	4	14	1.75	
		3	4	0	110	27.50	
	5	1	28	12	3	0.20	143
		2	12	4	20	2.50	
		3	4	0	120	30.00	
	6	1	28	12	3	0.20	153
		2	12	4	20	2.50	
		3	4	0	130	32.50	
	7	1	28	12	3	0.20	153
		2	12	4	20	2.50	
		3	4	0	130	32.50	

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
8		1	28	12	3	0.20	165
		2	12	4	32	4.00	
		3	4	0	130	32.50	
Over 8		1	28	12	3	0.20	183
		2	12	4	50	6.25	
		3	4	0	130	32.50	
30	1/2	1	30	14	3	0.20	17
		2	14	4	10	1.00	
		3	4	0	4	1.00	
1		1	30	14	3	0.20	28
		2	14	4	10	1.00	
		3	4	0	15	3.75	
1-1/2		1	30	14	3	0.20	38
		2	14	4	10	1.00	
		3	4	0	25	6.25	
2		1	30	14	3	0.20	62
		2	14	4	14	1.40	
		3	4	0	45	11.25	
3		1	30	14	3	0.20	105
		2	14	4	17	1.70	
		3	4	0	85	21.20	
4		1	30	14	3	0.20	143
		2	14	4	30	3.00	
		3	4	0	110	27.50	
5		1	30	14	3	0.20	165
		2	14	4	35	3.50	
		3	4	0	130	32.50	
6		1	30	14	3	0.20	168
		2	14	4	35	3.50	
		3	4	0	130	32.50	
7		1	30	14	3	0.20	178
		2	14	4	45	4.50	
		3	4	0	130	32.50	
8		1	30	14	3	0.20	188
		2	14	4	55	5.50	
		3	4	0	130	32.50	
Over 8		1	30	14	3	0.20	204
		2	14	4	71	7.10	
		3	4	0	130	32.50	
32	1/2	1	32	16	3	0.20	19
		2	16	4	12	1.00	
		3	4	0	4	1.00	
1		1	32	16	3	0.20	35
		2	16	4	12	1.00	
		3	4	0	20	5.00	
1-1/2		1	32	16	3	0.20	43
		2	16	4	15	1.25	
		3	4	0	25	6.25	
2		1	32	16	3	0.20	
		2	16	4	22	1.83	

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
3		1	32	16	3	0.20	126
		2	16	4	28	2.33	
		3	4	0	95	23.75	
4		1	32	16	3	0.20	163
		2	16	4	40	3.33	
		3	4	0	120	30.00	
5		1	32	16	3	0.20	178
		2	16	4	45	3.75	
		3	4	0	130	32.50	
6		1	32	16	3	0.20	193
		2	16	4	60	5.00	
		3	4	0	130	32.50	
7		1	32	16	3	0.20	203
		2	16	4	70	5.83	
		3	4	0	130	32.50	
8		1	32	16	3	0.20	213
		2	16	4	80	6.67	
		3	4	0	130	32.50	
Over 8		1	32	16	3	0.20	226
		2	16	4	93	7.75	
		3	4	0	130	32.50	
34	1/2	1	34	18	3	0.20	21
		2	18	4	14	1.00	
		3	4	0	4	1.00	
1		1	34	18	3	0.20	39
		2	18	4	14	1.00	
		3	4	0	22	5.50	
1-1/2		1	34	18	3	0.20	58
		2	18	4	25	1.80	
		3	4	0	30	7.50	
2		1	34	18	3	0.20	98
		2	18	4	35	2.50	
		3	4	0	60	15.00	
3		1	34	18	3	0.20	151
		2	18	4	43	3.10	
		3	4	0	105	26.25	
4		1	34	18	3	0.20	178
		2	18	4	55	3.93	
		3	4	0	120	30.00	
5		1	34	18	3	0.20	195
		2	18	4	62	4.43	
		3	4	0	130	32.50	
6		1	34	18	3	0.20	218
		2	18	4	85	6.07	
		3	4	0	130	32.50	
7		1	34	18	3	0.20	223
		2	18	4	90	6.43	
		3	4	0	130	32.50	

Working Chamber Pressure	Working Period	Decompression Data					Total Time Decompress
		Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	
			From	To			
	8	1	34	18	3	0.20	233
		2	18	4	100	7.15	
		3	4	0	130	32.50	
Over 8	1	34	18	3	0.20	248	
	2	18	4	115	8.23		
	3	4	0	130	32.50		
36	1/2	1	36	20	3	0.20	24
		2	20	4	16	1.00	
		3	4	0	5	1.25	
1	1	36	20	3	0.20	44	
	2	20	4	16	1.00		
	3	4	0	25	6.25		
1-1/2	1	36	20	3	0.20	63	
	2	20	4	30	1.88		
	3	4	0	30	7.50		
2	1	36	20	3	0.20	113	
	2	20	4	40	2.50		
	3	4	0	70	17.50		
3	1	36	20	3	0.20	170	
	2	20	4	52	3.25		
	3	4	0	115	28.75		
4	1	36	20	3	0.20	198	
	2	20	4	65	4.06		
	3	4	0	130	32.50		
5	1	36	20	3	0.20	223	
	2	20	4	90	5.63		
	3	4	0	130	32.50		
6	1	37	20	3	0.20	233	
	2	20	4	100	6.25		
	3	4	0	130	32.50		
7	1	36	20	3	0.20	243	
	2	20	4	110	6.88		
	3	4	0	130	32.50		
8	1	36	20	3	0.20	253	
	2	20	4	120	7.50		
	3	4	0	130	32.50		
Over 8	1	36	20	3	0.20	273	
	2	20	4	140	8.75		
	3	4	0	130	32.50		
38	1/2	1	38	22	3	0.20	28
		2	22	6	16	1.00	
		3	6	0	9	1.50	
1	1	38	22	3	0.20	49	
	2	22	6	16	1.00		
	3	6	0	30	5.00		
1-1/2	1	38	22	3	0.20	73	
	2	22	6	20	1.25		
	3	6	0	50	8.34		
2	1	38	22	3	0.20		
	2	22	6	30	1.88		

Working Chamber Pressure	Working Period	Decompression Data					Total Time Decompress	
		Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound		
			From	To				
		3	6	0	95	15.83	128	
		3	1	38	22	3	0.20	178
		2	22	6	35	2.19		
3	6	0	140	23.35				
4	1	38	22	3	0.20	203		
	2	22	6	50	3.12			
	3	6	0	150	25.00			
5	1	38	22	3	0.20	223		
	2	22	6	55	3.44			
	3	6	0	165	27.50			
6	1	38	22	3	0.20	238		
	2	22	6	70	4.38			
	3	6	0	165	27.50			
7	1	38	22	3	0.20	253		
	2	22	6	85	5.32			
	3	6	0	165	27.50			
8	1	38	22	3	0.20	263		
	2	22	6	95	5.93			
	3	6	0	165	27.50			
Over 8	1	38	22	3	0.20	278		
	2	22	6	110	6.88			
	3	6	0	165	27.50			
40	1/2	1	40	24	3	0.20	31	
		2	24	8	16	1.00		
		3	8	4	4	1.00		
1	1	40	24	3	0.20	49		
	2	24	8	16	1.00			
	3	8	4	5	1.25			
1-1/2	1	40	24	3	0.20	84		
	2	24	8	16	1.00			
	3	8	4	20	5.00			
2	1	40	24	3	0.20	143		
	2	24	8	25	1.56			
	3	8	4	20	5.00			
3	1	40	24	3	0.20	183		
	2	24	8	30	1.88			
	3	8	4	30	7.50			
4	1	40	24	3	0.20	213		
	2	24	8	45	2.81			
	3	8	4	35	8.75			
5	1	40	24	3	0.20	233		
	2	24	8	47	2.94			
	3	8	4	53	13.25			
6	1	40	24	3	0.20			
	2	24	8	130	32.50			

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
		2	24	8	55	3.44	
		3	8	4	60	15.00	
		4	4	0	130	32.50	248
7		1	40	24	3	0.20	
		2	24	8	65	4.06	
		3	8	4	60	15.00	
		4	4	0	130	32.50	258
8		1	40	24	3	0.20	
		2	24	8	75	4.70	
		3	8	4	60	15.00	
		4	4	0	130	32.50	268
Over 8		1	40	24	3	0.20	
		2	24	8	95	5.93	
		3	8	4	60	15.00	
		4	4	0	130	32.50	288
42	1/2	1	42	26	3	0.20	
		2	26	10	16	1.00	
		3	10	4	6	1.00	
		4	4	0	12	3.00	37
1		1	42	26	3	0.20	
		2	26	10	16	1.00	
		3	10	4	12	2.00	
		4	4	0	25	6.25	56
1-1/2		1	42	26	3	0.20	
		2	26	10	16	1.00	
		3	10	4	23	3.83	
		4	4	0	60	15.00	102
2		1	42	26	3	0.20	
		2	26	10	16	1.00	
		3	10	4	30	5.00	
		4	4	0	95	23.75	144
3		1	42	26	3	0.20	
		2	26	10	16	1.00	
		3	10	4	50	8.34	
		4	4	0	120	30.00	189
4		1	42	26	3	0.20	
		2	26	10	17	1.06	
		3	10	4	65	10.83	
		4	4	0	130	32.50	215
5		1	42	26	3	0.20	
		2	26	10	27	1.69	
		3	10	4	85	14.18	
		4	4	0	130	32.50	245
6		1	42	26	3	0.20	
		2	26	10	27	1.69	
		3	10	4	100	16.67	
		4	4	0	130	32.50	260
7		1	42	26	3	0.20	
		2	26	10	30	1.88	
		3	10	4	100	16.67	
		4	4	0	130	32.50	263
8		1	42	26	3	0.20	
		2	26	10	35	2.19	

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
		3	10	4	100	16.67	
		4	4	0	130	32.50	268
Over 8		1	42	26	3	0.20	
		2	26	10	60	3.75	
		3	10	4	100	16.67	
		4	4	0	130	32.50	293
44	1/2	1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	8	1.00	
		4	4	0	16	4.00	43
1		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	20	2.50	
		4	4	0	25	6.25	64
1-1/2		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	27	3.38	
		4	4	0	72	18.00	118
2		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	40	5.00	
		4	4	0	95	23.75	154
3		1	44	23	3	0.20	
		2	28	12	16	1.00	
		3	12	4	60	7.50	
		4	4	0	120	30.00	199
4		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	85	10.62	
		4	4	0	130	32.50	234
5		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	105	13.13	
		4	4	0	130	32.50	254
6		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	115	14.38	
		4	4	0	130	32.50	264
7		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	120	15.00	
		4	4	0	130	32.50	269
8		1	44	28	3	0.20	
		2	28	12	16	1.00	
		3	12	4	120	15.00	
		4	4	0	130	32.50	269
Over 8		1	44	28	3	0.20	
		2	28	12	40	2.50	
		3	12	4	120	15.00	
		4	4	0	130	32.50	293
46	1/2	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	10	1.00	

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
		4	4	0	15	3.75	44
	1	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	25	2.50	
		4	4	0	30	7.50	74
	1-1/2	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	35	3.50	
		4	4	0	85	21.20	139
	2	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	47	4.70	
		4	4	0	105	26.25	171
	3	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	65	6.50	
		4	4	0	130	32.50	214
	4	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	95	9.50	
		4	4	0	130	32.50	244
	5	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	120	12.00	
		4	4	0	130	32.50	269
	6	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	125	12.50	
		4	4	0	130	32.50	274
	7	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	140	14.00	
		4	4	0	130	32.50	289
	8	1	46	30	3	0.20	
		2	30	14	16	1.00	
		3	14	4	150	15.00	
		4	4	0	130	32.50	299
	Over 8	1	46	30	3	0.20	
		2	30	14	25	1.56	
		3	14	4	160	16.00	
		4	4	0	130	32.50	318
48	1/2	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	12	1.00	
		4	4	0	20	5.00	51
	1	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	35	2.92	
		4	4	0	35	8.75	89
	1-1/2	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	45	3.75	
		4	4	0	80	20.00	144

Decompression Data							
Working Chamber Pressure	Working Period	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
	2	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	60	5.00	
		4	4	0	110	27.50	189
	3	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	90	7.50	
		4	4	0	120	30.00	229
	4	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	120	10.00	
		4	4	0	130	32.50	269
	5	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	140	11.67	
		4	4	0	130	32.50	299
	6	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	160	13.33	
		4	4	0	130	32.50	309
	7	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	170	14.17	
		4	4	0	130	32.50	319
	8	1	48	32	3	0.20	
		2	32	16	16	1.00	
		3	16	4	170	14.17	
		4	4	0	130	32.50	319
50	1/2	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	14	1.00	
		4	4	0	25	6.25	58
	1	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	40	2.86	
		4	4	0	35	8.75	94
	1-1/2	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	55	3.93	
		4	4	0	90	22.50	164
	2	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	70	5.00	
		4	4	0	120	30.00	209
	3	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	100	7.15	
		4	4	0	130	32.50	249
	4	1	50	34	3	0.20	
		2	34	18	16	1.00	
		3	18	4	130	8.58	
		4	4	0	130	32.50	279

Decompression Data							
Working Chamber Pressure psig	Working Period Hours	Stage No.	Pressure Reduction Psig		Time in Stage Minutes	Pressure Reduction Rate Min/Pound	Total Time Decompress Minutes
			From	To			
5		1	50	34	3	0.20	309
		2	34	18	16	1.00	
		3	18	4	160	11.42	
		4	4	0	130	32.50	

6		1	50	34	3	0.20	329
		2	34	18	16	1.00	
		3	18	4	180	12.85	
		4	4	0	130	32.50	

DO NOT INTERPOLATE, USE NEXT HIGHER VALUE FOR CONDITIONS NOT COMPUTED

[Rules (Part IV E), filed 12/28/62; § 2, filed 3/23/60.]

WAC 296-36-125 Man locks. (1) **Use of man locks.** Except when prevented by an emergency, compressed air workers shall pass only through the man lock when passing into or out of a compressed air area. *Exception:* Caissons having a working area less than 150 square feet may use a combination material and man lock.

(2) **Size and capacity.** The head room in man locks shall be not less than 6 feet and their cubical content shall provide at least 30 cubic feet of air space for each person. The capacity shall be based upon such minimum space per person and shall be posted at the entrance to the lock. The posted capacity shall not be exceeded except in case of an emergency.

(3) **Equipment.** Each man lock shall be equipped with the following:

(a) A recording pressure gage, fixed to the exterior of the lock on the atmospheric pressure side, shall be installed for showing the rate of decompression. The gage dial and chart shall be of such size that the amount of rise or fall in air pressure within 5 minutes will be readily discernible. The gage shall be protected by a locked box from interference or damage. This requirement will not be necessary when working at pressures of 13 pounds per square inch or less.

(b) A clock or clocks suitably placed so that the man lock attendant and persons in the man lock can readily ascertain the time.

(c) A recording pressure gage whose chart shall be of sufficient size to register a legible record of variations in pressure within the working chamber. This gage shall be readily accessible to the lock attendant.

(d) Pressure gages which will indicate to the man lock attendant the pressure in the man lock and the pressure in each working chamber to which the man lock affords direct or indirect access and to persons in the man lock the pressure in the man lock.

(e) Valves to enable the lock attendant to reduce or cut off the supply of compressed air into the man lock.

(f) Valves and pipes in connection with the air supply and exhaust which shall be so arranged that the lock and pressure can be controlled from within and without.

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(g) Effective means of verbal intercommunication between the man lock attendant and (1) persons in the man lock, (2) persons in any working chamber and (3) the air compressor plant, and also some means to enable persons in the lock to convey visible or other nonverbal signals to the lock attendant.

(h) A glass bulls-eye in each end of the lock to permit observation of the occupants.

(4) **Seating facilities.** The seating facilities in man locks shall be so arranged as to provide a normal sitting posture without cramping. Seating space not less than 22 inches in width shall be provided per occupant. *Exception:* In caissons having a working area less than 150 square feet, portable seats shall be provided in the combination material and man lock.

(5) **Lighting and heating.** Every man lock shall be lighted by electricity. The lighting intensity shall be a minimum of 30 foot-candles as currently recommended for waiting rooms by the illuminating engineers society. It shall also be provided with a system of radiant (infra-red) heating using electricity, steam or hot water for heating the radiant surface. The radiant surface shall be so located and protected as to prevent thermal burns. The chamber shall be heated to a minimum dry bulb temperature of 70 degrees F.

(6) **Ventilation.** A minimum ventilation rate of 20 cubic feet per minute of standard air at the prevailing ambient pressure in the lock shall be provided for each occupant. In no event shall the carbon dioxide concentration be permitted to rise above 0.5 percent by volume.

(7) **Record of decompression.** Where the pressure in the working chamber is 13 pounds or more, a record of all persons passing into or out of the working chamber shall be kept by a lock attendant who shall be stationed at the low pressure side of the man lock. Such record shall show the period of stay in the working chamber and the length of time of each decompression. Such record shall be signed by the medical officer and shall be kept on the job subject to inspection by the director of the state department of labor and industries or his authorized representative.

(8) **Automatic controls.** Each man lock shall be equipped with a suitable automatic control which through taped programs or cams or similar apparatus shall automatically regulate compressions and decompressions. It shall also be equipped with a timing device and such manual control as will enable the lock attendant to override the automatic mechanism in an emergency.

[Rules (Part V A), filed 12/28/62; §§ 3 and 4, filed 3/23/60.]

WAC 296-36-130 Special decompression chamber.

(1) **General.** The special low-pressure decompression chamber shall be provided for use when the nature of the work requires decompression times and procedures clearly within the scope of WAC 296-36-110(4).

(2) **Size and capacity.** The headroom in the special decompression chamber shall be not less than 7 feet and the cubical content shall provide at least 50 cubic feet of air space for each person. For each occupant there shall be provided 4 square feet of free walking area and 3 square feet of seating space exclusive of area required for lavatory and toilet facilities. The rated capacity shall be based on the stated minimum

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space per person and shall be posted at the chamber entrance. The posted capacity shall not be exceeded except in case of emergency.

(3) **Equipment.** Each special decompression chamber shall be equipped with the following:

(a) A clock or clocks suitably placed so that the attendant and the chamber occupants can readily ascertain the time;

(b) Pressure gages which will indicate to the attendant and to the chamber occupants the pressure in the chamber;

(c) Valves to enable the attendant to reduce or cut off the supply of compressed air into the chamber;

(d) Valves and pipes in connection with the air supply and exhaust arranged that the chamber pressure can be controlled from within and without;

(e) Effective means of verbal intercommunication between the attendant, occupants of the chamber and the air compressor plant;

(f) A glass bulls-eye at the entrance to permit observation of the chamber occupants.

(4) **Seating facilities.** Seating facilities in special decompression chambers shall be so arranged as to permit a normal sitting posture without cramping. Seating space not less than 18 inches by 24 inches in width shall be provided per occupant. Seat and back shall be padded or cushioned with a one-inch thickness of foam rubber or its equivalent.

(5) **Lighting and heating.** Lighting and heating shall comply with that for man locks, WAC 296-36-125(5).

(6) **Ventilation.** Ventilation shall comply with that for man locks, WAC 296-36-125(6).

(7) **Record of decompression.** Final stage decompression in the special chamber shall be part of the records required by WAC 296-36-125(7).

(8) **Automatic controls.** Special decompression chambers shall be equipped with automatic controls complying with WAC 296-36-125(8), for man locks.

(9) **Sanitation.** One toilet and one wash basin with hot and cold water in a screened or enclosed recess shall be provided for each 10 units of rated capacity as defined in WAC 296-36-130(2). An adequate supply of disposable towels, drinking water and disposable cups shall be provided. No refuse or discarded material of any kind shall be permitted to accumulate and the chamber shall be kept clean.

(10) **Location.** Where practicable the special decompression chamber shall be situated adjacent to the man lock on the atmospheric pressure side of the bulkhead. When located adjacent to the man lock a passageway shall be provided connecting the special chamber with the man lock to permit workmen in the process of decompression to move from the man lock to the special chamber without a reduction in the ambient pressure from that designated for the initial pressure of the final stage of decompression. The passageway shall be so arranged as to not interfere with the normal operation of the man lock nor with the release of the occupants of the special chamber to atmospheric pressure upon the completion of the decompression procedure.

In event that the special chamber is located remote from the man lock a means of pressurized transport shall be provided to move the men from the man lock to the special chamber without a reduction in the ambient pressure from

that designated for the initial pressure of the final stage of decompression.

Under unusual circumstances or in an emergency and only with the express permission of the appointed physician, decanting procedures may be used to facilitate the movement of men at atmospheric pressure from the man lock to the special decompression chamber for the final stage of decompression. RECOMPRESSION OF THE MEN MUST TAKE PLACE WITHIN FIVE MINUTES IN THE SPECIAL CHAMBER. THE MEDICAL LOCK SHALL NOT BE USED FOR THE RECOMPRESSION.

(11) **Design.** The special decompression chamber and passageway or pressurized transport shall be designed for an operating pressure of 20 pounds per square inch gage pressure.

(12) **Fire protection.** All applicable provisions of WAC 296-36-190, fire prevention and fire fighting shall apply to special decompression chambers.

[Rules (Part V B), filed 12/28/62.]

WAC 296-36-132 Lock attendants. (1) Whenever any workman is in a man lock or in a working chamber to which the man lock affords direct or indirect access, each working man lock shall be in the charge of a competent lock attendant who shall perform no other duties except to operate the lock and shall be employed the same number of hours as the other employees working in compressed air. The lock attendant shall control the maximum rate of compressions and shall perform all decompressions except where such compressions and decompressions are automatically regulated, but in such case the lock attendant shall have means to determine the pressures within the lock and working chamber at any time, and shall have also a timing device and such manual controls as will enable him to override the automatic mechanism in an emergency.

(2) Subject to the overall control by the lock attendant of the admission of compressed air into the lock, he may, if so authorized by the appointed physician, allocate to a competent person who is to be compressed in the lock, the duty to regulate from inside the lock the admission of compressed air, and duty to communicate to the lock attendant any complaint of discomfort by a workman in the lock and any report by that workman that the discomfort has ceased.

(3) Man lock attendants shall be under the direct supervision, control, discipline and training of the appointed physician and each man lock attendant shall be the holder of an unexpired first-aid certificate from the Red Cross, U.S. Bureau of Mines, or the Department of Labor and Industries. Lock attendants shall receive their wage payments directly from the head office of the employer and shall not be carried on or subject to the payroll procedures of the local office. A lock attendant shall not be relieved of his duties or discharged without consulting the appointed physician nor without the physician's assent.

[Rules (Part VI), filed 12/28/62; § 4, filed 3/23/60.]

WAC 296-36-135 Regulation of pressure and air quality in working areas—Gage tender. There shall at all times be a thoroughly experienced competent and reliable person on duty at the air control valves as a gage tender who shall regulate the pressure in the working areas. No gage ten-

der shall be on duty more than 8 hours in any 24. During tunneling operations, one gage tender may regulate the pressure in not more than two headings provided that the gages and controls are all in one location. In caisson work there shall be a gage tender for each caisson.

[Rules (Part VII A), filed 12/28/62; Rule 303, filed 3/23/60.]

WAC 296-36-140 Regulation of pressure and air quality in working areas—Pressure monitoring. (1) **High pressure.** Every compressed air line used to maintain pressure in working areas shall have a pressure gage attached at a point in the immediate vicinity of the control valves to show the pressure on the high pressure side of the control valves. Such gages shall be so located and illuminated as to be easily read by the operator and shall be of such size and so graduated as to show clearly a change in pressure of one pound.

(2) **Back pressure.** Back pressure gages to show the pressure in the working areas shall be located on the low pressure side of the bulkhead, in the superintendent's office, at the air control valves and in the power house. Back pressure gages shall be maintained in accurate working order and shall be tested at least once every 24 hours and a record shall be kept of each such test. In addition to the foregoing back pressure gages, a continuous recording back pressure gage shall be installed to provide a record of variations and pressure in the working chamber. The record shall be kept in the superintendent's office and be available for inspection by the director of the state department of labor and industries. *Exception:* Caissons having a net working area less than 150 square feet shall have back pressure gages installed on the low pressure side of the caisson and at the air control valves.

[Rules (Part VII B), filed 12/28/62.]

WAC 296-36-145 Regulation of pressure and air quality in working areas—Air quality in working areas. (1) **Ventilation.** An automatic air quality monitoring system acceptable to the director, department of labor and industries, shall be installed in the pressurized working chamber and shall at all times be maintained in proper working condition. The system shall provide continuous sampling and monitoring of the air and shall indicate by visual and audible alarm the presence of dangerous air contaminants in excess of the following:

Carbon monoxide	0.01%	100 ppm
Carbon dioxide	0.50%	5000 ppm
Oxides of nitrogen	0.0005%	5 ppm
Methane	0.25%	2500 ppm
Hydrogen sulphide	0.002%	20 ppm

The director in his discretion may change these concentrations to conform with good practices as recommended by the American Conference of Governmental Industrial Hygienists.

The system shall also indicate and give alarm at any time the oxygen content is less than 19.5 percent.

The system shall be so arranged that the visual and audible alarm will give warning in the working chamber and at the lock tender's station at the low pressure side of the locks.

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In addition to the specific requirements contained in these standards of safety chapter 296-62 WAC shall apply for rock dust and ventilation.

(2) **Protection against atmospheric containments:** The requirements of chapters 296-62 and 296-155 WAC, Part Q shall apply.

[Statutory Authority: Chapter 49.17 RCW, 90-17-051 (Order 90-10), § 296-36-145, filed 8/13/90, effective 9/24/90; Rules (Part VII C), filed 12/28/62; § 25, filed 3/23/60.]

WAC 296-36-150 Air supply. (1) **Clean air.** Compressed air supplied to working area shall not contain quantities of harmful or offensive air contaminants exceeding the limits set forth hereinbefore.

(2) **Amount.** Nor less than 30 cubic feet per minute per man, measured at the prevailing working chamber pressure, of outside air shall be supplied to the working areas under pressure.

(3) **Supply lines.** In addition to the compressed air lines supplying working areas under pressure, there shall be a second such line of the same size and similarly equipped which shall be maintained ready for immediate use between the working chamber side of the bulkhead and the compressed air source in case of failure of the first line.

(4) **Point of discharge.** The point of discharge of the supply line in use shall be as close to the working face as is practicable and the discharge end of both supply lines shall be provided with a check valve.

(5) **Air outlet or exhaust line.** Air outlet lines from areas under pressure shall be properly located so that injurious gases may be promptly removed. Such lines shall be provided with suitable valves.

(6) **Air tools.** The high pressure air supplied for air-operated tools, equipment and appliances shall comply with the quality requirements contained in WAC 296-36-145, Air quality in working areas.

[Rules (Part VIII), filed 12/28/62; Rule 2009, filed 3/23/60.]

WAC 296-36-155 Compressor plant. (1) **Capacity.** The capacity, arrangement and number of compressors shall be sufficient to maintain the necessary pressure without overloading the equipment and to assure maintenance of such pressure in the working chamber during periods of breakdown or other emergency. The compressor installation shall be capable of delivering not less than 50 cubic feet per minute of ventilating air for each man in the working chamber at the prevailing working chamber pressure. Additional stand-by compressor units shall be installed in accordance with the following tabulation:

Normal installation at 50 C.F./Man/Min. units	Stand-by units	Total units	Percent rated total capacity of stand-by units divided by normal units
1	1	2	100
2	2	4	100
3	2	5	67
4	2	6	50
5	2	7	40

(2) **Sources of power.** Where the power is generated on the job there shall be a sufficient number of power units to maintain the necessary compressor operation.

(3) **Power feeders.** Where power is obtained from a public utility there shall be at least two feeders to the compressor plant. Each feeder shall have a capacity sufficient to carry the entire load and normal overload. The feeders shall run over separate routes in such a way that a breakdown of one feeder will not cause any interruption of power from the other feeder. Each feeder or service extension shall enter the compressor plant through a separate and independent opening.

(4) **Bus bar connections.** There shall be duplicate feeder bus bars at the compressor plant. Feeder connections to the bus bar shall be such that either feeder can feed to each bus bar separately or simultaneously to both bus bars. The electrical connections from the bus bars to the compressor shall be arranged in such a way as to insure continuous operation of the compressor plant, in spite of any breakdown of an individual feeder, bus bar or compressor unit.

(5) **Alternate sources of power.** Any combination of power either generated at the job or generated off the job as set forth above, and which complies with the above requirements is permitted.

(6) **Maintenance.** All equipment including reserve sources of power and reserve compressor equipment used to maintain pressure in working areas shall at all times be maintained in good repair and ready for use. All reserve equipment shall be periodically inspected and shall be operated for a period of one hour or more at least once in every week, except where there is danger of sudden flooding, in which case reserve equipment shall be operated at least one hour in every 24 hours. An ample supply of spare parts shall be kept on hand.

[Rules (Part IX), filed 12/28/62; § 12, filed 3/23/60.]

WAC 296-36-160 Personnel facilities. (1) **General.** There shall be provided on every job a change house which shall have a dressing room and separate spaces for each of the following: drying clothes, shower baths, toilet facilities and rest room with seating facilities and tables.

(2) **Maintenance.** The change house shall be kept clean throughout.

(3) **Dressing room.** The dressing room shall be provided with benches and a full length metal or other approved non-combustible locker with facilities for locking for each compressed air worker.

(4) **Clothes drying.** Facilities for drying clothing shall be installed and sufficient heat shall be provided to dry the clothing within 12 hours.

(5) **Toilet facilities.** One toilet and one urinal shall be provided for every 8 men or part thereof employed on each shift.

(6) **Shower baths.** Shower baths with hot and cold water shall be installed in the change house in sufficient number to provide one unit for every 8 men coming off shift.

(7) **Wash basins.** At least one wash basin with hot and cold running water or equivalent facilities at wash fountains shall be provided for every 8 men coming off shift.

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(8) **Temperature.** A minimum temperature of 72 degrees F. shall be maintained in the dressing room, wash room and bathroom.

(9) **Coffee.** A sufficient supply of hot coffee, cream, milk and sugar shall be supplied to men working in compressed air at the termination of shifts and during rest periods. Coffee shall be heated by means other than direct steam. Coffee containers shall be kept clean and covered. Unless drinking cups are of the single service type, individual cups shall be sterilized after each use.

(10) **Eating space underground.**

(a) **General.** Suitable eating space shall be provided in the working chamber in the event that established working periods are of sufficient length to normally include a meal time interval. *Exception:* This requirement is not applicable to caisson work.

(b) **Facilities.**

(i) **Space requirements.** The space provided shall have a minimum head room of 6 feet 6 inches and a minimum area of 6 square feet shall be provided per person occupying the space at any one time.

The area shall be dry and clean, shall be lighted, heated and ventilated in accordance with WAC 296-36-125 (5) and (6), man locks.

(ii) **Equipment.** The space shall be equipped with tables and comfortable seating facilities providing seating space not less than 22 inches in width per occupant; disposable towels; washing facilities with hot and cold water or in lieu thereof acceptable dry-cleansing tissues; and space outside the immediate eating area for the removal and temporary storage of protective clothing. Portable equipment, acceptable to the supervisor of safety, department of labor and industries, which may be moved into the working chamber and removed therefrom, may be provided.

[Rules (Part X), filed 12/28/62; § 21, filed 3/23/60.]

WAC 296-36-165 Sanitation below ground. (1) **Toilet facilities.** At least one approved chemical toilet shall be provided in the working chamber. Such facilities shall be maintained in a sanitary condition and shall be used by the workers.

(2) **Housekeeping.** No refuse or discarded material of any kind shall be permitted to accumulate underground. The man lock shall be kept clean.

(3) **Drinking water.** An ample supply of clean and potable drinking water shall at all times be available in working areas. Where water is supplied in containers it shall be kept covered. The use of common drinking cups is prohibited.

[Rules (Part XI), filed 12/28/62; § 21, filed 3/23/60.]

WAC 296-36-170 Stairs and ladders. The requirements of chapter 296-155 WAC Parts K and J shall apply.

[Statutory Authority: Chapter 49.17 RCW, 90-17-051 (Order 90-10), § 296-36-170, filed 8/13/90, effective 9/24/90; Rules (Part XII), filed 12/28/62.]

WAC 296-36-175 Lighting and power equipment. (1) **All lighting underground shall be by electricity.**

(a) Lighting shall comply with chapter 296-155 WAC.

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(b) Power equipment shall comply with chapter 296-155 WAC.

(2) **Emergency lighting.** The lighting circuits shall be connected to two independent sources of power supply. In addition to the lighting circuit, adequate and sufficient portable electric emergency lights shall be provided and maintained for immediate use. These shall be readily accessible to all employees working underground.

(3) **Lamp sockets.** The exterior of all lamp sockets shall be of nonmetallic material and all sockets shall be of the weatherproof type.

(4) **Location of lamps.** Lamps shall be so placed that they cannot come into contact with combustible materials and so that a clear space is provided all around.

(5) **Lamp guards.** All lamps shall be protected with wire cage guards.

[Statutory Authority: Chapter 49.17 RCW. 90-17-051 (Order 90-10), § 296-36-175, filed 8/13/90, effective 9/24/90; Rules (Part XIII), filed 12/28/62; § 6, filed 3/23/60.]

WAC 296-36-180 Signals and means of communication. (1) Effective and reliable signaling devices shall be maintained at all times to give instant communication between the bottom and top of shaft, and where considered necessary by the safety division, dual independent signal systems shall be installed.

(2) Special care shall be taken to keep the signaling apparatus in good order, and all proper precautions shall be taken to prevent electric signal and telephone wires from coming into contact with other electric conductors, whether insulated or not.

(3) Where it is necessary to use signals by means of bell or otherwise for hoisting or lowering, the following code shall be used:

Any code of signals used shall be printed and copies thereof shall be kept posted in a conspicuous place near entrances to work places and in such other places as may be necessary to bring them to the attention of all persons concerned.

1 bell:	Stop immediately if in motion.
2 bells:	Lower.
3-1 bells:	Hoisting men, run slowly.
3-2 bells:	Lowering men.
1-1 bells:	To hoist muck.
2-1-2 bells:	Release cage, skip, or bucket.
4 slow bells:	Blasting signal. (This is a caution signal and if the hoist operator is prepared to accept it he must acknowledge it by raising cage, skip or bucket a few feet then lowering it again. After accepting this signal, hoist operator must be prepared to hoist men away from blast as soon as signal 3-1 bells are given and must accept no other signal in the meantime.)
5 bells:	Water on or off.
6 bells:	Air on or off.

9 bells: Danger signal (fire, accident or other danger), followed by station signal, calls cage, skip, or bucket to that station. This signal takes precedence over all others except an accepted blasting signal.

(4) Where tunnels are driven from shafts more than two hundred fifty feet deep, a telephone system shall be established and maintained, communicating with the surface at each such shaft, and with a station or stations readily and quickly accessible to the men at the working level.

[Statutory Authority: Chapter 49.17 RCW. 90-17-051 (Order 90-10), § 296-36-180, filed 8/13/90, effective 9/24/90; Rules (Part XIV), filed 12/28/62.]

WAC 296-36-185 Explosives—Blasting. (1) **Storage and supply.** Explosives including detonators shall not be stored or kept underground. The supply for each blast shall be taken directly from above ground to the face and immediately loaded. All explosives remaining after loading a round shall be removed to the magazine before the leading wires are connected.

(2) **Explosives in air locks.** While explosives are being locked through a tunnel bulkhead, the detonators and explosives shall be placed at the opposite ends of the lock and no person, other than the lock tender and those persons necessary for carrying, shall be permitted in the lock. No other material or equipment shall be locked through with explosives.

Explosives and detonators shall be taken separately into caissons.

(3) **Carrying containers.** Explosives other than detonators shall be conveyed in a suitable covered wooden box painted red and provided with handles. Detonators shall be conveyed in a separate covered wooden box, painted red with a one-inch yellow stripe running horizontally entirely around the box. The box shall be provided with handles.

(4) **Blaster.** The blaster shall be a person designated by the superintendent and shall be in charge of all operations connected with preparations for blasting and shall fire all shots.

(5) **Duties of the blaster.** Before removing any explosives from the carrying containers, the blaster shall verify

(a) That the blasting switch is in "off" position and that its box is locked;

(b) That the "gap" in the blasting circuit is open; (Note: A gap of at least 5 feet on the incoming side of the switch, except during the firing operation, when connections at such gap are to be made by means of plugs, is required.)

(c) That the heading gang has been withdrawn to a safe distance or to a safe shelter, except such men from the gang as the blaster may direct to remain with him to assist in loading under his directions; and

(d) That all light and power circuits have been disconnected at a point not less than 100 feet from the place to be blasted. The blaster shall direct the loading of all holes and the making of the necessary connections in the blasting circuit; he shall sound a warning signal distinctly audible in any part of the working chamber, shield or any drift ahead of the

shield where any person remaining would be exposed to injury from the blast.

(6) **Vacating blasting area.** All persons shall promptly vacate the blasting area when so directed by the blaster. When the blaster is satisfied that all persons have vacated the blasting area, he, alone, shall unlock the box that contains the blasting switch and fire the blast.

(7) **Return to blasting area.** No person shall return to the blasting area until the air in such area has been cleared of injurious concentrations of toxic fumes. The blaster shall be the first to return to the heading. He shall examine the effects of the blast and investigate the matter of possible misfires and he, alone, shall give the signal for the return of the workmen to the heading and for the restoration of light and power in the blasted area.

(8) **Hand lamps and cap lamps.** Electric hand lamps and cap lamps used by the blaster or his helpers or by any other person in the working chamber during the blasting operation shall be approved.

(9) **Blasting circuits.** All circuits used for blasting shall be ungrounded circuits. Damaged leading wires shall not be used.

[Rules (Part XV), filed 12/28/62; § 14, filed 3/23/60.]

WAC 296-36-190 Fire prevention and fire fighting.

(1) **General.** Every building and every flammable structure above ground and all places underground shall be within easy range of fire fighting equipment, which shall at all times be maintained in proper working conditions and ready for use.

(2) **Smoking.** No person shall smoke or carry lighted smoking materials in compressed air. No matches, mechanical or chemical igniters will be permitted in the working chamber except those necessary for welding or flame cutting operations.

(3) **Welding or flame cutting.** While welding or flame cutting is being done in compressed air, a watchman with a fire hose or approved extinguisher shall stand by until such operation is completed. Acetylene shall not be used in compressed air at acetylene pressure exceeding 15 pounds per square inch gage, or 30 pounds per square inch absolute.

(4) **Fire hose.** Fire hose shall be at least 1-1/2 inches in nominal diameter; the water pressure shall at all times be adequate for efficient operation of the type of nozzle used; and the water supply shall be such as to insure an uninterrupted flow. Fire hose when not in use shall be so located or guarded to prevent injury thereto.

Every power house, compressor house and every building housing ventilating equipment shall be provided with at least one hose connection in the water line with the fire hose connected thereto. A fire hose shall be maintained within easy reach of structures of wood over or near shafts.

(5) **Shafts and caissons.** Every shaft and every caisson containing flammable material of any kind, either above or below ground, shall be provided with a water line and a fire hose connected thereto, so arranged that all points of the shaft or caisson are within easy reach of the hose stream.

(6) **Tunnels.** Every tunnel shall be provided with a water line extending into the working chamber and to within 100 feet of the working face. Such lines shall have hose outlets with 100 feet of fire hose properly attached and maintained as

follows: One at the working face, one immediately inside of the bulkhead of the working chamber, and one immediately outside such bulkhead. In addition, hose outlets shall be provided at 200-foot intervals throughout the length of the tunnel and 100 feet of fire hose shall be attached to the outlet nearest to any location where flammable material is being kept or stored or where any flame is being used.

(7) **Fire extinguishers.** In addition to required fire hose protection, on every floor of every building used in connection with compressed air work, there shall be provided at least one extinguisher of adequate size approved for the class of hazard involved, except that extinguishers containing carbon tetrachloride or methyl bromide shall not be used. Extinguishers shall be so located as to be readily available and protected from damage.

[Rules (Part XVI), filed 12/28/62; § 7, filed 3/23/60.]

WAC 296-36-195 Special provisions for tunnels. (1)

Bulkheads. The bulkheads separating the working chamber from areas of lower pressure shall be of sufficient strength to withstand safely the maximum pressure to which it may be subjected. Where there is a possibility of rapid flooding of the working chamber, such as might be present in subaqueous tunnels, the bulkhead shall be located sufficiently close to the face or shield to permit escape of the workers in case of an emergency. But in no case where there is such possibility shall such distance be more than 300 feet.

(2) **Safety curtain or screens.** Where danger of a blow or an in-rush of water exists in tunnels 12 feet or more in clear height, and the elevation of the top of the lining at the face and of the completed tunnel back to the emergency lock are such that a safety curtain will afford protection to the workman, a safety curtain shall be provided. It shall be located where it will afford the maximum of protection in case of an emergency but not impracticably close to the face.

Safety curtains shall be of incombustible material and shall be installed in the crown of the tunnel. They shall provide an airtight seal with the tunnel lining and shall be properly reinforced and braced as may be necessary. Curtains or screens shall be installed at right angles to the axis of the tunnel with the bottom edge horizontal. In tunnels up to and including 24 feet in inside clear height, the safety curtain shall extend down to the center line of the tunnel. In tunnels over 24 feet inside clear height, it shall extend at least 12 feet below the inside clearance line of the roof of the tunnel.

(3) **Walkways.** In tunnels 16 feet or more in diameter, containing safety curtains or screens, hanging walkways shall be provided from the face to the man lock and shall be installed as high in the tunnel as is practicable. Such walkway shall be installed above the tunnel floor and shall have at least 6 feet of head room above the walkway. A railing 42 inches high and a toe board shall be securely installed throughout the length of walkways on open sides. In areas under pressure, the walkways, stairways, and ladders including railings shall be of incombustible material.

(4) **Maintenance of walkways.** Walkways and the stairs or ladders leading thereto shall be at all times maintained clear, in good repair, and in a condition to carry safely the loads to which they may be subjected.

(5) **Ramps.** Walkways shall be provided with ramps under safety screens. Such ramps shall be provided with cleats.

(6) **Man lock and material lock.** Every tunnel shall have at least two locks in proper working condition, one of which shall be used as a material and equipment lock and the other used exclusively as a man lock.

(7) **Emergency man lock.** In subaqueous tunnels where space permits, there shall be in addition to the man lock and the material lock, an emergency man lock which shall be large enough to hold an entire heading shift and which shall be kept open toward the face and maintained ready for use at all times.

(8) **Location of locks.** Man locks and emergency locks shall be located as high in the tunnel as space will permit but the emergency lock shall be located in the crown of the tunnel.

(9) **Track safeties and brakes.** An automatic stop block or derailing device shall be provided at the top of every slope or incline greater than 3 percent. In addition, such a device shall be installed at a point not less than 150 feet nor more than 200 feet upgrade from any point where runaway cars may cause damage to the shield or air lock. A holding device shall be provided for cars used on inclines. Such device shall be set in the holding position during loading.

[Rules (Part XVII), filed 12/28/62; §§ 10 and 18, filed 3/23/60.]

WAC 296-36-200 Special provisions for caissons. (1) **Number of locks.** Every caisson shall have at least two locks, one of which shall be used exclusively as a man lock. *Exception:* Caissons having a working area less than 150 square feet may have a single or combined man and material lock.

(2) **Location of man locks.** The bottom of the lowest door opening of locks shall not be less than 3 feet above the water level being controlled by the use of compressed air.

(3) **Lock platforms.** All caisson locks located above ground shall be provided with an exterior platform not less than 42 inches wide with stairs or ladders leading thereto. The platform and stairs shall have a substantial handrail with midrail and the platform shall have toeboards at least 4 inches high.

(4) **Ladderways and stairways in man shafts or shaft-ing.** Ladderways or stairways shall be provided and shall be kept clear and in good condition. Stairways shall be lighted at every landing and ladderways shall be lighted at 10-foot intervals with guarded incandescent lamps. Ladders and landings shall be of incombustible material. Pockets in the wall of the shaft shall not be used in lieu of ladders. In caissons having a working area more than 150 square feet, the man shafts shall be separated from the hoisting shaft by a barrier. Where the man shaft is separated from the hoisting shaft, the ladderways shall be provided with platform landings at intervals not exceeding 15 feet. In caissons having a working area less than 150 square feet, the ladder shall be recessed to prevent interference between the bucket and the ladder.

(5) **Hoisting.** No person shall ride on a loaded car, cage or bucket. Where the ladderway and hoistway are not separated by a barrier, no hoisting shall be done while any person is ascending or descending the ladder, nor shall any person enter the shaft while the hoisting conveyance is in motion.

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Standard warning signals shall be provided and shall be given and acknowledged to affect compliance with this provision.

(6) **Shoring.** Where the bottom of the excavation is below the cutting edge of the caisson and there is danger of a cave-in, the sides of the excavation shall be securely shored.

[Rules (Part XVIII), filed 12/28/62; § 17, filed 3/23/60.]

WAC 296-36-210 Medical supervision and medical and first-aid facilities—Medical supervision. (1) **Appointed physician.** Where workmen are employed in compressed air, their employer shall make arrangements for their medical supervision by one or more licensed physicians trained in the physical requirements and the medical aspects of compressed air work and the treatment of decompression illness. The employer shall arrange for medical examination of all workmen employed in compressed air at a suitable place or places by the appointed physician in accordance with these regulations. The appointed physician or physicians shall be immediately available in case of emergency or accident. Each appointed physician shall be physically qualified to subject himself to a compressed air environment.

(2) **Appointed physician's duties and responsibilities.**

(a) General. All matters on the job pertaining to the health of employees, treatment on the job of illness and injuries, special first-aid and nursing personnel or assistants, lock attendants, and medical and first-aid equipment shall be under the supervision of the appointed physician.

(b) He shall make all required physical examinations.

(c) He shall make and sign all required reports of such examinations using the forms provided by the department of labor and industries.

(d) He shall make at least one inspection on the job every day of all treatment records and the required decompression record and he shall inspect or inquire into conditions which may constitute a potential hazard to the health of any employee.

(3) **Certified medical attendant.** There shall be on every job a certified medical attendant trained to the satisfaction of the appointed physician in administering first aid on compressed air jobs, and who shall be in attendance in the first-aid room while work in compressed air is going on and at such other times as the physician may direct. The medical attendant shall be in personal charge of the administration of first aid and such other duties as physician may direct. Under no circumstances shall female medical attendants be subjected to a compressed air environment.

(4) **First-aid personnel.**

(a) The superintendent and every foreman and at least one additional designated person on each shift below ground shall be trained to the satisfaction of the appointed physician in administering first aid.

(b) Where more than 10 but less than 50 men are employed per shift underground, there shall be at least 2 such additional designated trained persons on the job and available on call.

(c) Where more than 50 men are employed per shift underground, the designated trained personnel shall include all shift bosses and time keepers in addition to those required in subsection (b) above.

(d) All designated first-aid personnel shall have in their possession current first-aid certificates acceptable to the department of labor and industries.

(5) **First-aid meetings.** All designated first-aid personnel shall meet at least once in each 3 months or oftener if directed by the physician for further first-aid instruction by the physician.

(6) **First-aid room and equipment.** The employer shall provide a first-aid room properly heated and maintained within 100 yards of the principal entrance to the underground work. It shall be equipped with a first-aid kit, medical supplies and equipment consisting of not less than the minimum requirements listed in chapter 296-155 WAC, Part B-1.

(7) **First-aid equipment underground.** All the equipment and supplies which the appointed physician may deem necessary for first-aid underground shall be provided and maintained readily available in a suitable cabinet or cabinets. A list of the contents signed by the appointed physician shall be permanently attached to the inside of the cabinet door or cover. The cabinet shall be plainly marked with a red cross and the words "first aid."

In caissons, one such cabinet shall be conveniently located in the working chamber.

In tunnels where a bulkhead is installed, one such cabinet shall be located on each side of the bulkhead near the entrance to the man lock.

In tunnels having no bulkhead, one such cabinet shall be located within 100 yards of the working face.

[Statutory Authority: Chapter 49.17 RCW, 90-17-051 (Order 90-10), § 296-36-210, filed 8/13/90, effective 9/24/90; Rules (Part XIX A), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-215 Medical supervision and medical and first-aid facilities—Medical locks. (1) **Requirement and location.** When the pressure in a working chamber exceeds 13 pounds per square inch gage, a suitably constructed medical lock shall be provided and maintained and used solely for the treatment and examination of workmen working in compressed air. It shall be situated adjacent to a medical emergency room but separated therefrom to provide privacy for patient and doctor during treatment or examination.

(2) **Design and equipment.**

(a) The medical lock shall have not less than 6 feet of clear head room and shall consist of not less than two compartments so that the lock can be entered while under pressure. It shall be adequately ventilated, air conditioned, heated and lighted and be constructed and finished as to be readily kept in a clean and sanitary condition.

(b) The medical lock shall be designed for an operating pressure of 75 pounds per square inch gage pressure.

(c) It shall be equipped with pressure gages readily observed from inside and outside of the medical lock indicating the pressure on the inside of the lock.

(d) The air line supplying the medical lock shall be equipped with valves so arranged that the pressure may be controlled from inside or outside the lock.

(e) Oxygen inhalation apparatus shall at all times be maintained ready for use in the lock, but the source of supply shall be located outside of the lock. Oxygen and oxy-helium

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mixtures shall not be used until proper diagnosis is made by the appointed physician and shall be used only under his direction and supervision. The air compressing plant used for supplying compressed air to the medical lock shall have sufficient capacity to raise the pressure in the medical lock from zero pounds to 75 pounds per square inch gage within 5 minutes and shall be equipped to prevent excessively high temperature within the lock. The temperature within the lock shall not exceed 90 degrees F. at 75 pounds per square inch gage pressure.

(f) The medical lock shall be provided with suitable equipment including a couch not less than 6 feet in length, blankets, food lock, efficient means of verbal communication and of giving nonverbal signals between the inside and outside of the lock, and between the two compartments, and a window or windows through which workmen in either compartment can be observed from outside. Telephone communications shall be provided between the inside and outside of the medical lock. The telephone circuits shall, however, be so arranged that completion of calls originating inside the lock and destined for subscribers of the commercial communication system or calls the origin of which is from a subscriber of the commercial communication system and destined for the medical lock, must be completed by the lock attendant.

(g) All necessary apparatus, instruments, medical supplies and equipment as required by the appointed physician shall be kept in the lock at all times.

(3) **Use of medical lock.**

(a) The medical lock shall be kept ready for immediate use and, when any workman is actually employed in compressed air, shall be constantly in charge of a person trained in the use of a medical lock and suitably instructed as to the steps to be taken in the event of any workman suffering ill effects from compressed air.

(b) No workman shall enter or be treated in the medical lock in which pressure exists except at the direction of the appointed physician for the purpose of examination as to medical fitness or for the purpose of diagnosis of a suspected illness, or for treatment of the condition diagnosed by the appointed physician.

[Rules (Part XIX B), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-220 Medical supervision and medical and first-aid facilities—Decompression illness—Symptoms and treatment. Every compressed air worker, upon noticing any symptom of decompression illness and wherever he may be, on the job or off the job, shall proceed immediately to the first-aid room for examination and treatment. Treatment shall be rendered promptly as directed by the appointed physician. Recompression, if prescribed by the appointed physician, shall be as the appointed physician may direct. After such treatment, the worker shall return to work only as and when directed by the physician.

[Rules (Part XIX C), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-225 Medical supervision and medical and first-aid facilities—Decompression illness to be reported. Every case of decompression illness shall be reported by the physician to the _____. Distribution of the report

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shall be as directed by the _____. Responsibility for supervision of treatment and accuracy of the report shall rest with the physician.

[Rules (Part XIX D), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-250 Routine examination of employees—Preemployment examinations and reports. (1) Every person considered for work in compressed air on any job and before starting work shall be given a thorough medical and physical examination by the appointed physician who shall order special tests when deemed necessary. The physician's findings shall be entered on a form entitled "preemployment history" and a form entitled "physical examination" furnished by the department of labor and industries. A copy of his recommendation as to employability shall be submitted to the superintendent and shall be kept on the job. The physical examination shall include adequate X-rays to determine possible preexisting lung or bone disease, a test of the ability of the ear to adjust to pressure changes, an orthopedic examination, a clear tone audiogram, an inspection for gross obesity, a simple test for pulmonary and cardiac function, and an inquiry concerning metallic objects in the body.

(2) No workman shall be employed in compressed air unless he has been examined by the appointed physician and is certified by the physician, by a health certificate or a workman's compressed air health register, to be fit for such employment, and further that the date of such certificate is not more than 3 days earlier.

(3) Where work in compressed air is urgently required to be done, before it is reasonably practical, because of the inaccessibility of the appointed physician, to arrange for any examination to obtain any certificate required, an examination may be made by any duly qualified physician who may issue a temporary certificate of fitness. A reexamination of such a workman by the appointed physician shall be made as soon as practicable.

[Rules (Part XX A), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-255 Routine examination of employees—Beginners. Every person who has not previously worked in compressed air shall be tested in the medical lock as part of the preemployment examination before commencing such work. If he passes the test he shall not work more than 4 hours on his first day of work or not more than one-half the regular total work period whichever is the lesser in time, after which he shall be reexamined by the physician for physical fitness. The physician's recommendation shall be in writing and signed by him. A copy shall be submitted to the employer and shall be kept on the job.

[Rules (Part XX B), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-260 Routine examination of employees—Periodic examination. Every compressed air worker shall be examined at regular intervals to determine his fitness to continue work in compressed air. The interval between regular examinations shall not exceed 2 months when work pressures are 13 pounds or less. For pressures exceeding 13 pounds, the regular periodic examination shall be made at intervals not exceeding one month.

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[Rules (Part XX C), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-265 Routine examination of employees—Resumption of work. (1) Every compressed air worker who has been absent from the job 10 days or more shall be examined by the physician before resuming work. The physician's findings shall be submitted in writing to the person in charge and shall be kept on the job.

(2) Any workman who is suffering from a cold in the head, a sore throat, ear ache, or any other ailment which is likely to render him unfit for employment in compressed air shall report the matter to his employer or to the person placed in charge of the operation or to the appointed physician, and he shall not be employed in compressed air until he has since, so reporting, been examined by the appointed physician and certified by him to be fit for such employment.

(3) The appointed physician may, on examining or reexamining a person who has been or who is proposed to be employed in compressed air, vary, qualify, or revoke, by written entry in the workman's certificate, any statement relative to his fitness for employment in compressed air. By the same process, the physician may limit the pressure to which the workman is to be subjected or restrict the hours of employment or exposure in compressed air.

[Rules (Part XX D), filed 12/28/62; § 23, filed 3/23/60.]

WAC 296-36-270 Routine examination of employees—Physical fitness requirements. (1) Only persons who are able to readily equalize the pressure in their ears shall be accepted for work in compressed air.

(2) Persons having chronic alcoholism shall not be permitted to work in compressed air.

(3) Persons having chronic systemic disease or any impairing physical deformity or abnormality including excessive obesity shall not be engaged for work in compressed air.

(4) Persons having any disease of the ear or any systemic disease including skeletal, cardio-vascular, respiratory, genital urinary, or gastrointestinal, which may be aggravated by work in compressed air or which may prevent safe performance of such work, shall not be permitted to work in compressed air.

(5) A person engaged for work in compressed air shall demonstrate his ability to read, speak and comprehend the English language.

[Rules (Part XX E), filed 12/28/62.]

WAC 296-36-990 Severability. If any provision of this safety standard or the application thereof to any person or circumstance is held invalid, such invalidity shall not affect other provisions or applications of this safety standard which can be given effect without the invalid provisions or applications and to this end the provision of this safety standard are declared to be severable.

[Rules (Part XXI), filed 12/28/62.]

Chapter 296-37 WAC

STANDARDS FOR COMMERCIAL DIVING OPERATIONS

WAC

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DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-37-010	Scope and application. [Section I, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-020	Purpose. [Section II, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-030	Definitions. [Section III, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-040	Appointment and duties of committees. [Section IV, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-050	Classification of apparatus permitted and air purity. [Section V, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-060	Approval of equipment. [Section VI, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-070	Diver registration—Diver training or experience—Physical exam and medical history record. [Section VII, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-071	Form # 1. [Form # 1, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-072	Form # 2. [Form # 2, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-080	General requirements, procedures and techniques. [Section VIII, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-081	Form # 3. [Form # 3, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-082	Illustrations of flags and shapes. [Illustrations, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040,

296-37-090	49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. Recompression chamber—Tables—Attendant. [Section IX, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-100	Identification. [Section X, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-110	Waiver or variance. [Section XI, effective 2/1/64.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-300	Use of compressors in diving operations. [Rule 101, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-310	Equipment requirements—Divers air line, check valves, etc. [Rules 102 and 103, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-320	Equipment requirements—Barge operations. [Rule 104, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-330	Equipment requirements—Air tools used in underwater operations. [Rule 105, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-340	Equipment requirements—Inspection. [Rule 106, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-350	Safety rules—Generally. [Rule 107, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-360	Safety rules—Suggestions made by diver considered rule to govern. [Rule 108, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-370	Conditions on barge deck. [Rule 109, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-380	Use of two-way telephones. [Rule 110, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-390	Decompression chamber—When used. [Rule 111, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-395	Special stipulation regarding inexperienced divers and workmen. [Rule 112, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-400	Special stipulation regarding inexperienced divers and workmen—Diver may choose tender. [Rule 113, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-410	Judgment of diver to take precedent. [Rule 114, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
296-37-420	Requirement on all ship surveys. [Rule 115, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

- 296-37-430 Use of flood lights. [Rule 116, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
- 296-37-440 Rules for compressed air operations applicable to diving operations. [Rule 117, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
- 296-37-450 Availability of life preservers. [Rule 118, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.
- 296-37-460 Care and replacement of equipment. [Rules 119 and 120, filed 3/23/60.] Repealed by 78-10-094 (Order 78-18), filed 10/2/78. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW.

WAC 296-37-510 Scope and application. (1) The requirements included in this vertical chapter shall apply throughout the state wherever diving takes place within the jurisdiction of the department of labor and industries. These requirements shall also be applicable to those diving related and supportive work activities not at the diving site but which have a direct effect on the safety of the diving operations. Examples may include but are not limited to: The supply of breathing air or gas; the supply of materials, equipment or supplies required by this chapter; the maintenance of diving equipment.

(2) This standard applies to diving and related support operations conducted in connection with all types of work and employments, including general industry, construction, ship repairing, shipbuilding, shipbreaking and longshoring. However, this standard does not apply to any diving operation:

(a) Performed solely for instructional purposes, using open-circuit, compressed-air SCUBA and conducted within the no-decompression limits;

(b) Performed solely for search, rescue, or related public safety purposes by or under the control of a governmental agency; or

(c) Governed by 45 CFR Part 46 (Protection of Human Subjects, United States Department of Health and Human Services) or equivalent rules or regulations established by another federal agency, which regulate research, development, or related purposes involving human subjects.

(d) Defined as scientific diving and which is under the direction and control of a diving program containing at least the following elements:

(i) Diving safety manual which includes at a minimum: Procedures covering all diving operations specific to the program; procedures for emergency care, including recompression and evacuation; and criteria for diver training and certification.

(ii) Diving control (safety) board, with the majority of its members being active divers, which shall at a minimum have the authority to: Approve and monitor diving projects; review and revise the diving safety manual; assure compliance with the manual; certify the depths to which a diver has been trained; take disciplinary action for unsafe practices; and, assure adherence to the buddy system (a diver is accompanied by and is in continuous contact with another diver in the water) for SCUBA diving.

(3) This chapter shall augment the requirements of the general safety and health standard, chapter 296-24 WAC and the general occupational health standard, chapter 296-62 WAC. In instances where this chapter is in direct conflict with the requirements of any general horizontal standard, the requirements of this chapter shall apply.

(4) Hoisting gear used in diving operations shall be inspected and certified as required by chapter 296-56 WAC, safety standards for longshore, stevedore and related waterfront operations.

(5) Application in emergencies. An employer may deviate from the requirements of this standard to the extent necessary to prevent or minimize a situation which is likely to cause death, serious physical harm, or major environmental damage, provided that the employer:

(a) Notifies the assistant director of the department of labor and industries in Olympia or the regional administrator for the region within 48 hours of the onset of the emergency situation indicating the nature of the emergency and extent of the deviation from the prescribed regulations; and

(b) Upon request from the authority notified, submits such information in writing.

(6) Employer obligation. The employer shall be responsible for compliance with:

(a) All provisions of this standard of general applicability; and

(b) All requirements pertaining to specific diving modes to the extent diving operations in such modes are conducted.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-37-510, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-510, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 87-02-002 (Order 86-44), § 296-37-510, filed 12/26/86; 81-07-048 (Order 81-4), § 296-37-510, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-510, filed 10/2/78.]

WAC 296-37-512 Variance and procedure. Realizing that conditions may exist in operations under which certain state standards will not have practical application, the director of the department of labor and industries or his/her authorized representative may, pursuant to this section, RCW 49.17.080 and/or 49.17.090 and appropriate administrative rules of this state and the department of labor and industries and upon receipt of application and after adequate investigation by the department, permit a variation from these requirements when other means of providing an equivalent measure of protection are afforded. Such variation granted shall be limited to the particular case or cases covered in the application for variance and may be revoked for cause. The permit for variance shall be conspicuously posted on the premises and shall remain posted during the time it is in effect. All requests for variances from safety and health standards included in this or any other chapter of Title 296 WAC, shall be made in writing to the director of the department of labor and industries at Olympia, Washington, or his/her duly authorized representative, or the assistant director, Department of Labor and Industries, P.O. Box 44600, Olympia, Washington 98504-4600. Variance application forms may be obtained from the department upon request.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-37-512, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW, 78-10-094 (Order 78-18), § 296-37-512, filed 10/2/78.]

WAC 296-37-515 Definitions. As used in this standard, the listed terms are defined as follows:

- (1) "Acfm": Actual cubic feet per minute.
- (2) "ASME Code or equivalent": ASME (American Society of Mechanical Engineers) Boiler and Pressure Vessel Code, Section VIII, or an equivalent code which the employer can demonstrate to be equally effective.
- (3) "ATA": Atmosphere absolute.
- (4) "Bell": An enclosed compartment, pressurized (closed bell) or unpressurized (open bell), which allows the diver to be transported to and from the underwater work area and which may be used as a temporary refuge during diving operations.
- (5) "Bottom time": The total elapsed time measured in minutes from the time when the diver leaves the surface in descent to the time that the diver begins ascent.
- (6) "Bursting pressure": The pressure at which a pressure containment device would fail structurally.
- (7) "Cylinder": A pressure vessel for the storage of gases.
- (8) "Recompression/decompression chamber": A pressure vessel for human occupancy such as a surface decompression chamber, closed bell, or deep diving system used to decompress divers and to treat decompression sickness.
- (9) "Decompression sickness": A condition with a variety of symptoms which may result from gas or bubbles in the tissues of divers after pressure reduction.
- (10) "Recompression/decompression table": A profile or set of profiles of depth-time relationships for ascent rates and breathing mixtures to be followed after a specific depth-time exposure or exposures.
- (11) "Dive location": A surface or vessel from which a diving operation is conducted.
- (12) "Dive-location reserve breathing gas": A supply system of air or mixed-gas (as appropriate) at the dive location which is independent of the primary supply system and sufficient to support divers during the planned decompression.
- (13) "Dive team": Divers and support employees involved in a diving operation, including the designated person-in-charge.
- (14) "Diver": An employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.
- (15) "Diver-carried reserve breathing gas": A diver-carried supply of air or mixed gas (as appropriate) sufficient under standard operating conditions to allow the diver to reach the surface, or another source of breathing gas, or to be reached by a standby diver.
- (16) "Diving mode": A type of diving requiring specific equipment, procedures and techniques (SCUBA, surface-supplied air, or mixed gas).
- (17) "Fsw": Feet of seawater (or equivalent static pressure head).
- (18) "Heavy gear": Diver-worn deep-sea dress including helmet, breastplate, dry suit, weighted shoes.

(19) "Hyperbaric conditions": Pressure conditions in excess of surface pressure.

(20) "Inwater stage": A suspended underwater platform which supports a diver in the water.

(21) "Liveboating": The practice of supporting a surfaced-supplied air or mixed gas diver from a vessel which is underway.

(22) "Mixed-gas diving": A diving mode in which the diver is supplied in the water with a breathing gas other than air.

(23) "No-decompression limits": The depth-time limits of the "no-decompression limits and repetitive dive group designation table for no-decompression air dives, "U.S. Navy Diving Manual or equivalent limits which the employer can demonstrate to be equally effective.

(24) "Psi(g)": Pounds per square inch (gauge).

(25) "Scientific diving" means diving performed solely as a necessary part of a scientific, research, or educational activity by employees whose sole purpose for diving is to perform scientific research tasks. Scientific diving does not include performing any tasks usually associated with commercial diving such as: Placing or removing heavy objects underwater; inspection of pipelines and similar objects; construction; demolition; cutting or welding; or the use of explosives.

(26) "SCUBA diving": A diving mode independent of surface supply in which the diver uses open circuit self-contained underwater breathing apparatus.

(27) "Standby diver": A diver at the dive location properly equipped and available to assist a diver in the water.

(28) "Surface-supplied air diving": A diving mode in which the diver in the water is supplied from the dive location with compressed air for breathing.

(29) "Treatment table": A depth-time and breathing gas profile designed to treat decompression sickness.

(30) "Umbilical": The composite hose bundle between a dive location and a diver or bell, or between a diver and a bell, which supplies the diver or bell with breathing gas, communications, power, or heat as appropriate to the diving mode or conditions, and includes a safety line between the diver and the dive location.

(31) "Volume tank": A pressure vessel connected to the outlet of a compressor and used as an air reservoir.

(32) "Working pressure": The maximum pressure to which a pressure containment device may be exposed under standard operating conditions.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-37-515, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 87-02-002 (Order 86-44), § 296-37-515, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW, 78-10-094 (Order 78-18), § 296-37-515, filed 10/2/78.]

WAC 296-37-520 Qualifications of dive team. (1) General.

(a) Each dive team member shall have the experience or training necessary to perform assigned tasks in a safe and healthful manner.

(b) Each dive team member shall have experience or training in the following:

- (i) The use of tools, equipment and systems relevant to assigned tasks;
- (ii) Techniques of the assigned diving mode; and
- (iii) Diving operations and emergency procedures.
- (c) All dive team members shall be trained in cardiopulmonary resuscitation and first aid (American Red Cross standard course or equivalent).
- (d) Dive team members who are exposed to or control the exposure of others to hyperbaric conditions shall be trained in diving-related physics and physiology.

(2) Assignments.

(a) Each dive team member shall be assigned tasks in accordance with the employee's experience or training, except that limited additional tasks may be assigned to an employee undergoing training provided that these tasks are performed under the direct supervision of an experienced dive team member.

(b) The employer shall not require a dive team member to be exposed to hyperbaric conditions against the employee's will, except when necessary to complete decompression or treatment procedures.

(c) The employer shall not permit a dive team member to dive or be otherwise exposed to hyperbaric conditions for the duration of any temporary physical impairment or condition which is known to the employer and is likely to affect adversely the safety or health of a dive team member.

(3) Designated person-in-charge.

(a) The employer or an employee designated by the employer shall be at the dive location in charge of all aspects of the diving operation affecting the safety and health of dive team members.

(b) The designated person-in-charge shall have experience and training in the conduct of the assigned diving operation.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-520, filed 10/2/78.]

WAC 296-37-525 Medical requirements. (1) General.

(a) The employer shall determine that dive team members who are, or are likely to be, exposed to hyperbaric conditions are medically fit to perform assigned tasks in a safe and healthful manner.

(b) The employer shall provide each dive team member who is, or is likely to be, exposed to hyperbaric conditions with all medical examinations required by this standard.

(c) All medical examinations required by this standard shall be performed by, or under the direction of, a physician at no cost to the employee.

(2) Frequency of medical examinations. Medical examinations shall be provided:

(a) Prior to initial hyperbaric exposure with the employer, unless an equivalent medical examination has been given within the preceding 12 months and the employer has obtained the results of the examination and an opinion from the examining physician of the employee's medical fitness to dive or to be otherwise exposed to hyperbaric conditions;

(b) At one year intervals from the date of initial examination or last equivalent examination; and

(c) After an injury or illness requiring hospitalization of more than twenty-four hours.

(3) Information provided to examining physician. The employer shall provide the following information to the examining physician:

(a) A copy of the medical requirements of this standard; and

(b) A summary of the nature and extent of hyperbaric conditions to which the dive team member will be exposed, including diving modes and types of work to be assigned.

(4) Content of medical examinations.

(a) Medical examinations conducted initially and annually shall consist of the following:

(i) Medical history;

(ii) Diving-related work history;

(iii) Basic physical examination;

(iv) The tests required by Table I; and

(v) Any additional tests the physician considers necessary.

(b) Medical examinations conducted after an injury or illness requiring hospitalization of more than 24 hours shall be appropriate to the nature and extent of the injury or illness as determined by the examining physician.

TABLE I
TESTS FOR DIVING MEDICAL EXAMINATION

Test	Initial Examination	Annual Reexamination
Chest x-ray	x	
Visual acuity	x	x
Color blindness	x	
EKG: Standard 12L ¹		
Hearing test	x	x
Hematocrit or hemoglobin	x	x
Sickle cell index	x	
White blood count	x	x
Urinalysis	x	x

¹To be given to the employee once, at age 35 or over.

(5) Physician's written report.

(a) After any medical examination required by this standard, the employer shall obtain a written report prepared by the examining physician containing:

(i) The results of the medical examination; and

(ii) The examining physician's opinion of the employee's fitness to be exposed to hyperbaric conditions, including any recommended restrictions or limitations to such exposure (see WAC 296-37-585).

(b) The employer shall provide the employee with a copy of the physician's written report.

(6) Determination of employee fitness.

(a) The employer shall determine the extent and nature of the dive team member's fitness to engage in diving or be otherwise exposed to hyperbaric conditions consistent with the recommendations in the examining physician's report.

(b) If the examining physician has recommended a restriction or limitation on the dive team member's exposure to hyperbaric conditions, and the affected employee does not concur, a second physician selected by the employee shall

render a medical opinion on the nature and extent of the restriction or limitation, if any.

(c) If the recommendation of the second opinion differs from that of the examining (first) physician, and if the employer and employee are unable to agree on the nature and extent of the restriction or limitation, an opinion from a third physician selected by the first two physicians shall be obtained. The employer's determination of the dive team member's fitness shall be consistent with the medical opinion of the third physician, unless the employer and employee reach an agreement which is otherwise consistent with the recommendation or opinion of at least two of the physicians involved.

(d) Nothing in this procedure shall be construed to prohibit either a dive team member from accepting, or an employer from offering, an assignment which is otherwise consistent with at least one medical opinion while a final determination on the employee's fitness is pending.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-525, filed 10/2/78.]

WAC 296-37-530 Safe practices manual. (1) General. The employer shall develop and maintain a safe practices manual which shall be made available at the dive location to each dive team member.

(2) Contents.

(a) The safe practices manual shall contain a copy of this standard and the employer's policies for implementing the requirements of this standard.

(b) For each diving mode engaged in, the safe practices manual shall include:

(i) Safety procedures and checklists for diving operations;

(ii) Assignments and responsibilities of the dive team members;

(iii) Equipment procedures and checklists; and

(iv) Emergency procedures for fire, equipment failure, adverse environmental conditions, and medical illness and injury.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-530, filed 10/2/78.]

WAC 296-37-535 Pre-dive procedures. (1) General. The employer shall comply with the following requirements prior to each diving operation, unless otherwise specified.

(2) Emergency aid. A list shall be kept at the dive location of the telephone or call numbers of the following:

(a) An operational decompression chamber (if not at the dive location);

(b) Accessible hospitals;

(c) Available physicians;

(d) Available means of transportation; and

(e) The nearest U.S. Coast Guard Rescue Coordination Center.

(3) First-aid supplies.

(a) A first-aid kit appropriate for the diving operation and approved by a physician shall be available at the dive location.

(1999 Ed.)

(b) When used in a decompression chamber or bell, the first-aid kit shall be suitable for use under hyperbaric conditions.

(c) In addition to any other first-aid supplies, an American Red Cross standard first-aid handbook or equivalent, and a bag-type manual resuscitator with transparent mask and tubing shall be available at the dive location.

(4) Planning and assessment. Planning of a diving operation shall include an assessment of the safety and health aspects of the following:

(a) Diving mode;

(b) Surface and underwater conditions and hazards;

(c) Breathing gas supply (including reserves);

(d) Thermal protection;

(e) Diving equipment and systems;

(f) Dive team assignments and physical fitness of dive team members (including any impairment known to the employer);

(g) Repetitive dive designation or residual inert gas status of dive team members;

(h) Decompression and treatment procedures (including altitude corrections); and

(i) Emergency procedures.

(5) Hazardous activities. To minimize hazards to the dive team, diving operations shall be coordinated with other activities in the vicinity which are likely to interfere with the diving operation.

(6) Employee briefing.

(a) Dive team members shall be briefed on:

(i) The tasks to be undertaken;

(ii) Safety procedures for the diving mode;

(iii) Any unusual hazards or environmental conditions likely to affect the safety of the diving operation; and

(iv) Any modifications to operating procedures necessitated by the specific diving operation.

(b) Prior to making individual dive team member assignments, the employer shall inquire into the dive team member's current state of physical fitness, and indicate to the dive team member the procedure for reporting physical problems or adverse physiological effects during and after the dive.

(7) Equipment inspection. The breathing gas supply system including reserve breathing gas supplies, masks, helmets, thermal protection, and bell handling mechanism (when appropriate) shall be inspected prior to each dive.

(8) Warning signal. When diving from surfaces other than vessels in areas capable of supporting marine traffic, a rigid replica of the international code flag "A" at least one meter in height shall be displayed at the dive location in a manner which allows all-round visibility, and shall be illuminated during night diving operations.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-535, filed 10/2/78.]

WAC 296-37-540 Procedures during dive. (1) General. The employer shall comply with the following requirements which are applicable to each diving operation unless otherwise specified.

(2) Water entry and exit.

(a) A means capable of supporting the diver shall be provided for entering and exiting the water.

(b) The means provided for exiting the water shall extend below the water surface.

(c) A means shall be provided to assist an injured diver from the water or into a bell.

(3) Communications.

(a) An operational two-way voice communication system shall be used between:

(i) Each surface-supplied air or mixed-gas diver and a dive team member at the dive location or bell (when provided or required); and

(ii) The bell and the dive location.

(b) An operational, two-way communication system shall be available at the dive location to obtain emergency assistance.

(4) Decompression tables. Decompression, repetitive, and no-decompression tables (as appropriate) shall be at the dive location.

(5) Dive profiles. A depth-time profile, including when appropriate any breathing gas changes, shall be maintained for each diver during the dive including decompression.

(6) Hand-held power tools and equipment.

(a) Hand-held electrical tools and equipment shall be deenergized before being placed into or retrieved from the water.

(b) Hand-held power tools shall not be supplied with power from the dive location until requested by the diver.

(7) Welding and burning.

(a) A current supply switch to interrupt the current flow to the welding or burning electrode shall be:

(i) Tended by a dive team member in voice communication with the diver performing the welding or burning; and

(ii) Kept in the open position except when the diver is welding or burning.

(b) The welding machine frame shall be grounded.

(c) Welding and burning cables, electrode holders, and connections shall be capable of carrying the maximum current required by the work, and shall be properly insulated.

(d) Insulated gloves shall be provided to divers performing welding and burning operations.

(e) Prior to welding or burning on closed compartments, structures or pipes, which contain a flammable vapor or in which a flammable vapor may be generated by the work, they shall be vented, flooded, or purged with a mixture of gases which will not support combustion.

(8) Explosives.

(a) Employers shall transport, store, and use explosives in accordance with this section and applicable provisions of chapter 296-52 WAC.

(b) Electrical continuity of explosive circuits shall not be tested until the diver is out of the water.

(c) Explosives shall not be detonated while the diver is in the water.

(9) Termination of dive. The working interval of a dive shall be terminated when:

(a) A diver requests termination;

(b) A diver fails to respond correctly to communications or signals from a dive team member;

(c) Communications are lost and can not be quickly reestablished between the diver and a dive team member at the dive location, and between the designated person-in-charge and the person controlling the vessel in liveboating operations; or

(d) A diver begins to use diver-carried reserve breathing gas or the dive-location reserve breathing gas.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-540, filed 10/2/78.]

WAC 296-37-545 Postdive procedures. (1) General. The employer shall comply with the following requirements which are applicable after each diving operation, unless otherwise specified.

(2) Precautions.

(a) After the completion of any dive, the employer shall:

(i) Check the physical condition of the diver;

(ii) Instruct the diver to report any physical problems or adverse physiological effects including symptoms of decompression sickness;

(iii) Advise the diver of the location of a decompression chamber which is ready for use; and

(iv) Alert the diver to the potential hazards of flying after diving.

(b) For any dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas as a breathing mixture, the employer shall instruct the diver to remain awake and in the vicinity of the decompression chamber which is at the dive location for at least one hour after the dive (including decompression or treatment as appropriate).

(3) Recompression capability.

(a) A decompression chamber capable of recompressing the diver at the surface to a minimum of 165 fsw (6 ATA) shall be available at the dive location for:

(i) Surface-supplied air diving to depths deeper than 100 fsw and shallower than 220 fsw;

(ii) Mixed gas diving shallower than 300 fsw; or

(iii) Diving outside the no-decompression limits shallower than 300 fsw.

(b) A decompression chamber capable of recompressing the diver at the surface to the maximum depth of the dive shall be available at the dive location for dives deeper than 300 fsw.

(c) The decompression chamber shall be:

(i) Dual-lock;

(ii) Multiplace; and

(iii) Located within five minutes of the dive location.

(d) The decompression chamber shall be equipped with:

(i) A pressure gauge for each pressurized compartment designed for human occupancy;

(ii) A built-in-breathing-system with a minimum of one mask per occupant;

(iii) A two-way voice communication system between occupants and a dive team member at the dive location;

(iv) A viewport; and

(v) Illumination capability to light the interior.

(e) Treatment tables, treatment gas appropriate to the diving mode, and sufficient gas to conduct treatment shall be available at the dive location.

(f) A dive team member shall be available at the dive location during and for at least one hour after the dive to operate the decompression chamber (when required or provided).

(4) Record of dive.

(a) The following information shall be recorded and maintained for each diving operation:

(i) Names of dive team members including designated person-in-charge;

(ii) Date, time, and location;

(iii) Diving modes used;

(iv) General nature of work performed;

(v) Approximate underwater and surface conditions (visibility, water temperature and current); and

(vi) Maximum depth and bottom time for each diver.

(b) For each dive outside the no-decompression limits, deeper than 100 fsw or using mixed gas, the following additional information shall be recorded and maintained:

(i) Depth-time and breathing gas profiles;

(ii) Decompression table designation (including modification); and

(iii) Elapsed time since last pressure exposure if less than 24 hours or repetitive dive designation for each diver.

(c) For each dive in which decompression sickness is suspected or symptoms are evident, the following additional information shall be recorded and maintained:

(i) Description of decompression sickness symptoms (including depth and time of onset); and

(ii) Description and results of treatment.

(5) Decompression procedure assessment. The employer shall:

(a) Investigate and evaluate each incident of decompression sickness based on the recorded information, consideration of the past performance of decompression table used, and individual susceptibility;

(b) Take appropriate corrective action to reduce the probability of recurrence of decompression sickness; and

(c) Prepare a written evaluation of the decompression procedure assessment, including any corrective action taken, within 45 days of the incident of decompression sickness.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-545, filed 10/2/78.]

WAC 296-37-550 Scuba diving. (1) General. Employers engaged in scuba diving shall comply with the following requirements, unless otherwise specified.

(2) Limits. SCUBA diving shall not be conducted:

(a) At depths deeper than 130 fsw;

(b) At depths deeper than 100 fsw or outside the no-decompression limits unless a decompression chamber is ready for use;

(c) Against currents exceeding one knot unless line-tended; or

(d) In enclosed or physically confining spaces unless line-tended.

(3) Procedures. (a) A standby diver shall be available while a diver is in the water.

(b) A diver shall be line-tended from the surface, or accompanied by another diver in the water in continuous contact during the diving operations.

(c) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces and shall have positive means of communication with the diver or divers within the space.

(d) A diver-carried reserve breathing gas supply shall be provided for each diver consisting of:

(i) A manual reserve (J valve); or

(ii) An independent reserve cylinder with a separate regulator or connected to the underwater breathing apparatus.

(e) The valve of the reserve breathing gas supply shall be in the closed position prior to the dive.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-550, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 81-07-048 (Order 81-4), § 296-37-550, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-550, filed 10/2/78.]

WAC 296-37-555 Surface-supplied air diving. (1) General. Employers engaged in surface-supplied air diving shall comply with the following requirements, unless otherwise specified.

(2) Limits.

(a) Surface-supplied air diving shall not be conducted at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw.

(b) A decompression chamber shall be ready for use at the dive location for any dive outside the no-decompression limits or deeper than 100 fsw.

(c) A bell shall be used for dives with an inwater decompression time greater than 120 minutes, except when heavy gear is worn or diving is conducted in physically confining spaces.

(3) Procedures.

(a) Each diver shall be continuously tended while in the water.

(b) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(c) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(d) For dives deeper than 100 fsw or outside the no-decompression limits:

(i) A separate dive team member shall tend each diver in the water;

(ii) A standby diver shall be available while a diver is in the water;

(iii) A diver-carried reserve breathing gas supply shall be provided for each diver except when heavy gear is worn; and

(iv) A dive-location reserve breathing gas supply shall be provided.

(e) For heavy-gear diving deeper than 100 fsw or outside the no-decompression limits:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver.

(ii) An inwater stage shall be provided to divers in the water.

(f) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided whenever the diver is prevented by the configuration of the dive area from ascending directly to the surface.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-555, filed 10/2/78.]

WAC 296-37-560 Mixed-gas diving. (1) General. Employers engaged in mixed-gas diving shall comply with the following requirements, unless otherwise specified.

(2) Limits. Mixed-gas diving shall be conducted only when:

(a) A decompression chamber is ready for use at the dive location; and

(b) A bell is used at depths greater than 220 fsw or when the dive involves inwater decompression time of greater than 120 minutes, except when heavy gear is worn or when diving in physically confining spaces; or

(c) A closed bell is used at depths greater than 300 fsw, except when diving is conducted in physically confining spaces.

(3) Procedures.

(a) A separate dive team member shall tend each diver in the water.

(b) A standby diver shall be available while a diver is in the water.

(c) A diver shall be stationed at the underwater point of entry when diving is conducted in enclosed or physically confining spaces.

(d) Each diving operation shall have a primary breathing gas supply sufficient to support divers for the duration of the planned dive including decompression.

(e) Each diving operation shall have a dive-location reserve breathing gas supply.

(f) When heavy gear is worn:

(i) An extra breathing gas hose capable of supplying breathing gas to the diver in the water shall be available to the standby diver; and

(ii) An inwater stage shall be provided to divers in the water.

(g) An inwater stage shall be provided for divers without access to a bell for dives deeper than 100 fsw or outside the no-decompression limits.

(h) When a closed bell is used, one dive team member in the bell shall be available and tend the diver in the water.

(i) Except when heavy gear is worn or where physical space does not permit, a diver-carried reserve breathing gas supply shall be provided for each diver:

(i) Diving deeper than 100 fsw or outside the no-decompression limits; or

(ii) Prevented by the configuration of the dive area from directly ascending to the surface.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-560, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-560, filed 10/2/78.]

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WAC 296-37-565 Liveboating. (1) General. Employers engaged in diving operations involving liveboating shall comply with the following requirements.

(2) Limits. Diving operations involving liveboating shall not be conducted:

(a) With an inwater decompression time of greater than 120 minutes;

(b) Using surface-supplied air at depths deeper than 190 fsw, except that dives with bottom times of 30 minutes or less may be conducted to depths of 220 fsw;

(c) Using mixed gas at depths greater than 220 fsw;

(d) In rough seas which significantly impede diver mobility or work function; or

(e) In other than daylight hours.

(3) Procedures.

(a) The propeller of the vessel shall be stopped before the diver enters or exits the water.

(b) A device shall be used which minimizes the possibility of entanglement of the diver's hose in the propeller of the vessel.

(c) Two-way voice communication between the designated person-in-charge and the person controlling the vessel shall be available while the diver is in the water.

(d) A standby diver shall be available while a diver is in the water.

(e) A diver-carried reserve breathing gas supply shall be carried by each diver engaged in liveboating operations.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-565, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 87-02-002 (Order 86-44), § 296-37-565, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-565, filed 10/2/78.]

WAC 296-37-570 Equipment. (1) General.

(a) All employers shall comply with the following requirements, unless otherwise specified.

(b) Each equipment modification, repair, test, calibration or maintenance service shall be recorded by means of a tagging or logging system, and include the date and nature of work performed, and the name or initials of the person performing the work.

(2) Air compressor system.

(a) Compressors used to supply air to the diver shall be equipped with a volume tank with a check valve on the inlet side, a pressure gauge, a relief valve, and a drain valve.

(b) A compressor shall be constructed and situated so as to avoid entry of contaminated air into the air-supply system and shall be equipped with a suitable in-line particulate filter followed by a bed of activated charcoal and, if necessary, a moisture absorber to further assure breathing air quality. These filters should be placed before any receiver and after the discharge in the compressor. If an oil-lubricated compressor is used, it shall be equipped with a carbon monoxide alarm or an equally as effective alternative if approved by the department.

(i) If a carbon monoxide alarm is used, it shall be calibrated to activate at or below 20 parts per million carbon monoxide at least once per month. A calibration and maintenance log shall be kept and shall be available for review and copying by the director or his or her designee. The log shall

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identify the test method, date, time of test, results, and the name of the person performing the test. The log shall be retained for at least one year from the date of the test.

(ii) If the use of an alarm at the compressor will not effectively provide warning to the diver or tender of a carbon monoxide problem, a remote alarm or other means of warning the wearer shall be used.

(iii) Breathing air couplings shall be incompatible with outlets for nonrespirable plant air or other gas systems to prevent inadvertent servicing of air-line breathing apparatus with nonrespirable gases.

(c) Respirable air supplied to a diver shall not contain:

(i) A level of carbon monoxide (CO) greater than 20 ppm;

(ii) A level of carbon dioxide (CO₂) greater than 1,000 ppm;

(iii) A level of oil mist greater than 5 milligrams per cubic meter; or

(iv) A noxious or pronounced odor.

(d) Compressor systems providing surface air to divers must have a low pressure warning device installed at the air purification system inlet to alert dive tenders of low air pressure.

The minimum alarm setting shall be 45 Psi plus an additional 15 Psi for each working atmosphere.

1 ATM = 33 fsw or 15 Psi

2 ATM = 66 fsw or 30 Psi

3 ATM = 99 fsw or 45 Psi

4 ATM = 132 fsw or 60 Psi

5 ATM = 165 fsw or 75 Psi

6 ATM = 198 fsw or 90 Psi

(e) The output of air compressor systems shall be tested for air purity every six months by means of samples taken at the connection to the distribution system, except that nonoil lubricated compressors need not be tested for oil mist.

(3) Breathing gas supply hoses.

(a) Breathing gas supply hoses shall:

(i) Have a working pressure at least equal to the working pressure of the total breathing gas system;

(ii) Have a rated bursting pressure at least equal to four times the working pressure;

(iii) Be tested at least annually to 1.5 times their working pressure; and

(iv) Have their open ends taped, capped or plugged when not in use.

(b) Breathing gas supply hose connectors shall:

(i) Be made of corrosion-resistant materials;

(ii) Have a working pressure at least equal to the working pressure of the hose to which they are attached; and

(iii) Be resistant to accidental disengagement.

(c) Umbilicals shall:

(i) Include a safety line which shall be attached in a manner to remove strain from the air supply hose;

(ii) Be marked in 10-foot increments to 100 feet beginning at the diver's end, and in 50 foot increments thereafter;

(iii) Be made of kink-resistant materials; and

(iv) Have a working pressure greater than the pressure equivalent to the maximum depth of the dive (relative to the supply source) plus 100 psi.

(4) Buoyancy control.

(a) Helmets or masks connected directly to the dry suit or other buoyancy-changing equipment shall be equipped with an exhaust valve.

(b) A dry suit or other buoyancy-changing equipment not directly connected to the helmet or mask shall be equipped with an exhaust valve.

(c) When used for SCUBA diving, a buoyancy compensator shall have an inflation source separate from the breathing gas supply.

(d) An inflatable flotation device capable of maintaining the diver at the surface in a face-up position, having a manually activated inflation source independent of the breathing supply, an oral inflation device, and an exhaust valve shall be used for SCUBA diving.

(5) Compressed gas cylinders. Compressed gas cylinders shall:

(a) Be designed, constructed and maintained in accordance with the applicable provisions of WAC 296-24-295 and 296-24-940 of the General safety and health standards.

(b) Be stored in a ventilated area and protected from excessive heat;

(c) Be secured from falling; and

(d) Have shut-off valves recessed into the cylinder or protected by a cap, except when in use or manifolded, or when used for SCUBA diving.

(6) Recompression/decompression chambers.

(a) Each recompression/decompression chamber manufactured after the effective date of this standard, shall be built and maintained in accordance with the ASME Code or equivalent.

(b) Each recompression/decompression chamber manufactured prior to the effective date of this standard shall be maintained in conformity with the code requirements to which it was built, or equivalent.

(c) Each recompression/decompression chamber shall be equipped with:

(i) Means to maintain the atmosphere below a level of 25% oxygen by volume;

(ii) Mufflers on intake and exhaust lines, which shall be regularly inspected and maintained;

(iii) Suction guards on exhaust line openings; and

(iv) A means for extinguishing fire, and shall be maintained to minimize sources of ignition and combustible material.

(7) Gauges and timekeeping devices.

(a) Gauges indicating diver depth which can be read at the dive location shall be used for all dives except SCUBA.

(b) Each depth gauge shall be deadweight tested or calibrated against a master reference gauge every six months, and when there is a discrepancy greater than two percent of full scale between any two equivalent gauges.

(c) A cylinder pressure gauge capable of being monitored by the diver during the dive shall be worn by each SCUBA diver.

(d) A timekeeping device shall be available at each dive location.

(8) Masks and helmets.

(a) Surface-supplied air and mixed-gas masks and helmets shall have:

(i) A nonreturn valve at the attachment point between helmet or mask and hose which shall close readily and positively; and

(ii) An exhaust valve.

(b) Surface-supplied air masks and helmets shall have a minimum ventilation rate capability of 4.5 acfm at any depth at which they are operated or the capability of maintaining the diver's inspired carbon dioxide partial pressure below 0.02 ATA when the diver is producing carbon dioxide at the rate of 1.6 standard liters per minute.

(9) Oxygen safety.

(a) Equipment used with oxygen or mixtures containing over forty percent by volume oxygen shall be designed for oxygen service.

(b) Components (except umbilicals) exposed to oxygen or mixtures containing over forty percent by volume oxygen shall be cleaned of flammable materials before use.

(c) Oxygen systems over 125 psig and compressed air systems over 500 psig shall have slow-opening shut-off valves.

(10) Weights and harnesses.

(a) Except when heavy gear is worn, divers shall be equipped with a weight belt or assembly capable of quick release.

(b) Except when heavy gear is worn or in SCUBA diving, each diver shall wear a safety harness with:

(i) A positive buckling device;

(ii) An attachment point for the umbilical to prevent strain on the mask or helmet; and

(iii) A lifting point to distribute the pull force of the line over the diver's body.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-570, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 87-02-002 (Order 86-44), § 296-37-570, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-570, filed 10/2/78.]

WAC 296-37-575 Recordkeeping requirements. (1) Recording and reporting.

(a) The employer shall comply with the requirements of chapters 296-27 and 296-350 WAC.

(b) The employer shall record the occurrence of any diving-related injury or illness which requires any dive team member to be hospitalized for 24 hours or more, specifying the circumstances of the incident and the extent of any injuries or illnesses.

(2) Availability of records.

(a) Upon the request of the director of the department of labor and industries or his duly authorized designees, the employer shall make available for inspection and copying any record or document required by this standard.

(b) Records and documents required by this standard shall be provided upon request to employees, designated representatives, and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217. Safe practices manuals (WAC 296-37-530), depth-time profiles (WAC 296-37-540), recording of dives (WAC 296-37-545), decompression procedure assessment evaluations (WAC 296-37-545), and records of hospitalizations (WAC 296-37-575) shall be pro-

vided in the same manner as employee exposure records or analyses using exposure or medical records. Equipment inspections and testing records which pertain to employees (WAC 296-37-570) shall also be provided upon request to employees and their designated representatives.

(c) Records and documents required by this standard shall be retained by the employer for the following period:

(i) Dive team member medical records (physician's reports) (WAC 296-37-525) - five years;

(ii) Safe practices manual (WAC 296-37-530) - current document only;

(iii) Depth-time profile (WAC 296-37-540) - until completion of the recording of dive, or until completion of decompression procedure assessment where there has been an incident of decompression sickness;

(iv) Recording dive (WAC 296-37-545) one year, except five years where there has been an incident of decompression sickness;

(v) Decompression procedure assessment evaluations (WAC 296-37-545) - five years;

(vi) Equipment inspections and testing records (WAC 296-37-570) - current entry or tag, or until equipment is withdrawn from service;

(vii) Records of hospitalizations (WAC 296-37-575) - five years.

(d) After the expiration of the retention period of any record required to be kept for five years, the employer shall forward such records to the National Institute for Occupational Safety and Health, Department of Health and Human Services. The employer shall also comply with any additional requirements set forth in WAC 296-62-05215.

(e) In the event the employer ceases to do business:

(i) The successor employer shall receive and retain all dive and employee medical records required by this standard; or

(ii) If there is no successor employer, dive and employee medical records shall be forwarded to the National Institute for Occupational Safety and Health, Department of Health and Human Services.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-37-575, filed 7/20/94, effective 9/20/94. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-575, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 87-02-002 (Order 86-44), § 296-37-575, filed 12/26/86. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-37-575, filed 8/27/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-575, filed 10/2/78.]

WAC 296-37-580 Reserved.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-580, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-580, filed 10/2/78.]

WAC 296-37-585 Appendix A to chapter 296-37 WAC—Examples of conditions which may restrict or limit exposure to hyperbaric conditions. (1) The following disorders may restrict or limit occupational exposure to hyperbaric conditions depending on severity, presence of

residual effects, response to therapy, number of occurrences, diving mode, or degree and duration of isolation.

(a) History of seizure disorder other than early febrile convulsions.

(b) Malignancies (active) unless treated and without recurrence for five years.

(c) Chronic inability to equalize sinus and/or middle ear pressure.

(d) Cystic or cavitory disease of the lungs.

(e) Impaired organ function caused by alcohol or drug use.

(f) Conditions requiring continuous medication for control (e.g., antihistamines, steroids, barbiturates, mood altering drugs, or insulin).

(i) Meniere's disease.

(ii) Hemoglobinopathies.

(iii) Obstructive or restrictive lung disease.

(iv) Vestibular end organ destruction.

(v) Pneumothorax.

(vi) Cardiac abnormalities (e.g., pathological heart block, valvular disease, intraventricular conduction defects other than isolated right bundle branch block, angina pectoris, arrhythmia, coronary artery disease).

(vii) Juxta-articular osteonecrosis.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-585, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, and chapters 42.30 and 43.22 RCW. 78-10-094 (Order 78-18), § 296-37-585, filed 10/2/78.]

WAC 296-37-590 Appendix B to chapter 296-37 WAC—Guidelines for scientific diving. This appendix contains guidelines that will be used in conjunction with WAC 296-37-510 (2)(e) to determine those scientific diving programs which are exempt from the requirements for commercial diving. The guidelines are as follows:

(1) The diving control board consists of a majority of active scientific divers and has autonomous and absolute authority over scientific diving program's operations.

(2) The purpose of the project using scientific diving is the advancement of science; therefore, information and data resulting from the project are nonproprietary.

(3) The tasks of a scientific diver are those of an observer and data gatherer. Construction and trouble-shooting tasks traditionally associated with commercial diving are not included within scientific diving.

(4) Scientific divers, based on the nature of their activities, must use scientific expertise in studying the underwater environment and, therefore, are scientists or scientists in training.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-37-590, filed 10/30/92, effective 12/8/92.]

Chapter 296-43 WAC

HEATING INSTALLATIONS—CABLE, RADIANT, SOIL, ETC.

WAC

296-43-010
296-43-020

Heating cables—General.
Heating cables—Maximum wattage and temperature.

(1999 Ed.)

296-43-030

Heating cables—Permissible installation methods in buildings.

296-43-040

Heating cables—Thermal insulation.

296-43-050

Heating cables—Elements installed in tanks, troughs, or pipe lines containing liquids.

296-43-060

Heating element in soil or sand.

296-43-070

Heating element imbedded in driveways.

WAC 296-43-010 Heating cables—General. Heating cables or wires designed for use in low temperature heating applications, i.e., soil, water, plaster, walls and ceilings, floors, etc., shall conform to the provisions of the N.E.C. Article 422 as applicable and to the following specifications:

(1) The units shall be manufactured in such continuous lengths that the maximum temperature of the element does not exceed 100 degrees C. or the maximum safe working temperature of the insulating material covering the element. Whichever is the lower temperature shall be considered the maximum permissible working temperature of the element.

(2) The insulation on the element shall equal that specified for equivalent 600 v. combined Type TW and TH or RW and RH conductor insulation and, in addition, shall meet the following requirements:

(a) Permissible maximum water absorption shall not exceed .015 grams per sq. in. of surface in distilled water at 70 degree C. in 7 days.

(b) Maximum safe operating temperature of the insulation shall not be less than 70 degrees C.

(c) It shall be suitable for the purpose intended and approved by the Washington state electrical inspection department as such.

(d) Samples for testing: The manufacturer shall submit suitable samples to the Washington state inspection department for inspection and testing as required.

(e) Marking: Each unit shall be provided with permanent labels or markings at the factory.

(i) These labels shall be placed not more than 3 in. from the terminal on each end and shall include the makers' name and the normal rating in volts and amperes; or, volts and watts.

(ii) 120 volt labels shall be bright metal or white in color. 240 v. labels shall be colored red.

(f) Units shall be installed in their complete lengths as supplied by the factory. Units from which a label or labels are missing will be considered shortened and will not be approved until such time as the installing contractor shall provide proof, by connecting suitable test meters into the circuits with which the inspector, at his convenience, may satisfy himself that the element is suitable for the purpose intended.

(g) Heating element units shall not be covered until clearance has been received from the local inspecting authority.

(h) Lead covered heating elements shall not be permitted in direct contact with plaster, concrete or similar materials capable of causing crystallization and/or checking of the lead sheath, unless protected by a suitable covering of chemically inert material.

(i) All control equipment must be of approved type and of suitable rating for the use intended.

[Rules (part), filed 4/3/61.]

WAC 296-43-020 Heating cables—Maximum wattage and temperature. (1) In contact with combustible material. Maximum wattage of the element shall not exceed 3 watts per lineal foot or maximum temperature of 60 degrees C. (140 degrees F.) when in direct contact with combustible material or applied over existing ceilings.

(2) Imbedded in cement. Maximum wattage of the element shall not exceed 4 watts per lineal foot or maximum temperature of 80 degrees C. (194 degrees F.) when imbedded in cement, plaster or similar noncombustible, heat-diffusing material.

[Rules (part), filed 4/3/61.]

WAC 296-43-030 Heating cables—Permissible installation methods in buildings. Wiring to the elements shall conform to the National Electrical Code and to the following conditions:

(1) **Terminals.**

(a) Termination of radiant heating elements shall be with solderless lugs, binding posts, or similar compression terminals.

(b) Terminal boxes for radiant heating elements, where they are terminated in junction boxes and also for the circuit wires with which they are connected, shall be protected by asbestos, glass, or similar noncombustible sleeving to a point at least 18 in. from the terminal.

(c) Not more than 3 in. of element per lead shall be permitted inside the terminal box and not more than two heating element leads shall be terminated in any 1-gang terminal box.

(d) The use of metal raceways for terminating radiant heating cables is permissible providing 6 in. clearance is maintained between points where elements enter the raceways, and, that the elements are terminated as provided in subsections (1)(b) and (1)(c) above.

(e) Where nonheating leads, at least 2 ft. in length, from the element are provided by the factory requirements of subsections (1)(b), (1)(c) and (1)(d) above may be waived, providing that the number of wires per box shall comply with section 3705 of the N.E.C.

(2) **Imbedded in plaster.** Heating elements, when imbedded in plaster, shall conform to the following provisions:

(a) Adjacent turns shall be not less than 1 in. apart and secured suitably by insulated staples, adhesive tape, patching plaster, plaster of paris, or other suitable means of attachment, as approved by the local inspecting authority, on not less than 2 ft. centers.

(b) Nonmetallic insulating tape shall be used where the element crosses metal reinforcing on rock plaster board and similar lath substitutes, when the heating element is applied directly to the lath base. (Where possible, nonmetallic reinforcing should be substituted to avoid the hum that is occasionally generated in the reinforcing while the current is on.)

(c) When heating element is used on a surface employing metal lath base, a brown coat shall be applied sufficient to completely cover the metal lath before the element is applied; and, adhesive tape, patching plaster, plaster of paris, or other suitable means of attachment be used to secure the element in place.

(d) Heating element shall only be applied to fire resistant plaster bases.

(3) **Imbedded in concrete floors.** Heating elements imbedded in concrete floors shall conform to the following provisions:

(a) Adjacent turns shall not be less than 1 in. apart and shall be held securely in place by suitable frames or spreaders while the concrete topping is applied.

(b) Heating cables shall maintain at least 1 in. clearance between the element and adjacent metallic pipe or similar conductors imbedded in the slab.

(c) Suitable rigid conduit risers shall be provided for terminating elements imbedded in concrete floors unless raceways or other adequate means are provided for protecting the elements where they leave the slab.

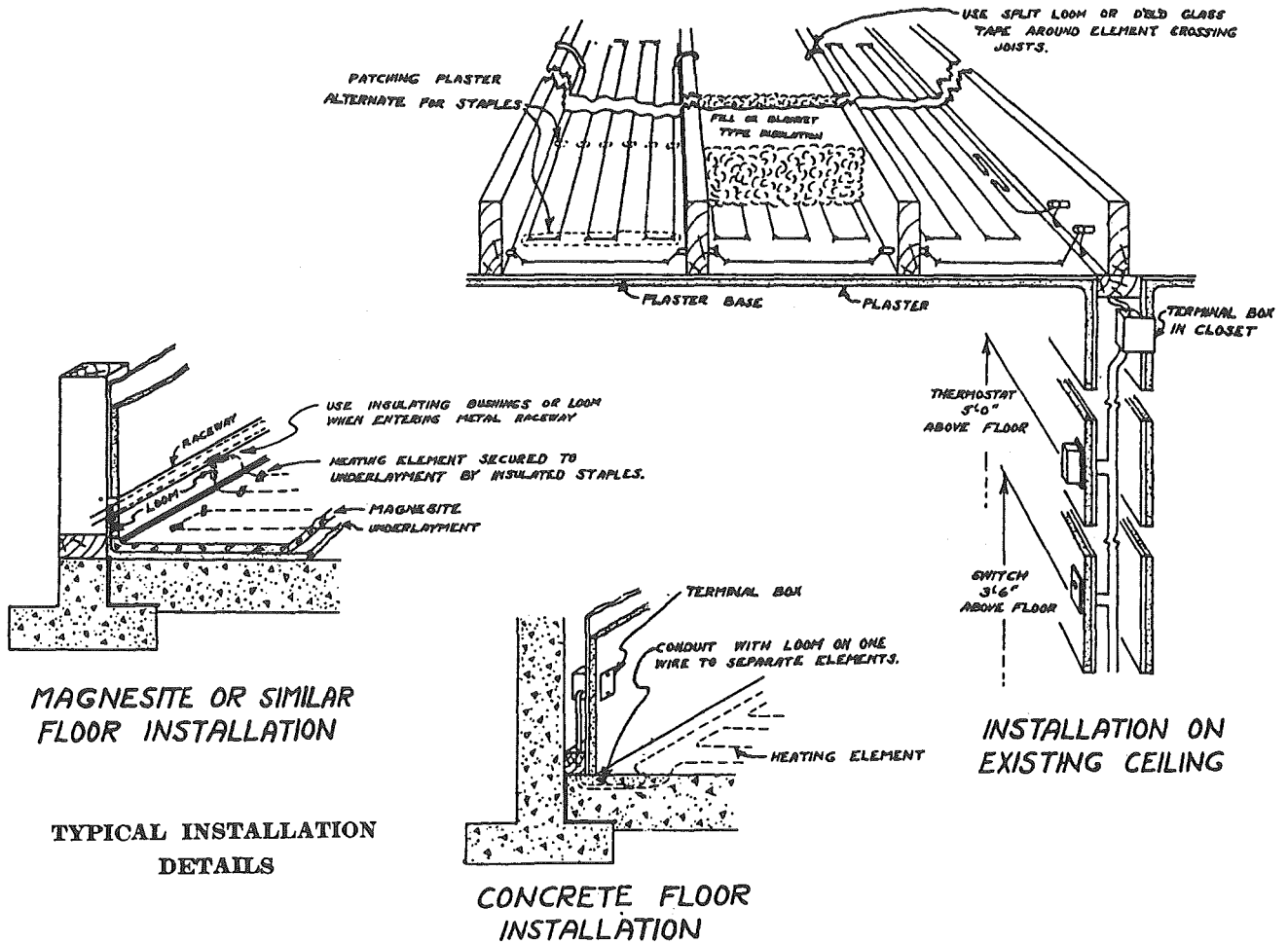
(d) Insulating sleeves shall be placed over the element from the point where it enters the slab through the conduit to the terminating box, unless nonheating leads, not less than 2 ft. long, are provided with the element by the factory.

(e) Suitable insulating bushings shall be used to separate the leads or elements where they enter the conduit in the slab.

(4) **Magnesite, terrazzo, tile and similar floors and walls.**

(a) Shall conform to the provisions of sections 1, 2, and 3 as applicable.

(b) Heating cables may be attached to the surface of the underlayment where magnesite or terrazzo floors are installed.



MAGNESITE OR SIMILAR FLOOR INSTALLATION

TYPICAL INSTALLATION DETAILS

CONCRETE FLOOR INSTALLATION



Upper: Heating cable applied to plaster board ceiling ready for plaster. Note clearance between metal lath and heating cable.

Lower: Heating cable applied to plaster board wall. Note that elements run vertically to allow plasterer to apply the brown coat parallel to the cable.

(5) Linoleum, asphalt tile and similar floor coverings may be placed over heating elements on wood floors providing the element is first covered with 3/8 in. of magnesium oxychloride or equal fire resistant underlayment.

(6) Existing ceilings.

(a) Heating elements placed over existing ceilings shall be suitably secured thereto conforming to the provisions of WAC 296-43-020(1), and 296-43-030 (1), (2), and (3) as applicable.

(b) Wood lath shall be covered with asbestos paper, gypsum board or similar fire resistant material before the element is applied to the ceiling.

(c) Heating elements shall not be applied over insulating board type of lath such as celotex, insulite, firtex, and similar materials. Where this type of material is used, the element should be secured to the under face of the ceiling and covered with plaster or fire resistant board of a noninsulating type.

(d) Elements crossing ceiling joints shall be enclosed in split loom or folded glass tape to protect the element.

(7) Gypsum board, plaster lath and similar heat conducting fire resistant materials may have the heating element applied directly thereto.

(8) Ceilings of combustible material; i.e., wood veneer, tempered hardboard and similar heat conducting materials shall first be covered by asbestos paper, gypsum board, or similar fire resistant material.

(9) Pads containing heating elements for placing heating elements in spaces over existing ceilings or in walls or floors which are otherwise inaccessible, shall conform to the provisions of WAC 296-43-010 (1), (2), 296-43-020(1), 296-43-030 (6), (7), (8), and 296-43-040 as applicable, and the following specifications:

(a) The pads shall be of fire resistant, nonconducting material.

(b) The pads shall rigidly secure the element in such a manner that it will be impossible for the adjacent turns of the element to touch.

(i) The leads shall be suitably secured to the pad in a manner which provides permanent adequate separation between the leads.

(ii) The leads shall be covered with an insulating sleeve from the pad to the termination of the heating part of the element.

(iii) All connections must be accessible.

[Rules (part), filed 4/3/61.]

WAC 296-43-040 Heating cables—Thermal insulation. Thermal insulation placed over heating elements or in contact therewith shall be noncorrosive, noncombustible, nonconducting material as provided in section 3249 of the N.E.C.

[Rules (part), filed 4/3/61.]

WAC 296-43-050 Heating cables—Elements installed in tanks, troughs, or pipe lines containing liquids. Elements installed in tanks, troughs or pipe lines containing liquids shall be provided with suitable insulating terminating bushings and terminal boxes at the points where the element enters and leaves the tank, trough, or pipe line. Elements so installed shall be secured in a manner maintaining at least 1 in. clearance between turns.

[Rules (part), filed 4/3/61.]

WAC 296-43-060 Heating element in soil or sand. (1) Heating element in soil or sand shall be so spaced that the minimum distance between adjacent turns is not less than 1 in.

(2) Heating elements shall never be placed directly in peat moss or similar material of an insulating nature. Where peat moss or similar material is used, the element shall be protected by a layer of at least 1 in. over and 1 in. under the element, of a heat conducting material such as sand.

(3) Suitable drains for condensation shall be provided at the bottom of all boxes used in greenhouse or hotbed wiring.

(4) Where open wiring is used in greenhouses and hotbeds, the use of nonmetallic boxes and covers is recommended as provided in section 3716 of the N.E.C.

[Rules (part), filed 4/3/61.]

[Title 296 WAC—p. 1012]

WAC 296-43-070 Heating element imbedded in driveways. Heating elements imbedded in driveways shall conform to the provisions of WAC 296-43-010, 296-43-020 and 296-43-030(3), as applicable.

[Rules (part), filed 4/3/61.]

Chapter 296-45 WAC SAFETY STANDARDS FOR ELECTRICAL WORKERS

WAC

296-45-005	Electrical workers safety rules—Foreword.
296-45-015	Scope and application.
296-45-025	Variations.
296-45-035	Definitions.
296-45-045	NESC applicable.
296-45-055	Employer's responsibility.
296-45-065	Training.
296-45-075	Employer's safety program.
296-45-085	Leadworker's responsibility.
296-45-095	Leadworker-employee responsibility.
296-45-105	Work required of leadworkers.
296-45-115	Employee's responsibility.
296-45-125	Medical services and first aid.
296-45-135	Job briefing.
296-45-175	Hazardous energy control (lockout/tagout) procedures.
296-45-17505	Lockout/tagout (hazardous control) program.
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296-45-17525	Notification.
296-45-17530	Lockout/tagout application.
296-45-17535	Releasing stored energy.
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296-45-17545	Temporary removal of lockout/tagout.
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296-45-17555	Shift changes.
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296-45-17565	Central system operator.
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296-45-205	Enclosed spaces.
296-45-215	Underground electrical installations.
296-45-225	Underground residential distribution (URD).
296-45-255	Protective equipment.
296-45-25505	Personal protective equipment.
296-45-25510	Fall protection.
296-45-275	Ladders, platforms, and manhole steps.
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296-45-295	Gasoline engine power chain saws.
296-45-305	Live-line tools.
296-45-315	Materials handling and storage.
296-45-325	Working on or near exposed energized parts.
296-45-335	De-energizing lines and equipment for employee protection.
296-45-345	Grounding for the protection of employees.
296-45-355	Underground grounding.
296-45-365	Testing and test facilities.
296-45-375	Mechanical equipment, including aerial manlift equipment.
296-45-385	Overhead lines.
296-45-455	Line-clearance tree-trimming operations.
296-45-45505	Brush chippers.
296-45-45510	Sprayers and related equipment.
296-45-45515	Stump cutters.
296-45-45520	Backpack power units for use in pruning and clearing.
296-45-45525	Rope.
296-45-45530	Fall protection.
296-45-465	Communication facilities.
296-45-475	Substations.
296-45-485	Power generation.
296-45-48505	Interlocks and other safety devices.
296-45-48510	Changing brushes.
296-45-48515	Access and working space.
296-45-48520	Guarding of rooms containing electric supply equipment.
296-45-48525	Guarding of energized parts.
296-45-48530	Water or steam spaces.
296-45-48535	Chemical cleaning of boilers and pressure vessels.
296-45-48540	Chlorine systems.
296-45-48545	Boilers.

296-45-48550	Turbine generators.	296-45-120	Tools—Inspection of tools. [§ IV, Rules 4.8 and 4.9, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-48555	Coal and ash handling.	296-45-130	Tools—Storage of tools and materials. [§ IV, Rule 4.10, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-48560	Hydroplants and equipment.	296-45-140	Tools—Hand tools—Using metal objects. [§ IV, Rules 4.11 and 4.12, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-525	Special conditions.	296-45-150	Tools—Ladders. [§ IV, Rules 4.13 through 4.27, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52505	Capacitors.	296-45-160	Tools—Scaffolds. [§ IV, Rule 4.28, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52510	Current transformer secondaries.	296-45-170	Tools—Guards and barriers. [§ IV, Rule 4.29, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52515	Series streetlighting.	296-45-180	Tools—Grounding equipment. [§ IV, Rules 4.30 and 4.31, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52520	Illumination.	296-45-190	Tools—Hot line tools. [§ IV, Rules 4.32 and 4.33, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52525	Protection against drowning.	296-45-200	Tools—Switch stick. [§ IV, Rules 4.34 and 4.35, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52530	Employee protection in public work areas.	296-45-210	Tools—Climbing equipment. [§ IV, Rules 4.36 through 4.39, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52535	Backfeed.	296-45-220	Protective devices—Rubber protective equipment. [§ IV, Rules 4.40 through 4.51, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52540	Lasers.	296-45-230	Equipment—Soldering equipment. [§ IV, Rules 4.52 through 4.55, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52545	Hydraulic fluids.	296-45-240	Equipment—Fire extinguishers. [§ IV, Rule 4.56, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-52550	Foreign attachments and placards.	296-45-250	Wearing apparel. [§ 296-45-250, filed 1/3/68; § IV, Rules 4.57 through 4.61, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-545	Trolley maintenance, jumpering or bypassing.	296-45-260	Transportation—Motor vehicle and trailer operations law. [§ IV, Rule 4.62, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-675	Rotorcraft/helicopter for power distribution and transmission line installation, construction and repair—Scope.	296-45-270	Transportation—Safety practices. [§ 296-45-270, filed 1/3/68; § IV, Rules 4.63 through 4.69, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67503	Definitions.	296-45-280	Employee qualifications. [§ V, Rule 5.1, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67505	Briefing.	296-45-290	Work required of foreman. [§ V, Rule 5.2, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67507	Signals.	296-45-300	Number of men required to do work safely. [§ V, Rules 5.3 through 5.5, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67509	Slings and tag lines.	296-45-310	Replacing or pulling fuses. [§ V, Rules 5.6 through 5.8, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67511	Cargo hooks.	296-45-320	Electric utility employee operated motor cranes, "A" frames, aerial lift equipment, hole digger, winches, etc. [§ V, Rule 5.9, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67513	Personal protective equipment.	296-45-330	Working on or near energized lines or equipment. [§ V, Rules 5.10 through 5.15, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67515	Wearing apparel.	296-45-340	Stringing or removing wires. [§ V, Rule 5.16, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67517	Loose gear and objects.	296-45-350	Temporary guard poles and structures. [§ V, Rule 5.17, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67519	Housekeeping.	296-45-360	Safe working practices. [§ V, Rules 5.18 through 5.46, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67521	Operator's responsibility.	296-45-370	Overhead lines—Working above energized circuits over 5 K.V. [§ V, Rules 5.47 through 5.50, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67523	Hooking and unhooking loads.	296-45-380	Overhead lines—Using hot line tools. [§ V, Rules 5.51 through 5.54, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-67525	Static charge.		
296-45-67527	Load permitted.		
296-45-67529	Visibility.		
296-45-67531	Signal systems.		
296-45-67533	Approaching the helicopter.		
296-45-67535	In helicopter.		
296-45-67537	Sling and rigging.		
296-45-67539	Personnel.		
296-45-67541	Fires.		
296-45-67543	General.		
296-45-67545	Refueling operations.		
296-45-900	Appendices.		
296-45-901	Appendix A—Nonmandatory.		
296-45-903	Appendix B—Protection from step and touch potentials—Nonmandatory.		
296-45-905	Appendix C—Methods of inspecting and testing wood poles—Nonmandatory.		

Reviser's note: Chapter 296-44 WAC Safety Standards—Electrical Construction code was absorbed into this chapter with the filing of WSR 98-07-009, filed 3/6/98, effective 5/6/98.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-45-010	General. [§ 296-45-010, filed 1/3/68; § I, Rules 1.1 through 1.9, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-020	Causes of accident. [§ I, Rule 1.10, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-030	Safety. [§ I, Rule 1.11, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-040	Definitions. [§ I, Rules 1.12 through 1.29, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-050	Employer's responsibility. [§ II, Rules 2.1 through 2.11, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-060	Foreman's responsibility. [§ II, Rules 2.12 through 2.23, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-070	Employees' responsibility. [§ II, Rules 2.24 through 2.31, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-080	First aid. [§ III, Rules 3.1 through 3.4, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-090	Industrial hygiene. [§ III, Rules 3.5 through 3.7, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.
296-45-110	Tools—General. [§ IV, Rules 4.1 through 4.7, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.

296-45-390	Overhead lines—Strength of spans and their supports. [§ V, Rules 5.55 and 5.56, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65003, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-400	Overhead lines—Foreign operations. [§ V, Rule 5.57, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65005	Definitions. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65005, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65005, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-410	Overhead lines—Tree trimming. [§ V, Rule 5.58, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-420	Overhead lines—Foreign attachments and placards. [§ V, Rule 5.59, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65009	Employer's responsibility. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65009, filed 9/30/94, effective 11/20/94; 89-11-035 (Order 89-03), § 296-45-65009, filed 5/15/89, effective 6/30/89; Order 76-38, § 296-45-65009, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-430	Substations and generating plants—General. [§ V, Rules 5.60 through 5.64, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-440	Maintenance of clearance. [§ V, Rule 5.65, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-450	Number of men required to work safely. [§ V, Rule 5.66, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65011	Leadworker's responsibility. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65011, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65011, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-460	Safe working practices. [§ V, Rules 5.67 through 5.78, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-470	Clearances. [§ VI, Rules 6.1 through 6.13, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65013	Leadworker-employee responsibility. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65013, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65013, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-480	Grounding. [§ VI, Rules 6.14 through 6.25, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-490	Underground maintenance—General. [§ VII, Rule 7.1, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-500	Underground maintenance—Working in manholes. [§ VII, Rules 7.2 through 7.7, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65015	Work required of leadworkers. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65015, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65015, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-510	Underground maintenance—Guarding manholes and street openings. [§ VII, Rules 7.8 through 7.12, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-520	Underground maintenance—Use of tools and equipment. [§ VII, Rules 7.13 through 7.17, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65017	Employee's responsibility. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65017, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65017, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-530	Underground maintenance—Pulling U.G. cable. [§ VII, Rule 7.18, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-540	Underground maintenance—Testing. [§ VII, Rules 7.19 through 7.21, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65019	First aid. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65019, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65019, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-550	Underground maintenance—Fishing conduit or ducts. [§ VII, Rule 7.22, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-560	Underground maintenance—Working in elevated position. [§ VII, Rule 7.23, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65021	Tools and protective equipment. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65021, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65021, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-570	Underground maintenance—Grounding U.G. power conductors and equipment. [§ VII, Rules 7.24 through 7.27, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-580	Trolley maintenance. [§ VII, Rules 7.28 through 7.40, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65023	Clearances, operating power lines and equipment. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65023, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65023, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-590	Aerial manlift equipment. [§ 296-45-590, filed 1/3/68; § VIII, Rules 8.1 through 8.10, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.		
296-45-600	Conclusion. [Matter following Rule 8.10, filed 3/23/60, effective 2/3/56.] Repealed by Order 76-38, filed 12/30/76.	296-45-65025	Grounding. [Order 76-38, § 296-45-65025, filed 12/30/76.] Repealed by 88-11-021 (Order 88-04), filed 5/11/88. Statutory Authority: Chapter 49.17 RCW.
296-45-60013	Hand and portable powered tools. [Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-45-60013, filed 10/28/96, effective 1/1/97.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.	296-45-65026	Personal protective grounding. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65026, filed 9/30/94, effective 11/20/94; 91-24-017 (Order 91-07), § 296-45-65026, filed 11/22/91, effective 12/24/91; 88-11-021 (Order 88-04), § 296-45-65026, filed 5/11/88.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-650	Electrical workers safety rules—Foreword. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-650, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-650, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.	296-45-65027	General requirements. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65027, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65027, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
296-45-65003	Scope and application. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65003,		

- 296-45-65029 Overhead lines. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65029, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65029, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65031 Poles and pole settings. [Order 76-38, § 296-45-65031, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65033 Transmission line construction. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65033, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65033, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65035 Substations. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65035, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65035, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65037 Underground. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65037, filed 9/30/94, effective 11/20/94; 88-11-021 (Order 88-04), § 296-45-65037, filed 5/11/88; Order 76-38, § 296-45-65037, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65038 Underground residential distribution (URD). [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65038, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-45-65038, filed 11/30/83; 83-15-017 (Order 83-19), § 296-45-65038, filed 7/13/83, effective 9/12/83.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65039 Trolley maintenance, jumpering or bypassing. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65039, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65039, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65041 Aerial manlift equipment. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65041, filed 9/30/94, effective 11/20/94; 89-11-035 (Order 89-03), § 296-45-65041, filed 5/15/89, effective 6/30/89; Order 76-38, § 296-45-65041, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65043 All motor vehicle and trailer operations. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-45-65043, filed 3/30/82; Order 76-38, § 296-45-65043, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65045 Material handling. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-65045, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65045, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-65047 Specification for lineworker's belts and similar equipment. [Statutory Authority: Chapter 49.17 RCW. 95-10-016, § 296-45-65047, filed 4/25/95, effective 10/1/95; 94-20-057 (Order 94-16), § 296-45-65047, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-65047, filed 12/30/76.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-660 Tree trimming. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-660, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66001 Electrical hazards. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-66001, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66001, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66003 Tools and protective equipment. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66003, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66005 Insulated tools used for tree trimming. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-66005, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66005, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66007 Aerial manlift equipment. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-66007, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-13-045 (Order 82-22), § 296-45-66007, filed 6/11/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66007, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66009 All motor vehicle and trailer operations. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-66009, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66009, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-66011 Working in proximity to electrical hazards. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-66011, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-13-053 (Order 81-9), § 296-45-66011, filed 6/17/81.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-680 Communication facilities. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-680, filed 9/30/94, effective 11/20/94.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-690 Power generation. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-690, filed 9/30/94, effective 11/20/94.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-695 Hazardous energy control (lockout/tagout) procedures. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-695, filed 9/30/94, effective 11/20/94.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.
- 296-45-700 Testing and test facilities. [Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-700, filed 9/30/94, effective 11/20/94.] Repealed by 98-07-009, filed 3/6/98, effective 5/6/98. Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060.

WAC 296-45-005 Electrical workers safety rules—
Foreword. The purpose of this chapter is to make the workplace of electrical employees as free from recognized hazards as reasonably possible. Following these rules may sometimes require that employee safety receive a higher priority than speed and work performance. These rules exist to provide employee safety, so employees are expected, in good faith, to follow the provisions of this chapter. This chapter is not intended to be a complete job description nor is it expected

that the chapter covers every hazard that an employee may encounter. When a hazard exists that is not covered by this chapter, the leadworker and employees are expected, in good faith, to mutually discuss the hazard and agree how to perform the work with the greatest degree of safety.

The department of labor and industries is the sole and paramount administrative agency responsible for the administration and interpretation of this chapter and the Washington Industrial Safety and Health Act of 1973. If there exists a question as to the meaning of any provision of this chapter, such question must first be directed to the department of labor and industries and its authorized representatives.

Experience has proven that the majority of injuries and deaths are preventable. Most injuries and deaths are not due to defective equipment but are due to failure on the part of the employees and those in authority to observe safety rules and failure to use safety devices. In the last analysis, this chapter is a compilation of experience and common sense. Electrical safety requires that the work be properly planned, executed by the use of good judgment and under the direction of intelligent supervision.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-005, filed 3/6/98, effective 5/6/98.]

WAC 296-45-015 Scope and application. (1) This chapter covers the operation and maintenance of electric power generation, control, transformation, transmission, and distribution lines and equipment. These provisions apply to:

(a) Power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees;

Note: The types of installations covered by this chapter include the generation, transmission, and distribution installations of electric utilities, as well as equivalent installations of industrial establishments. Trolley maintenance, jumpering, and bypass is also covered by this chapter. Supplementary electric generating equipment that is used to supply a workplace for emergency, standby, or similar purposes only is covered under Part L of chapter 296-24 WAC.

(b) Other installations at an electric power generating station, as follows:

(i) Fuel and ash handling and processing installations, such as coal conveyors;

(ii) Water and steam installations, such as penstocks, pipelines, and tanks, providing a source of energy for electric generators; and

(iii) Chlorine and hydrogen systems.

(c) Test sites where electrical testing involving temporary measurements associated with electric power generation, transmission, and distribution is performed in laboratories, in the field, in substations, and on lines, as opposed to metering, relaying, and routine line work;

(d) Work on or directly associated with the installations covered in subsections (1)(a) through (c) of this section; and

(e) Line-clearance tree-trimming operations, as follows:

(i) This chapter except WAC 296-45-455, applies to line-clearance tree-trimming operations performed by qualified employees (those who are knowledgeable in the construction and operation of electric power generation, trans-

mission, or distribution equipment involved, along with the associated hazards).

(ii) WAC 296-45-065, 296-45-125, 296-45-135, 296-45-255, 296-45-315, 296-45-375, and 296-45-455 through 296-45-45530 apply to line-clearance tree-trimming operations performed by line-clearance tree trimmers who are not qualified employees.

(2) Notwithstanding subsection (1) of this section, this chapter does not apply:

(a) To construction work as defined in chapter 296-155 WAC; or

(b) To electrical installations, electrical safety-related work practices, or electrical maintenance considerations covered by Part L of chapter 296-24 WAC.

Note 1: Work practices conforming to WAC 296-24-970 through 296-24-985 are considered as complying with the electrical safety-related work practice requirements of this chapter, provided the work is being performed on a generation or distribution installation meeting WAC 296-24-95601 through 296-24-95699. This chapter also applies to work by qualified persons directly on or associated with installations of electric power generation, transmission, and distribution lines or equipment, regardless of compliance with WAC 296-24-970 through 296-24-985.

Note 2: Work practices performed by qualified persons and conforming to this chapter are considered as complying with WAC 296-24-95601 through 296-24-95699.

(3) This section applies in addition to all other applicable safety and health standards administered by the department. Specific references in this section to other standards are provided for emphasis only.

(4) Operation, conditions, work methods and other work related situations or activities not specifically covered by this chapter are subject to the rules and regulations of chapter 296-24 WAC, General safety and health standards; chapter 296-62 WAC, General occupational health standards; chapter 296-155 WAC, Safety standards for construction work; and, insofar as applicable to employee safety and health, chapter 19.29 RCW. Additionally, operations, conditions, work methods and other work related situations or activities may be subject to additional rules and regulations depending upon the nature of the work being performed.

(5) These rules shall not apply to the use of existing electrical installations during their lifetime, provided they are maintained in good condition and in accordance with the applicable safety factor requirements and the rules in effect at the time they were installed, and provided that reconstruction shall conform to the rules as herein provided.

(6) Any rule, regulation or standard contained within this chapter, if subject to interpretation, shall be interpreted so as to achieve employee safety, which is the ultimate purpose of this chapter.

(7) Should a rule or standard contained within this chapter conflict, in any manner, with a standard or rule contained within any other chapter of Title 296 WAC the standard or rule contained herein shall apply so long as the work being done is power generation, transmission, and distribution installations, including related equipment for the purpose of communication or metering, which are accessible only to qualified employees. If there are rules within this chapter that conflict, the rule that provides the greatest employee safety will apply.

(8) Neither the promulgation of these rules, nor anything contained in these rules shall be construed as affecting the relative status or civil rights or liabilities between employers and their employees and/or the employees of others and/or the public generally; nor shall the use herein of the words "duty" and "responsibility" or either, import or imply liability other than provided for in the industrial insurance and safety laws of the state of Washington, to any person for injuries due to negligence predicated upon failure to perform or discharge any such "duty" or "responsibility," but failure on the part of the employees, leadworker, or employer to comply with any compulsory rule may be cause for the department of labor and industries to take action in accordance with the industrial insurance and safety laws.

(9) "Shall" and "must" as used in this chapter make the provisions mandatory. "Should," "may," or "it is recommended" are used to indicate the provisions are not mandatory but are recommended.

(10) If any section, subsection, phrase, or provisions of this chapter or part thereof should be held invalid by any court for any reason, such invalidity shall not in any way affect the validity of the remainder of this chapter, unless such decision renders the remainder of the provision unintelligible, or changes the meaning of such other provision or provisions.

(11) When the language used in this chapter indicates that it is the responsibility, duty, or obligation of the leadworker or other employee, it shall also be the employer's responsibility, obligation, and duty.

Whenever this chapter refers to the provisions of another safety and health standard or statute affecting safety and health, such reference refers to the statute or code in effect at the time the work is being performed.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-015, filed 3/6/98, effective 5/6/98.]

WAC 296-45-025 Variances. Under certain circumstances, an employer may obtain a variance from the director of the department of labor and industries or an authorized representative. Until such time as a variance is granted, the employer and employees must comply with the mandatory provisions of this chapter. The procedure and requirements for variances are found in chapter 296-350 WAC.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-025, filed 3/6/98, effective 5/6/98.]

WAC 296-45-035 Definitions. These definitions apply to chapter 296-45 WAC.

"Aerial manlift equipment" - Equipment such as extended towers, boom-mounted cages or baskets, and truck-mounted ladders, that is primarily designed to place personnel and equipment aloft to work on elevated structures and equipment.

"Affected employee" - An employee whose job requires him or her to operate or use a machine or equipment on which servicing or maintenance is being performed under lockout or tagout, or whose job requires him or her to work in an area in which such servicing or maintenance is being performed.

(1999 Ed.)

"Apprentice" - An employee who is being trained to be journey level.

"Approved" - Meets or exceeds the recognized standards of safety within the industry.

"Approved protectors" - Gloves worn over rubber insulating gloves which are of such material or substance and so constructed as to protect the rubber gloves from abrasions, lacerations, or other physical damage which might otherwise occur to rubber gloves. Approved protectors must conform to the standards which are recognized by the industry.

"Attendant" - An employee assigned to remain immediately outside the entrance to an enclosed or other space to render assistance as needed to employees inside the space.

"Authorized employee" - An employee who locks out or tags out machines or equipment in order to perform servicing or maintenance on that machine or equipment. An affected employee becomes an authorized employee when that employee's duties include performing servicing or maintenance covered under this section.

"Automatic circuit recloser" - A self-controlled device for interrupting and reclosing an alternating current circuit with a predetermined sequence of opening and reclosing followed by resetting, hold-closed, or lockout operation.

"Barricade" - A physical obstruction such as tapes, cones, or A-frame type wood or metal structures intended to provide a warning about and to limit access to a hazardous area.

"Barrier" - A physical obstruction which is intended to prevent contact with energized lines or equipment or to prevent unauthorized access to a work area.

"Bond" - The electrical interconnection of conductive parts designed to maintain a common electrical potential.

"Bus" - A conductor or a group of conductors that serve as a common connection for two or more circuits.

"Bushing" - An insulating structure, including a through conductor or providing a passageway for such a conductor, with provision for mounting on a barrier, conducting or otherwise, for the purposes of insulating the conductor from the barrier and conducting current from one side of the barrier to the other.

"Cable" - A conductor with insulation, or a stranded conductor with or without insulation and other coverings (single-conductor cable), or a combination of conductors insulated from one another (multiple-conductor cable).

"Cable sheath" - A conductive protective covering applied to cables.

Note: A cable sheath may consist of multiple layers of which one or more is conductive.

"Circuit" - A conductor or system of conductors through which an electric current is intended to flow.

"Clearance" (between objects) - The clear distance between two objects measured surface to surface.

"Clearance" (for work) - Authorization to perform specified work or permission to enter a restricted area.

"Communication lines." (See "Lines, communication.")

"Conductor" - A material, usually in the form of a wire, cable, or bus bar, used for carrying an electric current.

"Covered conductor" - A conductor covered with a dielectric having no rated insulating strength or having a rated insulating strength less than the voltage of the circuit in which the conductor is used.

"Current-carrying part" - A conducting part intended to be connected in an electric circuit to a source of voltage. Noncurrent-carrying parts are those not intended to be so connected.

"De-energized" - Free from any electrical connection to a source of potential difference and from electric charge; not having a potential difference from that of the earth.

Note: The term is used only with reference to current-carrying parts, which are sometimes energized (alive).

"Designated employee/person" - An employee/person who is designated by the employer to perform specific duties under the terms of this section and who is knowledgeable in the construction and operation of the equipment and the hazards involved.

"Electric line truck" - Any vehicle used to transport employees, tools, and material, which serves as a traveling workshop for electric power line construction and maintenance work. It may be equipped with a boom and auxiliary equipment for setting poles, digging holes, and elevating material and/or workers.

"Electric supply equipment" - Equipment that produces, modifies, regulates, controls, or safeguards a supply of electric energy.

"Electric supply lines." (See "Lines, electric supply.")

"Electric utility" - An organization responsible for the installation, operation, or maintenance of an electric supply system.

"Emergency" - An unforeseen occurrence endangering life, limb, or property.

"Enclosed" - Surrounded by a case, cage, fence or otherwise which will protect the contained equipment and prevent accidental contact of a person with live parts.

"Enclosed space" - A working space, such as a man-hole, vault, tunnel, or shaft, that has a limited means of egress or entry, that is designed for periodic employee entry under normal operating conditions, and that under normal conditions does not contain a hazardous atmosphere, but that may contain a hazardous atmosphere under abnormal conditions.

Note: Spaces that are enclosed but not designed for employee entry under normal operating conditions are not considered to be enclosed spaces for the purposes of this section. Similarly, spaces that are enclosed and that are expected to contain a hazardous atmosphere are not considered to be enclosed spaces for the purposes of this section. Such spaces meet the definition of permit spaces in WAC 296-62-145, and entry into them must be performed in accordance with that standard.

"Energized" (alive, live) - Electrically connected to a source of potential difference, or electrically charged so as to have a potential significantly different from that of earth in the vicinity.

"Energy isolating device" - A physical device that prevents the transmission or release of energy, including, but not limited to, the following: A manually operated electric circuit breaker, a disconnect switch, a manually operated switch, a slide gate, a slip blind, a line valve, blocks, and any

similar device with a visible indication of the position of the device. (Push buttons, selector switches, and other control-circuit-type devices are not energy isolating devices.)

"Energy source" - Any electrical, mechanical, hydraulic, pneumatic, chemical, nuclear, thermal, or other energy source that could cause injury to personnel.

"Equipment" (electric) - A general term including material, fittings, devices, appliances, fixtures, apparatus, and the like used as part of or in connection with an electrical installation.

"Exposed" - Not isolated or guarded.

"Fault current" - The current that flows in an electrical system because of a defect in the circuit induced accidentally or otherwise.

"Fixed ladder" - A ladder that is permanently secured to a structure.

"Ground" - A conducting connection, whether intentional or accidental, between an electric circuit or equipment and the earth, or to some conducting body that serves in place of the earth.

"Grounded" - Connected to earth or to some conducting body that serves in place of the earth.

"Grounded system" - A system of conductors in which at least one conductor or point (usually the middle wire, or neutral point of transformer or generator windings) is intentionally grounded either solidly or through a current-limiting device (not a current-interrupting device).

"Groundperson" - A member of crew working on ground under direction of a leadworker.

"Guarded" - Covered, fenced, enclosed, or otherwise protected, by means of suitable covers or casings, barrier rails or screens, mats, or platforms, designed to prevent the possibility, under normal conditions, of dangerous approach or accidental contact by persons or objects.

Note: Wires which are insulated, but not otherwise protected, are not considered as guarded.

"Hazardous atmosphere" - An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from an enclosed space), injury, or acute illness from one or more of the following causes:

- Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);
- Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less;

- Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

- Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in chapter 296-62 WAC, Part L, or in chapter 296-62 WAC, toxic and hazardous substances, and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

- Any other atmospheric condition that is "immediately dangerous to life or health" (IDLH).

"IDLH" - Any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials (hydrogen fluoride gas and cadmium vapor, for example) may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

Note: For air contaminants for which WISHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, chapter 296-62 WAC, Part C, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

"High-power tests" - Tests in which fault currents, load currents, magnetizing currents, and line-dropping currents are used to test equipment, either at the equipment's rated voltage or at lower voltages.

"High-voltage tests" - Tests in which voltages of approximately 1000 volts are used as a practical minimum and in which the voltage source has sufficient energy to cause injury.

"High wind" - A wind of such velocity that the following hazards would be present:

- An employee would be exposed to being blown from elevated locations; or
- An employee or material handling equipment could lose control of material being handled; or
- An employee would be exposed to other hazards not controlled by the standard involved.

Note: Winds exceeding 40 miles per hour (64.4 kilometers per hour), or 30 miles per hour (48.3 kilometers per hour) if material handling is involved, are normally considered as meeting this criteria unless precautions are taken to protect employees from the hazardous effects of the wind.

"Insulated" - Separated from other conducting surfaces by a dielectric (including air space) offering a high resistance to the passage of current.

Note: When any object is said to be insulated, it is understood to be insulated for the conditions to which it is normally subjected. Otherwise, it is, within the purpose of this section, uninsulated.

"Insulation" (cable) - That which is relied upon to insulate the conductor from other conductors or conducting parts or from ground.

"Insulation shielding" - An envelope which encloses the insulation of a cable and provides an equipotential surface in contact with cable insulation.

"Isolated" - An object that is not readily accessible to persons unless special means of access are used.

"Leadworker" - The person directly in charge of workers doing the work, regardless of title.

"Line-clearance tree trimmer" - An employee who, through related training or on-the-job experience or both, is

familiar with the special techniques and hazards involved in line-clearance tree trimming.

Note 1: An employee who is regularly assigned to a line-clearance tree-trimming crew and who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a line-clearance tree trimmer is considered to be a line-clearance tree trimmer.

Note 2: A line-clearance tree trimmer is not considered to be a "qualified employee" under this section unless he or she has the training required for a qualified employee under WAC 296-45-065. However, under the electrical safety-related work practices standard, a line-clearance tree trimmer is considered to be a "qualified employee." Tree trimming performed by such "qualified employees" is not subject to the electrical safety-related work practice requirements contained in WAC 296-24-970. (See also the note following WAC 296-24-970 for information regarding the training an employee must have to be considered a qualified employee.)

"Line-clearance tree trimming" - The pruning, trimming, repairing, maintaining, removing, or clearing of trees or the cutting of brush that is within 10 feet (305 cm) of electric supply lines and equipment.

"Lines" -

- **"Communication lines"** - The conductors and their supporting or containing structures which are used for public or private signal or communication service, and which operate at potentials not exceeding 400 volts to ground or 750 volts between any two points of the circuit, and the transmitted power of which does not exceed 150 watts. If the lines are operating at less than 150 volts, no limit is placed on the transmitted power of the system. Under certain conditions, communication cables may include communication circuits exceeding these limitations where such circuits are also used to supply power solely to communication equipment.

Note: Telephone, telegraph, railroad signal, data, clock, fire, police alarm, cable television, and other systems conforming with this definition are included. Lines used for signaling purposes, but not included under this definition, are considered as electric supply lines of the same voltage.

- **"Electric supply lines"** - Conductors used to transmit electric energy and their necessary supporting or containing structures. Signal lines of more than 400 volts are always supply lines within this section, and those of less than 400 volts are considered as supply lines, if so run and operated throughout.

"Live-line tools and ropes" - Tools and ropes specifically designed for work on energized high voltage lines and equipment.

"Load-break elbow" - A connector designed to close and interrupt current on energized circuits within the design current and voltage rating.

"Manhole" - A subsurface enclosure which personnel may enter and which is used for the purpose of installing, operating, and maintaining submersible equipment or cable.

"Manhole steps" - A series of steps individually attached to or set into the walls of a manhole structure.

"Minimum approach distance" - The closest distance an employee is permitted to approach an energized or a grounded object.

"Neutral" - A system in which one conductor is used as the neutral for one or more circuits; one conductor may be

used as the neutral for both primary and secondary circuits of a distribution system.

"Pole" - Any device used to support a power distribution or transmission line. The pole may be made of any substance including wood, concrete, metal, is usually cylindrical in shape and comparatively slender. It is the upright standard to which is affixed part of the power distribution and transmission line system as defined in this chapter.

"Power dispatcher" (load dispatcher or system operator) - A person who has been designated by the employer as having authority over switching and clearances of high voltage lines and station equipment.

"Protective devices" - Devices such as rubber gloves, rubber blankets, line hose, rubber boots, or other insulating devices, which are specifically designed for the protection of employees.

"Public highway" - Every way, land, road, street, boulevard, and every other way or place in the state open as a matter of right to public vehicular travel, both inside and outside the limits of cities and towns, regardless of ownership.

"Qualified person or qualified employee" - A person who is familiar with the construction of, or operation of such lines and/or equipment that concerns his/her position and who is fully aware of the hazards connected therewith, or, one who has passed a journey status examination for the particular branch of the electrical trades with which he/she may be connected.

Note 1: An employee must have the training required by WAC 296-45-065(1) in order to be considered a qualified employee.

Note 2: (Apprentice) Except under WAC 296-45-25510(12), an employee who is undergoing on-the-job training and who, in the course of such training, has demonstrated an ability to perform duties safely at his or her level of training and who is under the direct supervision of a qualified person is considered to be a qualified person for the performance of those duties.

"Rubber" - Any goods, equipment, or tool made out of either natural or synthetic rubber.

"Secured ladder" - A ladder which is not capable of being dislodged from the top by lateral, or jerking motion(s).

"Sheath" - As applied to tools carried in a lineman's tool belt, a sheath that effectively covers the tool and prevents such tool from falling from the belt.

"Step bolt" - A bolt or rung attached at intervals along a structural member and used for foot placement during climbing or standing.

"Supporting structure" - The main supporting unit (usually a pole or tower).

"Switch" - A device for opening and closing or for changing the connection of a circuit. In these rules, a switch is understood to be manually operable, unless otherwise stated.

"System operator or power dispatcher" - A qualified person who has been designated by the employer and having authority over switching, clearances, and operation of the system and its parts.

"Tag" - A system or method of identifying circuits, systems, or equipment for the purpose of alerting employees and others that the circuit, system, or equipment is being worked on.

"Underground network" - An underground electrical installation fed from multiple primary sources directly associated with area-wide secondary network connected into a common grid.

"Underground residential distribution system" (URD) - An electrical installation normally fed from a single primary source which may feed one or more transformers with secondaries not connected to a common grid.

"Utility" - An organization responsible for the installation, operation, or maintenance of electric supply or communications systems.

"Vault" - An enclosure, above or below ground, which personnel may enter and which is used for the purpose of installing, operating, or maintaining equipment or cable.

"Vented vault" - A vault that has provision for air changes using exhaust flue stacks and low level air intakes operating on differentials of pressure and temperature providing for airflow which precludes a hazardous atmosphere from developing.

"Voltage" - The effective (rms) potential difference between any two conductors or between a conductor and ground. Voltages are expressed in nominal values unless otherwise indicated. The nominal voltage of a system or circuit is the value assigned to a system or circuit of a given voltage class for the purpose of convenient designation. The operating voltage of the system may vary above or below this value.

Note: Low voltage includes voltages from 50 to 600 volts. High voltage shall mean those voltages of 601 volts to 230,000. Extra high voltage means any voltage over 230,000 volts. Where the words "high voltage" are used in this chapter it shall include extra high voltage, unless otherwise specified.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-035, filed 3/6/98, effective 5/6/98.]

WAC 296-45-045 NESC applicable. (1) All electric utilities and entities operating transmission and distribution facilities within the state of Washington must design, construct, operate, and maintain their lines and equipment according to the requirements of the 1997 National Electric Safety Code (NESC) (ANSI-C2), sections (1), (2), and (3).

Note: The department has copies of the NESC available for review at each service location across the state. To purchase a copy, write to:
The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street
New York, NY 10017-2394

(2) The employer must ensure that climbing space is provided on all poles and structures. The climbing space must meet the requirements of the 1997 National Electric Safety Code (NESC) (ANSI-C2), except that Rule 236H does not apply.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-045, filed 3/6/98, effective 5/6/98.]

WAC 296-45-055 Employer's responsibility. (1) The employer shall provide and maintain the necessary protective devices specified in these rules and require the employees to use them properly.

(2) The employer shall develop and maintain a hazard communication program as required by Part C, chapter 296-62 WAC, which will provide information to all employees

relative to hazardous chemicals or substances to which they are exposed, or may become exposed, in the course of their employment.

(3) There shall be installed and maintained in every fixed establishment employing eight or more persons a safety bulletin board of a size to display and post safety bulletins, newsletters, posters, accident statistics and other safety educational material. It is recommended that safety bulletin boards be painted green and white.

(4) The employer shall require the leadworker to observe and enforce all safety rules and shall furnish a copy of the electrical workers' safety rules to each employee who is covered by these rules.

(5) The employer shall appoint only competent workers to supervise other employees and those appointed shall be responsible for the safety of the employees under their supervision.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-055, filed 3/6/98, effective 5/6/98.]

WAC 296-45-065 Training. Employees shall be trained and proficient in the safety-related work practices, safety procedures, and other safety requirements in this section that pertain to their respective job assignments. Employees shall also be trained in and proficient with any other safety practices, including applicable emergency procedures (such as pole top, aerial, manhole, and tree rescue), that are not specifically addressed by this section but that are related to their work and are necessary for their safety.

(1) Qualified employees shall also be trained and competent in:

(a) The skills and techniques necessary to distinguish exposed live parts from other parts of electric equipment;

(b) The skills and techniques necessary to determine the nominal voltage of exposed live parts;

(c) The minimum approach distances specified in this section corresponding to the voltages to which the qualified employee will be exposed; and

(d) The proper use of the special precautionary techniques, personal protective equipment, insulating and shielding materials, and insulated tools for working on or near exposed energized parts of electric equipment.

Note: For the purposes of this section, a person must have this training in order to be considered a qualified person.

(2) The employer shall determine, through regular supervision and through inspections conducted on at least an annual basis, that each employee is complying with the safety-related work practices required by this section.

(3) An employee shall receive additional training (or retraining) under any of the following conditions:

(a) If the supervision and annual inspections required by subsection (2) of this section indicate that the employee is not complying with the safety-related work practices required by this section; or

(b) If new technology, new types of equipment, or changes in procedures necessitate the use of safety-related work practices that are different from those which the employee would normally use; or

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(c) If he or she must employ safety related work practices that are not normally used during his or her regular job duties.

Note: WISHA would consider tasks that are performed less often than once per year to necessitate retraining before the performance of the work practices involved.

(4) The training required by WAC 296-45-065 shall be of the classroom or on-the-job type.

(5) The training shall establish employee proficiency in the work practices required by this section and shall introduce the procedures necessary for compliance with this section.

(6) The employer shall certify that each employee has received the training required by WAC 296-45-065. This certification shall be made when the employee demonstrates proficiency in the work practices involved and shall be maintained for the duration of the employee's employment.

Note: Employment records that indicate that an employee has received the required training are an acceptable means of meeting this requirement.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-065, filed 3/6/98, effective 5/6/98.]

WAC 296-45-075 Employer's safety program. (1) The employer shall hold safety meetings at least once a month, which meetings shall be held at a reasonable time and place as selected by the employer. The employer shall require all employees subject to provisions of this chapter to attend said meetings: *Provided*, That employees whose presence is otherwise required by reason of an emergency or whose function is such that they cannot leave their station or cease their work without serious detriment to the service provided, such as dispatcher, may be excused from such meeting under those circumstances. Minutes shall be kept of each safety meeting and retained for a period of one year.

(2) The employer or a representative(s) designated shall investigate all accidents or injuries of a serious nature and, where possible, take the proper remedial steps to prevent the occurrence of similar accidents.

(3) The employer shall furnish instructions stating the proper procedure in event of an emergency, which shall include the names of those individuals to be notified and methods of contacting them.

(4) The employer shall provide and make available to all employees accident report and safety suggestion forms or other approved methods. Safety suggestion forms should, where possible, be used for suggesting the elimination of hazardous conditions and such reported suggestions shall be retained (for one year) by the employer or an authorized representative.

(5) The employer must notify the department of employee fatalities or catastrophes according to the requirements of WAC 296-24-020.

(6) Nothing contained within this chapter shall prohibit an employer or an authorized representative from disciplining employees for failure to comply with the provisions of this or any other safety code.

(7) Existing conditions related to the safety of the work to be performed shall be determined before work on or near electric lines or equipment is started. Such conditions

include, but are not limited to, the nominal voltages of lines and equipment, the maximum switching transient voltages, the presence of hazardous induced voltages, the presence and condition of protective grounds and equipment grounding conductors, the condition of poles, environmental conditions relative to safety, and the locations of circuits and equipment, including power and communication lines and fire protective signaling circuits.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-075, filed 3/6/98, effective 5/6/98.]

WAC 296-45-085 Leadworker's responsibility. (1) Every leadworker shall understand these and any other applicable safety rules and comply therewith. Leadworkers shall require all employees under their direction or supervision to read this chapter and the provisions contained therein and require every employee subject to this chapter to be able to apply this chapter and any provision of this chapter on a day-to-day basis.

(2) Leadworkers shall inform employees under their supervision or direction of the type and voltage of circuits on or near which the employees are to work.

(3) Leadworkers shall require all employees under their supervision to properly use safety devices and equipment, including barricades, warning flags or signs, or any other device called for to protect employees.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-085, filed 3/6/98, effective 5/6/98.]

WAC 296-45-095 Leadworker-employee responsibility. (1) An employee shall protect his/her climbing and working space at all times if the conductors are so spaced that in climbing or working he/she will be, or where it is possible to come within, the minimum required distances specified in these rules.

(2) Leadworkers or supervisors shall in good faith consider verbal or written reports of hazardous conditions and shall, as soon as practicable, investigate and remedy same if warranted.

(3) When hazards are reported by employees, leadworkers and others having authority shall accept the report in a cooperative manner, and in no case shall an employee be reprimanded or penalized for reporting hazards or potential hazards.

(4) Leadworkers shall require all employees under their supervision to keep their belts, spurs, and straps in good working condition. When straps and belts are in poor condition or defective, they shall not be used.

(5) Before leaving a jobsite, leadworkers shall correct or arrange to give warning of any condition which might result in injury to employees.

(6) No employee shall be permitted or allowed to remain on the jobsite when under the influence of any intoxicating beverage or controlled substance or substances: *Provided*, That if an employee is taking prescription medication under the direction of a practicing physician and such prescription does not interfere with the safe performance of the work assigned, such employee may be permitted to work.

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(7) No intoxicating beverages or controlled substances shall be consumed on the jobsite other than prescription medication as set forth above.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-095, filed 3/6/98, effective 5/6/98.]

WAC 296-45-105 Work required of leadworkers. (1) A leadworker cannot properly supervise the work and look out for the safety of employees under their direction if required to work as a leadworker and a lineworker at the same time.

(2) Leadworkers should be constantly alert and shall not be required to serve in such dual capacity, except in crews of not more than two lineworkers, in which case they may work as one of the lineworkers.

(3) In crews of two lineworkers or less, each lineworker may have a groundworker but, if additional lineworkers or groundworkers are added to the crew, the leadworker shall confine his/her activities to supervising the work, as exhibited below:

Type of Crew	Minimum Requirements
2 lineworkers	One lineworker as person-in-charge.
2 lineworkers plus 1 groundworker	One lineworker as person-in-charge or climbing leadworker.
2 lineworkers plus 2 groundworkers	One lineworker as person-in-charge or climbing leadworker.
2 lineworkers plus any combination of 3 lineworkers or groundworkers	One nonclimbing leadworker.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-105, filed 3/6/98, effective 5/6/98.]

WAC 296-45-115 Employee's responsibility. (1) Employees shall not engage in horseplay or scuffling while on the job or jobsite and the employer shall not permit horseplay or scuffling while on the jobsite or otherwise in the course of employment.

(2) During such time as any employee is working on or near any energized line or energized equipment in excess of 600 volts there shall be no talking or communication other than that which is absolutely necessary and essential for the safe and proper performance of the work. Should there be communication or talk from a person other than an employee, the work shall stop until such time as the distraction ceases.

(3) Employees shall report any hazardous or potentially hazardous condition, operation, means, or work in a constructive manner and shall not engage in personality conflicts.

(4) Neither the employer nor the employees shall throw or permit anything to be thrown from elevated position(s) or poles to the ground or lower level, nor shall anything be thrown from the ground or lower level to an elevated position, whether that elevated position is on a pole, aerial manlift or otherwise. Tools and loose materials shall not be left on poles, crossarms, ladders or other elevated structures or positions.

(5) Employees shall report all injuries, regardless of severity, to the employer or designated representative. Report forms furnished by the employer should be used.

(1999 Ed.)

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-115, filed 3/6/98, effective 5/6/98.]

WAC 296-45-125 Medical services and first aid. The employer shall provide medical services and first aid as required in chapter 296-24 WAC. In addition to the requirements of chapter 296-24 WAC, the following requirements also apply:

(1) Cardiopulmonary resuscitation and first-aid training. When employees are performing work on or associated with exposed lines or equipment energized at 50 volts or more, persons trained in first aid including cardiopulmonary resuscitation (CPR) shall be available as follows:

(a) For field work involving two or more employees at a work location, at least two trained persons shall be available. However, only one trained person need be available if all new employees are trained in first aid, including CPR, within 3 months of their hiring dates.

(b) For fixed work locations such as generating stations, the number of trained persons available shall be sufficient to ensure that each employee exposed to electric shock can be reached within 4 minutes by a trained person. However, where the existing number of employees is insufficient to meet this requirement (at a remote substation, for example), all employees at the work location shall be trained.

(2) First-aid supplies. First-aid supplies required by chapter 296-24 WAC shall be placed in weatherproof containers if the supplies could be exposed to the weather.

(3) First-aid kits. Each first-aid kit shall be maintained, shall be readily available for use, and shall be inspected frequently enough to ensure that expended items are replaced but at least once per year.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-125, filed 3/6/98, effective 5/6/98.]

WAC 296-45-135 Job briefing. The employer shall ensure that the leadworker conducts a job briefing with the employees involved before they start each job. The briefing shall cover at least the following subjects: Hazards associated with the job, work procedures involved, special precautions, energy source controls, and personal protective equipment requirements.

(1) Number of briefings. If the work or operations to be performed during the work day or shift are repetitive and similar, at least one job briefing shall be conducted before the start of the first job of each day or shift. Additional job briefings shall be held if significant changes, which might affect the safety of the employees, occur during the course of the work.

(2) Extent of briefing. A brief discussion is satisfactory if the work involved is routine and if the employee, by virtue of training and experience, can reasonably be expected to recognize and avoid the hazards involved in the job. A more extensive discussion shall be conducted:

(a) If the work is complicated or particularly hazardous; or

(b) If the employee cannot be expected to recognize and avoid the hazards involved in the job.

Note: The briefing is always required to touch on all the subjects listed in the introductory text to this section.

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(3) Working alone. An employee working alone need not conduct a job briefing. However, the employer shall ensure that the tasks to be performed are planned as if a briefing were required.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-135, filed 3/6/98, effective 5/6/98.]

WAC 296-45-175 Hazardous energy control (lockout/tagout) procedures. The provisions of this section apply to the use of lockout/tagout procedures for the control of energy sources in installations for the purpose of electric power generation, including related equipment for communication or metering. Locking and tagging procedures for the de-energizing of electric energy sources which are used exclusively for purposes of transmission and distribution are addressed by WAC 296-45-335.

Note 1: Installations in electric power generation facilities that are not an integral part of, or inextricably commingled with, power generation processes or equipment are covered under chapter 296-24 WAC.

Note 2: Lockout and tagging procedures that comply with chapter 296-24 WAC will also be deemed to comply with this section if the procedures address the hazards covered by this section.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-175, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17505 Lockout/tagout (hazardous control) program. (1) The employer shall establish a program consisting of energy control procedures, employee training, and periodic inspections to ensure that, before any employee performs any servicing or maintenance on a machine or equipment where the unexpected energizing, start up, or release of stored energy could occur and cause injury, the machine or equipment is isolated from the energy source and rendered inoperative.

(2) The employer's energy control program under this section shall meet the following requirements:

(a) If an energy isolating device is not capable of being locked out, the employer's program shall use a tagout system.

(b) If an energy isolating device is capable of being locked out, the employer's program shall use lockout, unless the employer can demonstrate that the use of a tagout system will provide full employee protection as follows:

(i) When a tagout device is used on an energy isolating device which is capable of being locked out, the tagout device shall be attached at the same location that the lockout device would have been attached, and the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by the use of a lockout program.

(ii) In demonstrating that a level of safety is achieved in the tagout program equivalent to the level of safety obtained by the use of a lockout program, the employer shall demonstrate full compliance with all tagout-related provisions of this standard together with such additional elements as are necessary to provide the equivalent safety available from the use of a lockout device. Additional means to be considered as part of the demonstration of full employee protection shall include the implementation of additional safety measures such as the removal of an isolating circuit element, blocking

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of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle to reduce the likelihood of inadvertent energizing.

(3) Whenever replacement or major repair, renovation, or modification of a machine or equipment is performed, and whenever new machines or equipment are installed, energy isolating devices for such machines or equipment shall be designed to accept a lockout device.

(4) Procedures shall be developed, documented, and used for the control of potentially hazardous energy covered by this section.

(5) The procedure shall clearly and specifically outline the scope, purpose, responsibility, authorization, rules, and techniques to be applied to the control of hazardous energy, and the measures to enforce compliance including, but not limited to, the following:

(a) A specific statement of the intended use of this procedure;

(b) Specific procedural steps for shutting down, isolating, blocking and securing machines or equipment to control hazardous energy;

(c) Specific procedural steps for the placement, removal, and transfer of lockout devices or tagout devices and the responsibility for them; and

(d) Specific requirements for testing a machine or equipment to determine and verify the effectiveness of lockout devices, tagout devices, and other energy control measures.

(6) The employer shall conduct a periodic inspection of the energy control procedure at least annually to ensure that the procedure and the provisions of this section are being followed.

(a) The periodic inspection shall be performed by an authorized employee who is not using the energy control procedure being inspected.

(b) The periodic inspection shall be designed to identify and correct any deviations or inadequacies.

(c) If lockout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized employee, of that employee's responsibilities under the energy control procedure being inspected.

(d) Where tagout is used for energy control, the periodic inspection shall include a review, between the inspector and each authorized and affected employee, of that employee's responsibilities under the energy control procedure being inspected, and the elements set forth in this section.

(e) The employer shall certify that the inspections required by this section have been accomplished. The certification shall identify the machine or equipment on which the energy control procedure was being used, the date of the inspection, the employees included in the inspection, and the person performing the inspection.

Note: If normal work schedule and operation records demonstrate adequate inspection activity and contain the required information, no additional certification is required.

(7) The employer shall provide training to ensure that the purpose and function of the energy control program are understood by employees and that the knowledge and skills required for the safe application, usage, and removal of energy controls are acquired by employees. The training shall include the following:

(a) Each authorized employee shall receive training in the recognition of applicable hazardous energy sources, the type and magnitude of energy available in the workplace, and in the methods and means necessary for energy isolation and control.

(b) Each affected employee shall be instructed in the purpose and use of the energy control procedure.

(c) All other employees whose work operations are or may be in an area where energy control procedures may be used shall be instructed about the procedures and about the prohibition relating to attempts to restart or reenergize machines or equipment that are locked out or tagged out.

(8) When tagout systems are used, employees shall also be trained in the following limitations of tags:

(a) Tags are essentially warning devices affixed to energy isolating devices and do not provide the physical restraint on those devices that is provided by a lock.

(b) When a tag is attached to an energy isolating means, it is not to be removed without authorization of the authorized person responsible for it, and it is never to be bypassed, ignored, or otherwise defeated.

(c) Tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective.

(d) Tags and their means of attachment must be made of materials which will withstand the environmental conditions encountered in the workplace.

(e) Tags may evoke a false sense of security, and their meaning needs to be understood as part of the overall energy control program.

(f) Tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17505, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17510 Retraining. (1) Retraining shall be provided for all authorized and affected employees whenever there is a change in their job assignments, a change in machines, equipment, or processes that present a new hazard or whenever there is a change in the energy control procedures.

(2) Retraining shall also be conducted whenever a periodic inspection reveals, or whenever the employer has reason to believe, that there are deviations from or inadequacies in an employee's knowledge or use of the energy control procedures.

(3) The retraining shall reestablish employee proficiency and shall introduce new or revised control methods and procedures, as necessary.

(4) The employer shall certify that employee training has been accomplished and is being kept up to date. The certification shall contain each employee's name and dates of training.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17510, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17515 Protective materials and hardware. (1) Locks, tags, chains, wedges, key blocks, adapter

pins, self-locking fasteners, or other hardware shall be provided by the employer for isolating, securing, or blocking of machines or equipment from energy sources.

(2) Lockout devices and tagout devices shall be singularly identified; shall be the only devices used for controlling energy; may not be used for other purposes; and shall meet the following requirements:

(a) Lockout devices and tagout devices shall be capable of withstanding the environment to which they are exposed for the maximum period of time that exposure is expected.

(b) Tagout devices shall be constructed and printed so that exposure to weather conditions or wet and damp locations will not cause the tag to deteriorate or the message on the tag to become illegible.

(c) Tagout devices shall be so constructed as not to deteriorate when used in corrosive environments.

(3) Lockout devices and tagout devices shall be standardized within the facility in at least one of the following criteria: Color, shape, size. Additionally, in the case of tagout devices, print and format shall be standardized.

(4) Lockout devices shall be substantial enough to prevent removal without the use of excessive force or unusual techniques, such as with the use of bolt cutters or metal cutting tools.

(5) Tagout devices, including their means of attachment, shall be substantial enough to prevent inadvertent or accidental removal. Tagout device attachment means shall be of a nonreusable type, attachable by hand, self-locking, and non-releasable with a minimum unlocking strength of no less than fifty pounds and shall have the general design and basic characteristics of being at least equivalent to a one-piece, all-environment-tolerant nylon cable tie.

(6) Each lockout device or tagout device shall include provisions for the identification of the employee applying the device.

(7) Tagout devices shall warn against hazardous conditions if the machine or equipment is energized and shall include a legend such as the following: Do Not Start, Do Not Open, Do Not Close, Do Not Energize, Do Not Operate.

Note: For specific provisions covering accident prevention tags, see chapter 296-24 WAC.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17515, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17520 Energy isolation. Lockout and tagout device application and removal may only be performed by the authorized employees who are performing the servicing or maintenance.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17520, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17525 Notification. Affected employees shall be notified by the employer or authorized employee of the application and removal of lockout or tagout devices. Notification shall be given before the controls are applied and after they are removed from the machine or equipment.

Note: This section requires that the second notification take place before the machine or equipment is reenergized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17525, filed 3/6/98, effective 5/6/98.]

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WAC 296-45-17530 Lockout/tagout application. The established procedures for the application of energy control (the lockout or tagout procedures) shall include the following elements and actions, and these procedures shall be performed in the following sequence:

(1) Before an authorized or affected employee turns off a machine or equipment, the authorized employee shall have knowledge of the type and magnitude of the energy, the hazards of the energy to be controlled, and the method or means to control the energy.

(2) The machine or equipment shall be turned off or shut down using the procedures established for the machine or equipment. An orderly shutdown shall be used to avoid any additional or increased hazards to employees as a result of the equipment stoppage.

(3) All energy isolating devices that are needed to control the energy to the machine or equipment shall be physically located and operated in such a manner as to isolate the machine or equipment from energy sources.

(4) Lockout or tagout devices shall be affixed to each energy isolating device by authorized employees.

(a) Lockout devices shall be attached in a manner that will hold the energy isolating devices in a "safe" or "off" position.

(b) Tagout devices shall be affixed in such a manner as will clearly indicate that the operation or movement of energy isolating devices from the "safe" or "off" position is prohibited.

(5) Where tagout devices are used with energy isolating devices designed with the capability of being locked out, the tag attachment shall be fastened at the same point at which the lock would have been attached.

(6) Where a tag cannot be affixed directly to the energy isolating device, the tag shall be located as close as safely possible to the device, in a position that will be immediately obvious to anyone attempting to operate the device.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17530, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17535 Releasing stored energy. Following the application of lockout or tagout devices to energy isolating devices, all potentially hazardous stored or residual energy shall be relieved, disconnected, restrained, or otherwise rendered safe.

(1) If there is a possibility of reaccumulation of stored energy to a hazardous level, verification of isolation shall be continued until the servicing or maintenance is completed or until the possibility of such accumulation no longer exists.

(2) Before starting work on machines or equipment that have been locked out or tagged out, the authorized employee shall verify that isolation and de-energizing of the machine or equipment have been accomplished. If normally energized parts will be exposed to contact by an employee while the machine or equipment is de-energized, a test shall be performed to ensure that these parts are de-energized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17535, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17540 Release from lockout/tagout. Before lockout or tagout devices are removed and energy is

restored to the machine or equipment, procedures shall be followed and actions taken by the authorized employees to ensure the following:

(1) The work area shall be inspected to ensure that non-essential items have been removed and that machine or equipment components are operationally intact.

(2) The work area shall be checked to ensure that all employees have been safely positioned or removed.

(3) After lockout or tagout devices have been removed and before a machine or equipment is started, affected employees shall be notified that the lockout or tagout devices have been removed.

(4) Each lockout or tagout device shall be removed from each energy isolating device by the authorized employee who applied the lockout or tagout device. However, if that employee is not available to remove it, the device may be removed under the direction of the employer, provided that specific procedures and training for such removal have been developed, documented, and incorporated into the employer's energy control program. The employer shall demonstrate that the specific procedure provides a degree of safety equivalent to that provided by the removal of the device by the authorized employee who applied it. The specific procedure shall include at least the following elements:

(a) Verification by the employer that the authorized employee who applied the device is not at the facility;

(b) Making all reasonable efforts to contact the authorized employee to inform him or her that his or her lockout or tagout device has been removed; and

(c) Ensuring that the authorized employee has this knowledge before he or she resumes work at that facility.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17540, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17545 Temporary removal of lockout/tagout. If the lockout or tagout devices must be temporarily removed from energy isolating devices and the machine or equipment must be energized to test or position the machine, equipment, or component thereof, the following sequence of actions shall be followed:

(1) Clear the machine or equipment of tools and materials in accordance with this section;

(2) Remove employees from the machine or equipment area in accordance with this section;

(3) Remove the lockout or tagout devices as specified in this section;

(4) Energize and proceed with the testing or positioning; and

(5) De-energize all systems and reapply energy control measures in accordance with this section to continue the servicing or maintenance.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17545, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17550 Servicing contractors. When servicing or maintenance is performed by a crew, craft, department, or other group, they shall use a procedure which affords the employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device. Group lockout or tagout devices shall be used

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in accordance with the procedures required by the following specific requirements:

(1) Primary responsibility shall be vested in an authorized employee for a set number of employees working under the protection of a group lockout or tagout device (such as an operations lock);

(2) Provision shall be made for the authorized employee to ascertain the exposure status of all individual group members with regard to the lockout or tagout of the machine or equipment;

(3) When more than one crew, craft, department, or other group is involved, assignment of overall job-associated lockout or tagout control responsibility shall be given to an authorized employee designated to coordinate affected work forces and ensure continuity of protection; and

(4) Each authorized employee shall affix a personal lockout or tagout device to the group lockout device, group lockbox, or comparable mechanism when he or she begins work and shall remove those devices when he or she stops working on the machine or equipment being serviced or maintained.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17550, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17555 Shift changes. Procedures shall be used during shift or personnel changes to ensure the continuity of lockout or tagout protection, including provision for the orderly transfer of lockout or tagout device protection between off-going and on-coming employees, to minimize their exposure to hazards from the unexpected energizing or start-up of the machine or equipment or from the release of stored energy.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17555, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17560 Outside servicing personnel. Whenever outside servicing personnel are to be engaged in activities covered by this section, the on-site employer and the outside employer shall inform each other of their respective lockout or tagout procedures, and each employer shall ensure that his or her personnel understand and comply with restrictions and prohibitions of the energy control procedures being used.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-17560, filed 3/6/98, effective 5/6/98.]

WAC 296-45-17565 Central system operator. If energy isolating devices are installed in a central location under the exclusive control of a system operator, the following requirements apply:

(1) The employer shall use a procedure that affords employees a level of protection equivalent to that provided by the implementation of a personal lockout or tagout device.

(2) The system operator shall place and remove lockout and tagout devices in place of the authorized employee.

(3) Provisions shall be made to identify the authorized employee who is responsible for (that is, being protected by) the lockout or tagout device, to transfer responsibility for lockout and tagout devices, and to ensure that an authorized employee requesting removal or transfer of a lockout or

tagout device is the one responsible for it before the device is removed or transferred.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-17565, filed 3/6/98, effective 5/6/98.]

WAC 296-45-195 Trenching and excavation. (1) During excavation or trenching, in order to prevent exposure of employees to the hazards created by damage to dangerous underground facilities, efforts shall be made to determine the location of such facilities and work conducted in a manner designed to avoid damage.

(2) Trenching and excavation operations shall comply with the provisions of Part N, chapter 296-155 WAC.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-195, filed 3/6/98, effective 5/6/98.]

WAC 296-45-205 Enclosed spaces. This section covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if a determination is made that the ventilation system is operating to protect employees before they enter the space. This paragraph applies to routine entry into enclosed spaces in lieu of the permit-space entry requirements contained in WAC 296-62-145. If, after the precautions given in WAC 296-45-205, 296-45-215, and 296-45-225 are taken, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with escape from the space, then entry into the enclosed space shall meet the permit-space entry requirements of WAC 296-62-145.

Note: Entries into enclosed spaces conducted in accordance with the permit-space entry requirements of WAC 296-62-145 are considered as complying with this section.

(1) "Safe work practices." The employer shall ensure the use of safe work practices for entry into and work in enclosed spaces and for rescue of employees from such spaces.

(2) "Training." Employees who enter enclosed spaces or who serve as attendants shall be trained in the hazards of enclosed space entry, in enclosed space entry procedures, and in enclosed space rescue procedures.

(3) "Rescue equipment." Employers shall provide equipment to ensure the prompt and safe rescue of employees from the enclosed space.

(4) "Evaluation of potential hazards." Before any entrance cover to an enclosed space is removed, the employer shall determine whether it is safe to do so by checking for the presence of any atmospheric pressure or temperature differences and by evaluating whether there might be a hazardous atmosphere in the space. Any conditions making it unsafe to remove the cover shall be eliminated before the cover is removed.

Note: The evaluation called for in this subsection may take the form of a check of the conditions expected to be in the enclosed space. For example, the cover could be checked to see if it is hot and, if it is fastened in place, could be loosened gradually to release any residual pressure. A determination must also be made of whether conditions at the site could cause a hazardous atmosphere, such as an oxygen deficient or flammable atmosphere, to develop within the space.

(5) "Removal of covers." When covers are removed from enclosed spaces, the opening shall be promptly guarded by a railing, temporary cover, or other barrier intended to prevent

an accidental fall through the opening and to protect employees working in the space from objects entering the space.

(6) "Hazardous atmosphere." Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the generic permit-required confined spaces standard in WAC 296-62-145 through 296-62-14543.

Note: The term "entry" is defined in WAC 296-62-14501.

(7) "Attendants." While work is being performed in the enclosed space, a person with first-aid training meeting WAC 296-45-125 shall be immediately available outside the enclosed space to render emergency assistance if there is reason to believe that a hazard may exist in the space or if a hazard exists because of traffic patterns in the area of the opening used for entry. That person is not precluded from performing other duties outside the enclosed space if these duties do not distract the attendant from monitoring employees within the space.

Note: See WAC 296-45-215(12) for additional requirements on attendants for work in manholes.

(8) "Calibration of test instruments." Test instruments used to monitor atmospheres in enclosed spaces shall be kept in calibration, with a minimum accuracy of + or - 10 percent.

(9) "Testing for oxygen deficiency." Before an employee enters an enclosed space, the internal atmosphere shall be tested for oxygen deficiency with a direct-reading meter or similar instrument, capable of collection and immediate analysis of data samples without the need for off-site evaluation. If continuous forced air ventilation is provided, testing is not required provided that the procedures used ensure that employees are not exposed to the hazards posed by oxygen deficiency.

(10) "Testing for flammable gases and vapors." Before an employee enters an enclosed space, the internal atmosphere shall be tested for flammable gases and vapors with a direct-reading meter or similar instrument capable of collection and immediate analysis of data samples without the need for off-site evaluation. This test shall be performed after the oxygen testing and ventilation required by subsection (9) of this section demonstrate that there is sufficient oxygen to ensure the accuracy of the test for flammability.

(11) "Ventilation and monitoring." If flammable gases or vapors are detected or if an oxygen deficiency is found, forced air ventilation shall be used to maintain oxygen at a safe level and to prevent a hazardous concentration of flammable gases and vapors from accumulating. A continuous monitoring program to ensure that no increase in flammable gas or vapor concentration occurs may be followed in lieu of ventilation, if flammable gases or vapors are detected at safe levels.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substance is considered to be hazardous.

(12) "Specific ventilation requirements." If continuous forced air ventilation is used, it shall begin before entry is made and shall be maintained long enough to ensure that a safe atmosphere exists before employees are allowed to enter the work area. The forced air ventilation shall be so directed as to ventilate the immediate area where employees are

present within the enclosed space and shall continue until all employees leave the enclosed space.

(13) "Air supply." The air supply for the continuous forced air ventilation shall be from a clean source and may not increase the hazards in the enclosed space.

(14) "Open flames." If open flames are used in enclosed spaces, a test for flammable gases and vapors shall be made immediately before the open flame device is used and at least once per hour while the device is used in the space. Testing shall be conducted more frequently if conditions present in the enclosed space indicate that once per hour is insufficient to detect hazardous accumulations of flammable gases or vapors.

Note: See the definition of hazardous atmosphere for guidance in determining whether or not a given concentration of a substance is considered to be hazardous.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-205, filed 3/6/98, effective 5/6/98.]

WAC 296-45-215 Underground electrical installations. This section provides additional requirements for work on underground electrical installations.

(1) Protective barriers, or approved guards and warning signs must be erected before removing manhole covers or making excavations in places accessible to vehicular or pedestrian traffic.

(2) Whenever an opening is made in the street, it shall be properly guarded or covered until same is closed and whenever an obstruction is left in the roadway after dark, it shall be marked with approved lights, flares or similar devices.

(3) Access. A ladder or other climbing device shall be used to enter and exit a manhole or subsurface vault exceeding 4 feet (122 cm) in depth. No employee may climb into or out of a manhole or vault by stepping on cables or hangers.

(4) When work is to be performed in a manhole or unvented vault:

(a) No entry shall be permitted unless forced ventilation is provided or the atmosphere is found to be safe by testing for oxygen deficiency and the presence of explosive or potentially hazardous gases or fumes.

(b) When unsafe conditions are detected, by testing or other means, the work area shall be ventilated and otherwise made safe before entry.

(c) Provisions shall be made for a continuous supply of air as provided for in Part L, chapter 296-62 WAC.

(d) When forced ventilation is not used a method of monitoring said manhole or vault so as to prevent the occurrence of oxygen deficiency due to work being performed in said manhole or vault, and to detect the presence of any explosive gases or fumes which may occur while the employees are working in said manhole or vault.

(5) When open flames are used or smoking is permitted in manholes, adequate mechanical forced air ventilation shall be used.

(6) Before using open flames in a manhole or excavation in an area where combustible gases or liquids may be present, such as near a gasoline service station, the atmosphere of the manhole or excavation shall be tested and found safe or cleared of the combustible gases or liquids prior to the entry.

(7) When work is to be performed in manholes containing any wires or appliances carrying electrical current, they shall be in a sanitary condition.

(8) Care shall be taken to prevent the possibility of vehicles or pedestrians coming in contact with the wires and equipment.

(9) Lowering equipment into manholes. Equipment used to lower materials and tools into manholes or vaults shall be capable of supporting the weight to be lowered and shall be checked for defects before use. Before tools or materials are lowered into the opening for a manhole or vault, each employee working in the manhole or vault shall be clear of the area directly under the opening.

(10) Materials shall not be thrown into or out of manholes but shall be placed in the proper receptacle and hoisted in and out by means of a rope.

(11) Tools and materials shall not be left on the ground around or near the manhole opening where they might be pushed or otherwise fall into the hole.

(12) Attendants for manholes.

(a) An attendant shall be kept at the surface when there is any hazard to the employees in the manhole and the attendant should not leave the manhole unwatched until such time as all employees are out and the cover has been replaced.

(b) While work is being performed in a manhole containing energized electric equipment, an employee with first aid and CPR training meeting WAC 296-45-125(1) shall be available on the surface in the immediate vicinity to render emergency assistance.

Note 1: An attendant may also be required under WAC 296-45-205(7). One person may serve to fulfill both requirements. However, attendants required under WAC 296-45-205(7) are not permitted to enter the manhole.

Note 2: Employees entering manholes containing unguarded, unisolated energized lines or parts of electric equipment operating at 50 volts or more are required to be qualified under WAC 296-45-325(1) through (4).

(c) No work shall be permitted to be done in any manhole or subway on any energized wire, cable or appliance carrying more than 300 volts of electricity by less than two qualified persons who shall at all times, while performing such work, be in the same manhole or subway in which work is being done. This rule shall not apply to work on telephone, telegraph or signal wires or cables.

(d) For the purpose of inspection, housekeeping, taking readings, or similar work, an employee working alone may enter, for brief periods of time, a manhole where energized cables or equipment are in service, if the employer can demonstrate that the employee will be protected from all electrical hazards.

(e) Reliable communications, through two-way radios or other equivalent means, shall be maintained among all employees involved in the job.

(13) Cable in manholes or underground vaults shall be accessible to employees and a clear working space shall be maintained at all times; and/or approved protective guards, barriers, etc., when installed shall be considered as providing adequate working clearance for cables over 5 k.v. If a manhole and/or underground vault is determined to have an electrical or structural hazard, no work shall be done in the man-

hole and/or vault until the unsafe condition is corrected or de-energized.

(14) No work shall be performed on cables or equipment unless they have been properly identified by an approved method.

(15) Duct rods. If duct rods are used, they shall be installed in the direction presenting the least hazard to employees. An employee shall be stationed at the far end of the duct line being rodded to ensure that the required minimum approach distances are maintained.

(16) Multiple cables. When multiple cables are present in a work area, the cable to be worked shall be identified by electrical means, unless its identity is obvious by reason of distinctive appearance or location or by other readily apparent means of identification. Cables other than the one being worked shall be protected from damage.

(17) Before cutting into a high voltage cable or opening a high voltage splice, the cable shall be de-energized then clearance obtained, tested and then grounded in an approved manner. The cable to be worked on shall be identified by tags or equivalent means.

(18) Moving cables. Energized cables that are to be moved shall be inspected for defects.

(19) Insulated platforms or other protective devices shall be provided when work is to be done on energized wires or equipment in manholes.

(20) Furnaces shall always be placed in a secure, level position on the downhill side of the manhole to avoid spillage of hot metals or compounds into the manhole.

(21) Pulling underground cable. When pulling cable(s) all employees shall be made aware of the hazard of being caught in the sheaves, lashings or winch gears. All employees shall stand clear of the pulling line when the pull is begun or when the line is under tension. This rule applies to all work performed by means of a winch.

(22) Fishing conduit or ducts. When fishing conduit or ducts, it shall first be determined that the fish tape or wires will not contact any energized line or equipment.

(23) WAC 296-45-65023 on clearances and WAC 296-45-65026 on grounding shall be complied with.

(24) Defective cables. Where a cable in a manhole has one or more abnormalities that could lead to or be an indication of an impending fault, the defective cable shall be de-energized before any employee may work in the manhole, except when service load conditions and a lack of feasible alternatives require that the cable remain energized. In that case, employees may enter the manhole provided they are protected from the possible effects of a failure by shields or other devices that are capable of containing the adverse effects of a fault in the joint.

Note: Abnormalities such as oil or compound leaking from cables or joints, broken cable sheaths or joint sleeves, hot localized surface temperatures of cables or joints, or joints that are swollen beyond normal tolerance are presumed to lead to or be an indication of an impending fault.

(25) Sheath continuity. When work is performed on buried cable or on cable in manholes, metallic sheath continuity shall be maintained by bonding across the opening (or by equivalent means), or the cable sheath shall be treated as energized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-215, filed 3/6/98, effective 5/6/98.]

WAC 296-45-225 Underground residential distribution (URD). (1) General.

(a) Each employee shall be knowledgeable of the equipment provided for their use and shall at all times use this equipment only for the purpose intended.

(b) U.R.D. cables which are properly insulated for the voltages to which they are energized shall be considered as an effective barrier to protect the employees and table one need not apply.

(i) Workers will take adequate precautions to avoid physical contact with energized U.R.D. cable by using approved procedures and/or protective devices.

(ii) When handling energized U.R.D. primary cables, the work shall be done with approved tools and/or procedures by two qualified employees. Switching is exempt from this rule.

(iii) When energized terminators or load-break elbows are handled by a hot stick, there shall be two qualified employees at the scene.

(c) When energized pad-mounted transformers or similar equipment are to be left unlocked and open, they shall be attended by a qualified employee.

(d) Approved tools and procedures shall be used to remove any debris, vines, weeds, etc., from an underground system.

(e) A primary and secondary system neutral on any energized circuit shall not be opened under any circumstances except for testing.

(f) Primary and secondary neutrals shall be firmly connected and grounded before the circuit or equipment is energized.

(g) Where different phases are in the same vault, enclosures, or parked in some manner that they could be looped, these phases shall be marked or identified.

(h) Bayonet fuses:

(i) Bayonet fuses shall not be closed into suspected faults or overloads.

(ii) Submersible U.G. transformer installations will require other methods of energizing or de-energizing and bayonet fuses shall not be used for this purpose.

(iii) Bayonet fuses shall only be operated after pad-mount transformers have been properly vented.

(iv) Bayonet fuses shall only be operated in accordance with manufacturing design and rating capabilities.

(2) Working on cables.

(a) Before any work is to be performed on underground cables and apparatus carrying high voltage, they shall be de-energized with the following exceptions:

(i) Replacing fuses, operating switches, closing or opening load-break elbows, when approved protective devices are used.

(ii) Work in the high-voltage compartment of pad-mounted transformers and similar equipment installed above ground, provided the work is done by approved methods.

(b) Only one energized conductor shall be worked on at any one time, and protective means shall be used to insulate or isolate it from all others.

(c) When work is to be performed in manholes containing any wires or appliances carrying electrical current, they shall be in a sanitary condition.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-225, filed 3/6/98, effective 5/6/98.]

WAC 296-45-255 Protective equipment. (1) Rubber protective equipment shall be in accordance and tested as follows:

Item	Standard
Rubber Insulating Gloves	(ASTM) D 120-87
Rubber Matting for Use Around Electrical Apparatus	(ASTM) D 178-88
Rubber Insulating Blankets	(ASTM) D 1046-88a
Rubber Insulating Hoods	(ASTM) D 1049-88
Rubber Insulating Line Hose	(ASTM) D 1050-90
Rubber Insulating Sleeves	(ASTM) D 1051-87

(2) No protective equipment or material other than rubber shall be used: *Provided*, That such other nonconductive equipment may be used if it provides equal or better (dielectric) electrical and mechanical protection than rubber protective equipment: *Provided*, That the employer obtain before placing in service, manufacturer's data or other data to demonstrate that such nonrubber protective equipment provided equal or better electrical and mechanical protection than approved rubber equipment.

(3) Protective equipment shall not be used at voltages in excess of that for which the manufacturer has supplied data to the employer demonstrating that it is fit for such voltages.

(4) No protective equipment shall be modified, altered, or used for purposes other than those for which it is designed unless and until the manufacturer has, in writing, agreed or suggested that there be such modification, alteration, or use.

(5) Each rubber glove before it is used shall be inspected for defects and an approved air test performed. If, upon inspection, rubber gloves are either defective or appear to be defective, they shall not be used.

(6) Before being placed in service, all rubber protective equipment shall be numbered and records kept for test purposes and assignment.

(7) Rubber protective equipment shall not be used unless it has been dielectrically tested within six months and bears marking or identification of the date of the test or the expiration date.

(8) Protector gloves must be worn over insulating gloves.

Exception: Protector gloves need not be used with Class 0 gloves, under limited-use conditions, where small equipment and parts manipulation necessitate unusually high finger dexterity.

Note: Extra care is needed in the visual examination of the glove and in the avoidance of handling sharp objects.

(9) Rubber gloves when not in use shall be carried in an approved bag provided and designed for that purpose. It shall be provided by the employer and made available to the employees.

(10) Approved rubber gloves and carrying bag shall be assigned to each employee who works with, or is exposed to energized parts.

(11) Rubber protective equipment shall not be vulcanized or patched.

(12) A compartment or box shall be provided on each electric line truck, which box or compartment shall be used for storing rubber protective equipment. No equipment shall be stored in said compartment or box which can or could cause damage to the rubber equipment or goods placed in the compartment or box. Additionally, a separate container or compartment shall be provided for rubber blankets.

(13) Line hose shall not be doubled on themselves at any time. All blankets before storage must be wiped clean and rolled, not folded, before being placed in the container or box.

(14) Protective line equipment of material other than rubber shall be kept clean and visually inspected before each use.

(15) If protective line equipment of material other than rubber is found to be substantially defective or unsuitable for the purpose for which it is designed and intended, said protective line equipment shall not be used for personal protection of employees as may be required in Table 1 of this chapter. Said protective line equipment shall be marked defective but may be otherwise used unless the defect or damage to said protective line equipment creates additional safety hazards.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-255, filed 3/6/98, effective 5/6/98.]

WAC 296-45-25505 Personal protective equipment.

(1) General. Personal protective equipment shall meet the requirements of chapter 296-24 WAC, Part A-2.

(2) All protective hats shall be in accordance with the specifications of ANSI Z89.2-1971 Edition Industrial Protective Helmets for Electrical Workers, Class B, and shall be worn at the jobsite by employees who are exposed to overhead or electrical hazards.

(3) Wearing apparel. Goggles, hearing protection, respirators, rubber gloves, and other such personal protective devices shall not be interchanged among employees unless they have been sanitized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-25505, filed 3/6/98, effective 5/6/98.]

WAC 296-45-25510 Fall protection. (1) Personal fall arrest equipment shall meet the requirements of WAC 296-155-245.

(2) Body belts and safety straps for work positioning shall meet the requirements of WAC 296-155-245.

(3) Body belts, safety straps, lanyards, lifelines, and body harnesses shall be inspected before use each day to determine that the equipment is in safe working condition. Defective equipment may not be used.

(4) Employees shall not wear climbers while doing work where they are not required. Employees shall not continue to wear their climbers while working on the ground; except for momentary or short periods of time on the ground.

(5) Employees, when working from a hook ladder, must either belt themselves securely to the ladder, attach themselves to the structures by means of a safety line, or belt themselves to ladder safety equipment, which shall consist of

a safety rope or belting threaded through the rungs or secured to the ladder at intervals of not more than three feet.

(6) Before an employee throws his/her weight on a belt, the employee shall determine that the snap or fasteners are properly engaged.

(7) Safety straps shall not be placed around poles above the cross-arm except where it is not possible for the strap to slide or be slipped over the top of the pole by inadvertence of the employee. Neither end of the strap shall be allowed to hang loose or dangle while the employee is ascending or descending poles or other structures.

(8) Body belts and safety straps shall not be stored with sharp-edged tools or near sharp objects. When a body belt, safety strap and climbers are kept in the same container, they shall be stored in such a manner as to avoid cutting or puncturing the material of the body belt or safety strap with the gaffs or climbers.

(9) Employees shall not attach metal hooks or other metal devices to body belts. Leather straps or rawhide thongs shall have hardwood or fibre crossbars. Leather straps and rawhide thongs shall not have metal or other conductive crossbars on them.

(10) Climbing gaffs shall be kept properly sharpened and shall be at least 1-1/8 inches in length.

(11) Lifelines shall be protected against being cut or abraded.

(12) Fall arrest equipment, work positioning equipment, or travel restricting equipment shall be used by employees working at elevated locations more than 4 feet (1.2 m) above the ground on poles, towers, or similar structures if other fall protection has not been provided. Fall protection equipment is not required to be used by a qualified employee climbing or changing location on poles, towers, or similar structures, unless conditions, such as, but not limited to, ice, high winds, the design of the structure (for example, no provision for holding on with hands), or the presence of contaminants on the structure, could cause the employee to lose his or her grip or footing.

Note 1: This subsection applies to structures that support overhead electric power generation, transmission, and distribution lines and equipment. It does not apply to portions of buildings, such as loading docks, to electric equipment, such as transformers and capacitors, nor to aerial lifts. Requirements for fall protection associated with walking and working surfaces are contained in WAC 296-155-245; requirements for fall protection associated with aerial lifts are contained in chapter 296-155 WAC, Part J-1.

Note 2: Employees undergoing training are not considered "qualified employees" for the purposes of this provision. Unqualified employees (including trainees) are required to use fall protection any time they are more than 4 feet (1.2 m) above the ground.

(13) The following requirements apply to personal fall arrest systems:

(a) When stopping or arresting a fall, personal fall arrest systems shall limit the maximum arresting force on an employee to 1800 pounds (8 kN) if used with a body harness.

(b) Personal fall arrest systems shall be rigged such that an employee can neither free fall more than 6 feet (1.8 m) nor contact any lower level.

(14) If vertical lifelines or droplines are used, not more than one employee may be attached to any one lifeline.

(15) Snaphooks may not be connected to loops made in webbing-type lanyards.

(16) Snaphooks may not be connected to each other.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-25510, filed 3/6/98, effective 5/6/98.]

WAC 296-45-275 Ladders, platforms, and manhole steps. (1) General. Requirements for ladders contained in chapter 296-24 WAC, Part J-1, apply, except as specifically noted in subsection (2) of this section.

(2) Special ladders and platforms. Portable ladders and platforms used on structures or conductors in conjunction with overhead line work need not meet chapter 296-24 WAC, Part J-1 or chapter 296-155 WAC, Part J. However, these ladders and platforms shall meet the following requirements:

(a) Ladders and platforms shall be secured to prevent their becoming accidentally dislodged.

(b) Ladders and platforms may not be loaded in excess of the working loads for which they are designed.

(c) Ladders and platforms may be used only in applications for which they were designed.

(d) In the configurations in which they are used, ladders and platforms shall be capable of supporting without failure at least 2.5 times the maximum intended load.

(e) All ladders shall be handled and stored in such a manner as to prevent damage to the ladder.

(f) When ascending or descending a ladder, the employee shall face the ladder and have free use of both hands.

(g) All defective ladders shall be taken out of service and labeled as defective.

(h) When a ladder is being used which is not fixed or otherwise secured, there shall be an attendant to hold the ladder and watch traffic when the work is being done on streets, alleys, sidewalks, or in industrial plants or other places where there exists the possibility of accidental contact with the ladder by third persons or vehicles.

(i) When working on the ladder, employees shall, where possible, tie the top of the ladder to a substantial object to prevent falling unless the ladder is equipped with approved hooks which may be used for the same purpose.

(j) Portable ladders shall not be moved with employees on the ladder.

(k) No employee shall ascend or descend a rolling ladder while it is moving.

(l) No employee shall stand on the top two steps of a step ladder.

(m) No employee shall use a step ladder as a straight ladder.

(n) Ladders shall always be placed on a secure footing with both legs resting firmly on the lower surface.

(o) Ladders made by fastening cleats or similar devices across a single rail shall not be used.

(3) Conductive ladders. Portable metal ladders and other portable conductive ladders may not be used near exposed energized lines or equipment. However, in specialized high-voltage work, conductive ladders shall be used where the employer can demonstrate that nonconductive ladders would present a greater hazard than conductive ladders.

Note: A greater electrical hazard would be static electricity such as might be found in extra high voltage substations.

(4) All conductive or metal ladders shall be prominently marked and identified as being conductive and shall be grounded when used near energized lines or equipment.

Note: See chapter 296-24 WAC for additional ladder requirements.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-275, filed 3/6/98, effective 5/6/98.]

WAC 296-45-285 Hand, and portable powered tools.

(1) General requirements.

(a) The employer shall assure that each hand and portable powered tool, including any tool provided by an employee, is maintained in serviceable condition.

(b) The employer shall assure that each tool, including any tool provided by an employee, is inspected before initial use during each workshift. At a minimum, the inspection shall include the following:

(i) Handles and guards, to assure that they are sound, tight-fitting, properly shaped, free of splinters and sharp edges, and in place;

(ii) Controls, to assure proper function;

(iii) Heads of shock, impact-driven and driving tools, to assure that there is no mushrooming;

(iv) Cutting edges, to assure that they are sharp and properly shaped; and

(v) All other safety devices, to assure that they are in place and function properly.

(c) The employer shall assure that each tool is used only for purposes for which it has been designed.

(d) When the head of any shock, impact-driven or driving tool begins to chip, it shall be repaired or removed from service.

(e) The cutting edge of each tool shall be sharpened in accordance with manufacturer's specifications whenever it becomes dull during the workshift.

(f) Each tool shall be stored in the provided location when not being used at a work site.

(g) Racks, boxes, holsters or other means shall be provided, arranged and used for the transportation of tools so that a hazard is not created for any vehicle operator or passenger.

(2) Electric equipment connected by cord and plug must meet the following requirements:

(a) Cord- and plug-connected equipment supplied by premises wiring is covered by chapter 296-24 WAC, Part L.

(b) Any cord- and plug-connected equipment supplied by other than premises wiring shall comply with one of the following instead of chapter 296-24 WAC, Part L:

(i) It shall be equipped with a cord containing an equipment grounding conductor connected to the tool frame and to a means for grounding the other end (however, this option may not be used where the introduction of the ground into the work environment increases the hazard to an employee); or

(ii) It shall be of the double-insulated type conforming to 296-24 WAC, Part L; or

(iii) It shall be connected to the power supply through an isolating transformer with an ungrounded secondary.

(3) Portable and vehicle-mounted generators. Portable and vehicle-mounted generators used to supply cord- and plug-connected equipment shall meet the following requirements:

(a) The generator may only supply equipment located on the generator or the vehicle and cord- and plug-connected equipment through receptacles mounted on the generator or the vehicle.

(b) The non-current-carrying metal parts of equipment and the equipment grounding conductor terminals of the receptacles shall be bonded to the generator frame.

(c) In the case of vehicle-mounted generators, the frame of the generator shall be bonded to the vehicle frame.

(d) Any neutral conductor shall be bonded to the generator frame.

(4) Hydraulic and pneumatic tools must meet the following requirements:

(a) Safe operating pressures for hydraulic and pneumatic tools, hoses, valves, pipes, filters, and fittings may not be exceeded.

Note: If any hazardous defects are present, no operating pressure would be safe, and the hydraulic or pneumatic equipment involved may not be used. In the absence of defects, the maximum rated operating pressure is the maximum safe pressure.

(b) A hydraulic or pneumatic tool used where it may contact exposed live parts shall (use nonconductive hoses and) be designed and maintained for such use.

(c) The hydraulic system supplying a hydraulic tool used where it may contact exposed live parts shall provide protection against loss of insulating value for the voltage involved due to the formation of a partial vacuum in the hydraulic line.

Note: Hydraulic lines without check valves having a separation of more than 35 feet (10.7 m) between the oil reservoir and the upper end of the hydraulic system promote the formation of a partial vacuum.

(d) A pneumatic tool used on energized electric lines or equipment or used where it may contact exposed live parts shall provide protection against the accumulation of moisture in the air supply.

(e) Pressure shall be released before connections are broken, unless quick acting, self-closing connectors are used. Hoses may not be kinked.

(f) Employees may not use any part of their bodies to locate or attempt to stop a hydraulic leak.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-285, filed 3/6/98, effective 5/6/98.]

WAC 296-45-295 Gasoline engine power chain saws.

(1) Each chain saw placed into initial service after February 9, 1995, shall be equipped with a chain brake and shall otherwise meet the requirements of the ANSI B175.1-1991 "Safety Requirements for Gasoline-Powered Chain Saws." Each chain saw placed into service before February 9, 1995, shall be equipped with a protective device that minimizes chain saw kickback, i.e., reduced kickback bar, chains, bar tip guard or chain brake. No chain-saw kickback device shall be removed or otherwise disabled.

(2) Gasoline-engine power saw operations shall meet the requirements of WAC 296-54-515(10).

(3) The chain saw shall be operated and adjusted in accordance with the manufacturer's instructions.

(4) The employer must ensure that each chain saw, including any chain saw provided by an employee, is inspected before initial use during each workshift. At a minimum, the inspection shall include the following:

(a) Chain-saw chains, to assure proper adjustment;

(b) Chain-saw mufflers, to assure that they are operational and in place;

(c) Chain brakes and nose shielding devices, to assure that they are in place and function properly;

(5) The chain saw shall be fueled at least 10 feet (3 m) from any open flame or other source of ignition.

(6) The chain saw shall be started at least 10 feet (3 m) from the fueling area.

(7) The chain saw shall be started on the ground or where otherwise firmly supported. Drop-starting a chain saw is prohibited.

(8) The chain saw shall be started with the chain brake engaged.

(9) The chain saw shall be held with the thumbs and fingers of both hands encircling the handles during operation unless the employer demonstrates that a greater hazard is posed by keeping both hands on the chain saw in that particular situation.

(10) The chain-saw operator shall be certain of footing before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, to have insecure footing, or to relinquish a firm grip on the saw.

(11) Prior to felling any tree, the chain saw operator shall clear away brush or other potential obstacles which might interfere with cutting the tree or using the retreat path.

(12) The chain saw shall not be used to cut directly overhead.

(13) The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and muffler.

(14) The chain saw shall be shut off or at idle before the feller starts their retreat.

(15) The chain saw shall be shut down or the chain brake shall be engaged whenever a saw is carried further than 50 feet (15.2 m). The chain saw shall be shut down or the chain brake shall be engaged when a saw is carried less than 50 feet if conditions such as, but not limited to, the terrain, underbrush and slippery surfaces, may create a hazard for an employee.

(16) Each power saw weighing more than 15 pounds (6.8 kilograms, service weight) that is used in trees shall be supported by a separate line, except when work is performed from an aerial lift and except during topping or removing operations where no supporting limb will be available, and the following:

(a) Each power saw shall be equipped with a control that will return the saw to idling speed when released;

(b) Each power saw shall be equipped with a clutch and shall be so adjusted that the clutch will not engage the chain drive at idling speed;

(c) Drop starting of saws over 15 pounds (6.8 kg) is permitted outside of the bucket of an aerial lift only if the area below the lift is clear of personnel;

(d) A power saw engine may be started and operated only when all employees other than the operator are clear of the saw;

(e) A power saw may not be running when the saw is being carried up into a tree by an employee; and

(f) Power saw engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-295, filed 3/6/98, effective 5/6/98.]

WAC 296-45-305 Live-line tools. (1) Design of tools. Live-line tool rods, tubes, and poles shall be designed and constructed to withstand the following minimum tests:

(a) 100,000 volts per foot (3281 volts per centimeter) of length for 5 minutes if the tool is made of fiberglass-reinforced plastic (FRP); or

(b) 75,000 volts per foot (2461 volts per centimeter) of length for 3 minutes if the tool is made of wood; or

(c) Other tests that the employer can demonstrate are equivalent.

Note: Live-line tools using rod and tube that meet ASTM F711-89, Standard Specification for Fiberglass-Reinforced Plastic (FRP) Rod and Tube Used in Live-Line Tools, conform to subsection (1)(a) of this section.

(2) Condition of tools.

(a) Each live-line tool shall be wiped clean and visually inspected for defects before use each day.

(b) If any defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is present after wiping, the tool shall be removed from service and examined and tested according to this section before being returned to service.

(c) Live-line tools used for primary employee protection shall be removed from service every two years and whenever required under this subsection for examination, cleaning, repair, and testing as follows:

(i) Each tool shall be thoroughly examined for defects.

(ii) If a defect or contamination that could adversely affect the insulating qualities or mechanical integrity of the live-line tool is found, the tool shall be repaired and refinished or shall be permanently removed from service. If no such defect or contamination is found, the tool shall be cleaned and waxed.

(iii) The tool shall be tested in accordance with this section under the following conditions:

(A) After the tool has been repaired or refinished; and

(B) After the examination if repair or refinishing is not performed, unless the tool is made of FRP rod or foam-filled FRP tube and the employer can demonstrate that the tool has no defects that could cause it to fail in use.

(iv) The test method used shall be designed to verify the tool's integrity along its entire working length and, if the tool is made of fiberglass-reinforced plastic, its integrity under wet conditions.

(v) The voltage applied during the tests shall be as follows:

(A) 75,000 volts per foot (2461 volts per centimeter) of length for one minute if the tool is made of fiberglass; or

(B) 50,000 volts per foot (1640 volts per centimeter) of length for one minute if the tool is made of wood; or

(C) Other tests that the employer can demonstrate are equivalent.

Note: Guidelines for the examination, cleaning, repairing, and in-service testing of live-line tools are contained in the Institute of Electrical and Electronics Engineers Guide for In-Service Maintenance and Electrical Testing of Live-Line Tools, IEEE Std. 978-1984.

(d) Live-line tools and rope shall be stored and maintained and used in such a manner as to prevent damage. Live-line tools and ropes shall not be used for purposes other than line work.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-305, filed 3/6/98, effective 5/6/98.]

WAC 296-45-315 Materials handling and storage. (1)

General. Material handling and storage shall conform to the requirements of chapter 296-24 WAC, Part D.

(2) Materials storage near energized lines or equipment. In areas not restricted to qualified persons only, materials or equipment may not be stored closer to energized lines or exposed energized parts of equipment than the following distances plus an amount providing for the maximum sag and side swing of all conductors and providing for the height and movement of material handling equipment:

(a) For lines and equipment energized at 50 kV or less, the distance is 10 feet (305 cm).

(b) For lines and equipment energized at more than 50 kV, the distance is 10 feet (305 cm) plus 4 inches (10 cm) for every 10 kV over 50 kV.

(c) In areas restricted to qualified employees, material may not be stored within the working space about energized lines or equipment.

Note: Requirements for the size of the working space are contained in WAC 296-45-475(1) and 296-45-48515.

(3) Prior to unloading steel, poles, crossarms and similar materials, the load shall be thoroughly examined to determine if the load has shifted, binders or stakes have broken or the load is otherwise hazardous to employees. The hoist rope shall not be wrapped around the load. This provision shall not apply to electric construction crews when setting or removing poles.

(4) Pole handling.

(a) During pole hauling operations, all loads shall be secured to prevent displacement, and a red flag shall be displayed at the trailing end of the longest pole.

(b) While loading and unloading materials, roadways shall not be blocked unless approved traffic control is used.

(c) When hauling poles during darkness, illuminated warning devices shall be attached to the trailing end of the longest pole in accordance with the state of Washington motor vehicle code.

(5) Tag lines. When necessary to control loads, tag lines or other approved devices shall be used.

(6) Oil filled equipment. During construction or repair of oil filled equipment, the oil may be stored in temporary containers other than those required by WAC 296-155-270, such as pillow tanks.

(7) Storage of tools and materials. All tools and materials shall be stored in a safe and orderly manner in yards for equipment and other areas.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-315, filed 3/6/98, effective 5/6/98.]

WAC 296-45-325 Working on or near exposed energized parts. This section applies to work on exposed live parts, or near enough to them, to expose the employee to any hazard they present.

(1) General. Only qualified employees may work on or with exposed energized lines or parts of equipment. Only qualified employees may work in areas containing unguarded, uninsulated energized lines or parts of equipment operating at 50 volts or more. Electric lines and equipment shall be considered and treated as energized unless the provisions of WAC 296-45-175 through 296-45-17565 or 296-45-335 have been followed.

(2) Except as provided in subsection (3) of this section, at least two qualified employees shall be present while the following types of work are being performed:

(a) Installation, removal, or repair of lines that are energized at more than 600 volts;

(b) Installation, removal, or repair of de-energized lines if an employee is exposed to contact with other parts energized at more than 600 volts;

(c) Installation, removal, or repair of equipment, such as transformers, capacitors, and regulators, if an employee is exposed to contact with parts energized at more than 600 volts;

(d) Work involving the use of mechanical equipment, other than insulated aerial lifts, near parts energized at more than 600 volts; and

(e) Other work that exposes an employee to electrical hazards greater than or equal to those posed by operations that are specifically listed in subsection (2)(a) through (e) of this section.

Note 1: One employee shall serve principally as a standby person who shall be so located that they may physically reach the other employee in the event of an accident either with their hand or with a hot stick. The stand-by shall be so positioned as to be able to observe the other employee, their bodily movements, and verbally warn of any impending dangers. In no case when working in pairs shall employees work simultaneously on energized wires or parts of different phases or polarity;

Note 2: In cases of necessity the stand-by person may temporarily assist the other employee provided that they both work on wires or parts of the same phase or polarity. Both employees shall so position themselves so that the presence of the second person does not increase the hazard.

(3) The provisions of WAC 296-45-325(2) do not apply in the following circumstances:

(a) When re-fusing circuits or equipment with a hot stick.

(b) When operating switches by means of operating handle or switch sticks.

(c) When installing or removing a hot line clamp connection with an approved hot stick on single phase line or apparatus, providing that the connection or disconnection does not interrupt or pick up a load.

(d) When installing or removing by hotstick simple load metering devices provided the connection does not interrupt or pickup load.

(e) Emergency repairs to the extent necessary to safeguard the general public.

(4) "Minimum approach distances." The employer shall ensure that no employee approaches or takes any conductive object closer to exposed energized parts than set forth in Table 1 through Table 4, unless:

The employee is insulated from the energized part (insulating gloves or insulating gloves and sleeves worn in accordance with subsection (7) of this section are considered insulation of the employee only with regard to the energized part upon which work is being performed); or

The energized part is insulated from the employee and from any other conductive object at a different potential.

Note 1: WAC 296-45-475 (5)(a) and 296-45-48525(1) contain requirements for the guarding and isolation of live parts. Parts of electric circuits that meet these two provisions are not considered as "exposed" unless a guard is removed or an employee enters the space intended to provide isolation from the live parts.

Note 2: When an employee is required to work on or within reach of any unprotected conductors that are or may become energized at more than 50 volts and less than 600 volts between phases, they shall take the following precautions:

- 1: They shall wear approved rubber gloves during the time they are working on such conductor, or
- 2: They shall cover, with approved devices, any adjacent unprotected conductor that could be touched by any part of their body, and use insulated tools.
- 3: Cables which are properly insulated for the voltages to which they are energized, shall be considered as an effective barrier to protect the employees and Table 1 need not apply.

(5) Initial determination.

(a) Before any work is performed, the location of energized lines and their condition, the location and condition of energized equipment, the condition of the poles, the location of circuits and equipment including power communication lines, CATV and fire alarm circuits, shall be determined as shall any other particular hazard of a particular work site.

(b) No work shall be performed on energized lines or parts until the voltage of such equipment and lines is determined.

(6) Type of insulation. If the employee is to be insulated from energized parts by the use of insulating gloves (under subsection (4)(a) of this section), insulating sleeves shall also be used. However, insulating sleeves need not be used under the following conditions:

(a) If exposed energized parts on which work is not being performed are insulated from the employee; and

(b) If such insulation is placed from a position not exposing the employee's upper arm to contact with other energized parts.

(7) Working position. The employer shall ensure that each employee, to the extent that other safety-related conditions at the worksite permit, works in a position from which a slip or shock will not bring the employee's body into contact with exposed, uninsulated parts energized at a potential different from the employee.

(8) Making connections. The employer shall ensure that connections are made as follows:

(a) In connecting de-energized equipment or lines to an energized circuit by means of a conducting wire or device, an employee shall first attach the wire to the de-energized part;

(b) When disconnecting equipment or lines from an energized circuit by means of a conducting wire or device, an employee shall remove the source end first; and

(c) When lines or equipment are connected to or disconnected from energized circuits, loose conductors shall be kept away from exposed energized parts.

(9) Rubber gloves can only be used on 5,000 volts or less between phases.

(10) It shall not be permissible to consider one part of a high voltage switch or disconnect as de-energized for the purpose of doing work on it if the remainder of the switch or disconnect remains energized unless approved barriers are erected which will prevent employees who are doing the work on such equipment from coming in direct contact with the energized parts.

(11) Conductor support tools such as link sticks, strain carriers, and insulator cradles may be used: *Provided*, That the clear insulation is at least as long as the insulator string or the minimum distance specified in Table 1 for the operating voltage.

(12) Apparel.

(a) When work is performed within reaching distance of exposed energized parts of equipment, the employer shall ensure that each employee removes or renders nonconductive all exposed conductive articles, such as key or watch chains, rings, or wrist watches or bands, unless such articles do not increase the hazards associated with contact with the energized parts.

(b) The employer shall train each employee who is exposed to the hazards of flames or electric arcs in the hazards involved.

(c) The employer shall ensure that each employee who is exposed to the hazards of flames or electric arcs does not wear clothing that, when exposed to flames or electric arcs, could increase the extent of injury that would be sustained by the employee.

Note: Clothing made from the following types of fabrics, either alone or in blends, is prohibited by this subsection, unless the employer can demonstrate that the fabric has been treated to withstand the conditions that may be encountered or that the clothing is worn in such a manner as to eliminate the hazard involved: Acetate, nylon, polyester, rayon.

(d) Workers shall wear clothing appropriate to the season and the kind of work being performed. Shirts or jumpers must have full length sleeves that are rolled down. Protective hard hats and eye protection shall be worn when working on or near live parts or while climbing poles.

(13) Fuse handling. When fuses must be installed or removed with one or both terminals energized at more than 300 volts or with exposed parts energized at more than 50 volts, the employer shall ensure that tools or gloves rated for the voltage are used. When expulsion-type fuses are installed with one or both terminals energized at more than 300 volts, the employer shall ensure that each employee wears eye protection meeting the requirements of WAC 296-45-25505(1), uses a tool rated for the voltage, and is clear of the exhaust path of the fuse barrel.

(14) Covered (noninsulated) conductors. The requirements of this section which pertain to the hazards of exposed live parts also apply when work is performed in the proximity of covered (noninsulated) wires.

(15) Noncurrent-carrying metal parts. Noncurrent-carrying metal parts of equipment or devices, such as transformer cases and circuit breaker housings, shall be treated as ener-

gized at the highest voltage to which they are exposed, unless the employer inspects the installation and determines that these parts are grounded before work is performed.

(16) Opening circuits under load. Devices used to open circuits under load conditions shall be designed to interrupt the current involved.

Table 1: AC Live Work Minimum Approach Distance

Voltage in kilovolts phase to phase*	Phase to ground		Distance to employee	
	(m)	(ft-in)	(m)	(ft-in)
0 to 0.050	not specified		not specified	
0.051 to 0.300	avoid contact		avoid contact	
0.301 to 0.750	0.31	1-0	0.31	1-0
0.0751 to 15	0.65	2-2	0.67	2-3
15.1 to 36.0	0.77	2-7	0.86	2-10
36.1 to 46.0	0.84	2-9	0.96	3-2
46.1 to 72.5	1.00**	3-3**	1.20	3-11
72.6 to 121	0.95**	3-2**	1.29	4-3
138 to 145	1.09	3-7	1.50	4-11
161 to 169	1.22	4-0	1.71	5-8
230 to 242	1.59	5-3	2.27	7-6
345 to 362	2.59	8-6	3.80	12-6
500 to 550	3.42	11-3	5.50	18-1
765 to 800	4.53	14-11	7.91	26-0

* For single-phase systems, use the highest voltage available.

For single-phase lines off three phase systems, use the phase-to-phase voltage of the system.

** The 46.1 to 72.5 kV phase-to-ground 3-3 distance contains a 1-3 electrical component and a 2-0 inadvertent movement component while the 72.6 to 121 kV phase-to-ground 3-2 distance contains a 2-2 electrical component and a 1-0 inadvertent movement component.

- Note 1: These distances take into consideration the highest switching surge an employee will be exposed to on any system with air as the insulating medium and the maximum voltages shown.
- Note 2: The clear live-line tool distance shall equal or exceed the values for the indicated voltage ranges.
- Note 3: See Appendix B to this section for information on how the minimum approach distances listed in the tables were derived.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-325, filed 3/6/98, effective 5/6/98.]

WAC 296-45-335 De-energizing lines and equipment for employee protection. (1) Application. This section applies to the de-energizing of transmission and distribution lines and equipment for the purpose of protecting employees. Control of hazardous energy sources used in the generation of electric energy is covered in WAC 296-45-175. Conductors and parts of electric equipment that have been de-energized under procedures other than those required by WAC 296-45-175 or 296-45-335, as applicable, shall be treated as energized.

(2) "General."

(a) If a system operator is in charge of the lines or equipment and their means of disconnection, all of the requirements of subsection (3) of this section shall be observed, in the order given.

(b) If no system operator is in charge of the lines or equipment and their means of disconnection, one employee in the crew shall be designated as being in charge of the clearance. All of the requirements of subsection (3) of this section apply, in the order given, except as provided in subsection (2)(c) of this section. The employee in charge of the clearance shall take the place of the system operator, as necessary.

(c) If only one crew will be working on the lines or equipment and if the means of disconnection is accessible

and visible to and under the sole control of the employee in charge of the clearance, subsection (3)(a), (c), and (d) of this section do not apply. Additionally, tags required by the remaining provisions of subsection (3) of this section need not be used.

(d) Any disconnecting means that are accessible to persons outside the employer's control (for example, the general public) shall be rendered inoperable while they are open for the purpose of protecting employees.

(3) De-energizing lines and equipment.

(a) In all cases, switching orders must be given directly to the employees in charge of operating the switches by the system operator who has jurisdiction and such communications must be repeated back word for word to the speaker. When requesting clearance on lines under the control of the system operator, a person requesting the clearance shall obtain the name of the system operator to whom the request was made and the system operator shall obtain the name of the person requesting the clearance; and assure that the person is qualified to receive such a clearance. A designated employee shall make a request of the system operator to have the particular section of line or equipment de-energized. The designated employee becomes the employee in charge (as this term is used in subsection (2)(b) of this section) and is responsible for the clearance. In giving a clearance, the system operator shall make certain that the person to whom the clearance is given is fully aware of the extent or the limits of the clearance.

(b) All switches, disconnectors, jumpers, taps, and other means through which known sources of electric energy may be supplied to the particular lines and equipment to be de-energized shall be opened. Such means shall be rendered inoperable, unless its design does not so permit, and tagged to indicate that employees are at work.

(c) Automatically and remotely controlled switches that could cause the opened disconnecting means to close shall also be tagged at the point of control. The automatic or remote control feature shall be rendered inoperable, unless its design does not so permit.

(d) Tags shall prohibit operation of the disconnecting means and shall indicate that employees are at work.

(e) After the applicable requirements in subsection (3)(a) through (d) of this section have been followed and the employee in charge of the work has been given a clearance by the system operator, the lines and equipment to be worked shall be tested to ensure that they are de-energized.

(4) The system operator shall order clearance tags printed on red cardboard, or equivalent, not less than 2-1/4 inches by 4-1/2 inches, attached to all switches opened or checked open to provide clearance on any line or equipment for employees to work thereon.

(5) Clearance tags attached to substation control devices and to line switches beyond the switchyard of any substation; indicating the limits of the clearance involved; shall state the designation of the switch opened or checked open and tagged; the name of the person to whom the clearance is to be issued; the date and time the switch was opened or checked open; the name of the dispatcher ordering the switching and tagging; and the name of the person doing the switching and tagging.

(6) Protective grounds shall be installed as required by WAC 296-45-345.

(7) After the applicable requirements of subsection (3)(a) through (d) of this section have been followed, the lines and equipment involved may be worked as de-energized.

(8) If two or more independent crews will be working on the same lines or equipment, each crew shall independently comply with the requirements in subsection (3) of this section.

(9) To transfer the clearance, the employee in charge (or, if the employee in charge is forced to leave the worksite due to illness or other emergency, the employee's supervisor) shall inform the system operator; employees in the crew shall be informed of the transfer; and the new employee in charge shall be responsible for the clearance.

(10) To release a clearance, the employee in charge shall:

(a) Notify employees under his or her direction that the clearance is to be released;

(b) Determine that all employees in the crew are clear of the lines and equipment;

(c) Determine that all protective grounds installed by the crew have been removed; and

(d) Report this information to the system operator and release the clearance.

(11) The person releasing a clearance shall be the same person that requested the clearance, unless responsibility has been transferred under subsection (9) of this section.

(12) Tags may not be removed unless the associated clearance has been released under subsection (10) of this section.

(13) Only after all protective grounds have been removed, after all crews working on the lines or equipment have released their clearances, after all employees are clear of the lines and equipment, and after all protective tags have been removed from a given point of disconnection, may action be initiated to reenergize the lines or equipment at that point of disconnection.

(14) To meet unforeseen conditions, it will be permissible to tag isolated switches for the system operator and issue clearances against this tag. In tagging out inter-utility tie lines, the open switches on the foreign end of the line shall be tagged for the foreign system operator requesting the outage who will issue clearances to individuals of the organization against this tag.

(15) Metal-clad, draw-out switchgear of over 600 volts in which the physical separation of the disconnecting parts is not visible may be used to clear a line or equipment, provided the switchgear is equipped with:

(a) A positive positioning means to insure that the disconnecting contacts are separated;

(b) An isolating shutter which moves into place between the separated contact for circuit isolation; and

(c) A mechanically-connected indicating means to show that the shutter is in place.

(16) In all other cases, only a visible break of all phases shall be regarded as clearing a line or equipment.

(17) No person shall make contact with a circuit or equipment that has not been taken out of service to be worked on until he/she has the circuit or equipment cleared and tagged for themselves or is working directly under the supervision of one who has the circuit or equipment cleared and tagged for themselves.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-335, filed 3/6/98, effective 5/6/98.]

WAC 296-45-345 Grounding for the protection of employees. (1) Application. This section applies to the grounding of transmission and distribution lines and equipment for the purpose of protecting employees. Subsection (4) of this section also applies to the protective grounding of other equipment as required elsewhere in this section.

(2) General. For the employee to work lines or equipment as de-energized, the lines or equipment shall be de-energized under the provisions of WAC 296-45-335 and shall be grounded as specified in subsections (3) through (9) of this section. However, if the employer can demonstrate that installation of a ground is impracticable or that the conditions resulting from the installation of a ground would present greater hazards than working without grounds, the lines and equipment may be treated as de-energized provided all of the following conditions are met:

(a) The lines and equipment have been de-energized under the provisions of WAC 296-45-335.

(b) There is no possibility of contact with another energized source.

(c) The hazard of induced voltage is not present.

(3) Equipotential zone. Temporary protective grounds shall be placed at such locations and arranged in such a manner as to prevent each employee from being exposed to hazardous differences in electrical potential.

(4) Protective grounding equipment.

(a) Protective grounding equipment shall be capable of conducting the maximum fault current that could flow at the point of grounding for the time necessary to clear the fault. This equipment shall have an ampacity greater than or equal to that of No. 2 AWG copper.

(b) Grounding jumpers shall have approved ferrules and grounding clamps that provide mechanical support for jumper cables independent of the electrical connection.

Note: Guidelines for protective grounding equipment are contained in American Society for Testing and Materials Standard Specifications for Temporary Grounding Systems to be Used on De-Energized Electric Power Lines and Equipment, ASTM F855-1990.

(c) Protective grounds shall have an impedance low enough to cause immediate operation of protective devices in case of accidental energizing of the lines or equipment.

(5) Testing. Before any ground is installed, lines and equipment shall be tested and found absent of nominal voltage, unless a previously installed ground is present.

(a) Inspection before use: Grounding equipment shall be given a visual inspection and all mechanical connections shall be checked for tightness before each use.

(b) Ground surface cleaning: The surface to which the ground is to be attached shall be clean before the grounding clamp is installed; otherwise, a self-cleaning clamp shall be used.

(6) Order of connection. When a ground is to be attached to a line or to equipment, the ground-end connection shall be attached first, and then the other end shall be attached by means of a live-line tool.

(7) "Order of removal." When a ground is to be removed, the grounding device shall be removed from the line or equipment using a live-line tool before the ground-end connection is removed.

(8) "Additional precautions." When work is performed on a cable at a location remote from the cable terminal, the cable may not be grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.

(9) Removal of grounds for test. Grounds may be removed temporarily during tests. During the test procedure, the employer shall ensure that each employee uses insulating equipment and is isolated from any hazards involved, and the employer shall institute any additional measures as may be necessary to protect each exposed employee in case the previously grounded lines and equipment become energized.

(10) Conductor separation: In cases where the conductor separation at any pole or structure is so great as to make it impractical to apply shorts on all conductors, and where only one conductor is to be worked on, only that conductor which is to be worked on needs to be grounded.

(11) Ground personnel: In cases where ground rods or pole grounds are utilized for personal protective grounding, personnel working on the ground should maintain sufficient distance from such equipment or utilize other approved pro-

cedures designed to prevent "touch-and step potential" hazards.

Note: See the Appendix for tables.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-345, filed 3/6/98, effective 5/6/98.]

WAC 296-45-355 Underground grounding. (1) Grounding. A capacitance charge can remain in the high voltage cables after it has been disconnected from the circuit and a static-type arc can occur when grounds are applied to such cables.

(2) When work is to be done on cables or equipment of a high-voltage underground system, precautions to prevent back-feed shall be taken. This shall include either isolating or grounding of the secondary conductors.

(3) After grounding the cable, if the worker is to work on cable between terminations, he/she must first spike the cable or use other approved methods of testing. If the cable is to be cut, it shall be cut only with approved hot cutters.

(4) Additional precautions. When work is performed on a cable at a location remote from the cable terminal, the cable may not be grounded at the cable terminal if there is a possibility of hazardous transfer of potential should a fault occur.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-355, filed 3/6/98, effective 5/6/98.]

WAC 296-45-365 Testing and test facilities. (1) Application. This section provides for safe work practices for high-voltage and high-power testing performed in laboratories, shops, and substations, and in the field and on electric transmission and distribution lines and equipment. It applies only to testing involving interim measurements utilizing high voltage, high power, or combinations of both, and not to testing involving continuous measurements as in routine metering, relaying, and normal line work.

Note: Routine inspection and maintenance measurements made by qualified employees are considered to be routine line work and are not included in the scope of this section, as long as the hazards related to the use of intrinsic high-voltage or high-power sources require only the normal precautions associated with routine operation and maintenance work required in the other subsections of this section. Two typical examples of such excluded test work procedures are "phasing-out" testing and testing for a "no-voltage" condition.

(2) General requirements.

(a) The employer shall establish and enforce work practices for the protection of each worker from the hazards of high-voltage or high-power testing at all test areas, temporary and permanent. Such work practices shall include, as a minimum, test area guarding, grounding, and the safe use of measuring and control circuits. A means providing for periodic safety checks of field test areas shall also be included.

(b) Employees shall be trained in safe work practices upon their initial assignment to the test area, with periodic reviews and updates provided as required by subsections of this section.

(3) Guarding of test areas.

(a) Permanent test areas shall be guarded by walls, fences, or barriers designed to keep employees out of the test areas.

(b) In field testing, or at a temporary test site where permanent fences and gates are not provided, one of the following means shall be used to prevent unauthorized employees from entering:

(i) The test area shall be guarded by the use of distinctively colored safety tape that is supported approximately waist high and to which safety signs are attached;

(ii) The test area shall be guarded by a barrier or barricade that limits access to the test area to a degree equivalent, physically and visually, to the barricade specified in this section; or

(iii) The test area shall be guarded by one or more test observers stationed so that the entire area can be monitored.

(c) The barriers required by this section shall be removed when the protection they provide is no longer needed.

(d) Guarding shall be provided within test areas to control access to test equipment or to apparatus under test that may become energized as part of the testing by either direct or inductive coupling, in order to prevent accidental employee contact with energized parts.

(4) Grounding practices.

(a) The employer shall establish and implement safe grounding practices for the test facility.

(i) All conductive parts accessible to the test operator during the time the equipment is operating at high voltage shall be maintained at ground potential except for portions of the equipment that are isolated from the test operator by guarding.

(ii) Wherever ungrounded terminals of test equipment or apparatus under test may be present, they shall be treated as energized until determined by tests to be de-energized.

(b) Visible grounds shall be applied, either automatically or manually with properly insulated tools, to the high-voltage circuits after they are de-energized and before work is performed on the circuit or item or apparatus under test. Common ground connections shall be solidly connected to the test equipment and the apparatus under test.

(c) In high-power testing, an isolated ground-return conductor system shall be provided so that no intentional passage of current, with its attendant voltage rise, can occur in the ground grid or in the earth. However, an isolated ground-return conductor need not be provided if the employer can demonstrate that both the following conditions are met:

(i) An isolated ground-return conductor cannot be provided due to the distance of the test site from the electric energy source; and

(ii) Employees are protected from any hazardous step and touch potentials that may develop during the test.

Note: See Appendix B for information on measures that can be taken to protect employees from hazardous step and touch potentials.

(d) In tests in which grounding of test equipment by means of the equipment grounding conductor located in the equipment power cord cannot be used due to increased hazards to test personnel or the prevention of satisfactory measurements, a ground that the employer can demonstrate affords equivalent safety shall be provided, and the safety ground shall be clearly indicated in the test set up.

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(e) When the test area is entered after equipment is de-energized, a ground shall be placed on the high-voltage terminal and any other exposed terminals.

(i) High capacitance equipment or apparatus shall be discharged through a resistor rated for the available energy.

(ii) A direct ground shall be applied to the exposed terminals when the stored energy drops to a level at which it is safe to do so.

(f) If a test trailer or test vehicle is used in field testing, its chassis shall be grounded. Protection against hazardous touch potentials with respect to the vehicle, instrument panels, and other conductive parts accessible to employees shall be provided by bonding, insulation, or isolation.

(5) Control and measuring circuits.

(a) Control wiring, meter connections, test leads and cables may not be run from a test area unless they are contained in a grounded metallic sheath and terminated in a grounded metallic enclosure or unless other precautions are taken that the employer can demonstrate as ensuring equivalent safety.

(b) Meters and other instruments with accessible terminals or parts shall be isolated from test personnel to protect against hazards arising from such terminals and parts becoming energized during testing. If this isolation is provided by locating test equipment in metal compartments with viewing windows, interlocks shall be provided to interrupt the power supply if the compartment cover is opened.

(c) The routing and connections of temporary wiring shall be made secure against damage, accidental interruptions and other hazards. To the maximum extent possible, signal, control, ground, and power cables shall be kept separate.

(d) If employees will be present in the test area during testing, a test observer shall be present. The test observer shall be capable of implementing the immediate de-energizing of test circuits for safety purposes.

(6) Safety check.

(a) Safety practices governing employee work at temporary or field test areas shall provide for a routine check of such test areas for safety at the beginning of each series of tests.

(b) The test operator in charge shall conduct these routine safety checks before each series of tests and shall verify at least the following conditions:

(i) That barriers and guards are in workable condition and are properly placed to isolate hazardous areas;

(ii) That system test status signals, if used, are in operable condition;

(iii) That test power disconnects are clearly marked and readily available in an emergency;

(iv) That ground connections are clearly identifiable;

(v) That personal protective equipment is provided and used;

(vi) That signal, ground, and power cables are properly separated.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-365, filed 3/6/98, effective 5/6/98.]

WAC 296-45-375 Mechanical equipment, including aerial manlift equipment. (1) General requirements.

[Title 296 WAC—p. 1039]

(a) The critical safety components of mechanical elevating and rotating equipment shall receive a thorough visual inspection and operational test before use on each shift.

Note: Critical safety components of mechanical elevating and rotating equipment are components whose failure would result in a free fall or free rotation of the boom.

(b) No vehicular equipment having an obstructed view to the rear may be operated on off-highway jobsites where any employee is exposed to the hazards created by the moving vehicle, unless:

(i) The vehicle has a reverse signal alarm audible above the surrounding noise level; or

(ii) The vehicle is backed up only when a designated employee signals that it is safe to do so.

(c) The operator of an electric line truck may not leave his or her position at the controls while a load is suspended, unless the employer can demonstrate that no employee (including the operator) might be endangered.

(d) Rubber-tired, self-propelled scrapers, rubber-tired front-end loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler-type tractors, crawler-type loaders, and motor graders, with or without attachments, shall have rollover protective structures that meet the requirements of chapter 296-155 WAC, Part V.

(2) Outriggers.

(a) Vehicular equipment, if provided with outriggers, shall be operated with the outriggers extended and firmly set as necessary for the stability of the specific configuration of the equipment. Outriggers may not be extended or retracted outside of clear view of the operator unless all employees are outside the range of possible equipment motion.

(b) If the work area or the terrain precludes the use of outriggers, the equipment may be operated only within its maximum load ratings for the particular configuration of the equipment without outriggers.

(3) Applied loads. Mechanical equipment used to lift or move lines or other material shall be used within its maximum load rating and other design limitations for the conditions under which the work is being performed.

(4) Hydraulic fluids. All hydraulic fluids used for the insulated section of derrick trucks, aerial lifts, and hydraulic tools which are used on or around energized lines or equipment shall be of the insulating type.

(5) Mechanical adjustment or repairs shall not be attempted or performed in the field except by a person qualified to perform such work.

(6) Malfunction or needed repairs of manlift equipment shall be reported to the employee responsible for such repairs as soon as is reasonably possible. Use of equipment which is known to be in need of repairs or is malfunctioning is prohibited when such deficiency creates an unsafe operating condition.

(7) When any aerial manlift equipment is parked for operation at the jobsite, the brakes shall be set. Wheel chocks shall be used to prevent accidental movement while parked on an incline.

(8) Employees shall not sit or stand on the basket edge, stand on materials placed in or across the basket, or work from a ladder set inside the basket.

(9) The basket shall not be rested on a fixed object(s) so that the weight of the boom is either totally or partially supported by the basket.

(10) Operations near energized lines or equipment.

(a) Mechanical equipment shall be operated so that the minimum approach distances of Table 1 through Table 4 are maintained from exposed energized lines and equipment. However, the insulated upper portion excluding the basket/bucket of an aerial lift operated by a qualified employee in the lift is exempt from this requirement.

(b) A designated employee other than the equipment operator shall observe the approach distance to exposed lines and equipment and give timely warnings before the minimum approach distance required by subsection (10)(a) of this section is reached, unless the employer can demonstrate that the operator can accurately determine that the minimum approach distance is being maintained.

(c) If, during operation of the mechanical equipment, the equipment could become energized, the operation shall also comply with at least one of the following:

(i) The energized lines exposed to contact shall be covered with insulating protective material that will withstand the type of contact that might be made during the operation.

(ii) The equipment shall be insulated for the voltage involved. The equipment shall be positioned so that its uninsulated portions cannot approach the lines or equipment any closer than the minimum approach distances specified in Table 1 through 4.

(iii) Each employee shall be protected from hazards that might arise from equipment contact with the energized lines. The measures used shall ensure that employees will not be exposed to hazardous differences in potential. Unless the employer can demonstrate that the methods in use protect each employee from the hazards that might arise if the equipment contacts the energized line, the measures used shall include all of the following techniques:

(A) Using the best available ground to minimize the time the lines remain energized;

(B) Bonding equipment together to minimize potential differences;

(C) Providing ground mats to extend areas of equipotential; and

(D) Employing insulating protective equipment or barricades to guard against any remaining hazardous potential differences.

Note: Appendix B contains information on hazardous step and touch potentials and on methods of protecting employees from hazards resulting from such potentials.

(11) While working in aerial equipment, employees shall wear a full body harness and a lanyard attached to the boom or basket, in a secure manner.

(12) No component of aerial devices shall be operated from the ground without permission from the employee in the basket except in case of emergency.

(13) Operating levers or controls shall be kept clear of tools, materials or obstructions.

(14) Employees shall not climb into or out of the basket or platform while it is elevated or change from one basket to another on dual basket equipment, except in case of emergency or when the employees involved agree that this is the

safest way to perform the work. This exception shall not be used to circumvent safety rules.

(15) Existing safety rules governing the use of hot line tools, rubber and other protective equipment and safe work practices while performing work from poles or structures shall also apply to work done from aerial manlift equipment.

(16) The basket shall be kept clean and all tools not in use shall be secured or removed.

(17) Approved warning light shall be operating when the boom leaves the cradle. This light shall be visible to approaching traffic when the boom is in position over any traveled area.

(18) All aerial manlift equipment shall have both upper and lower controls (except ladder trucks need not have upper controls). The upper controls shall not be capable of rendering the lower controls inoperative. The lower controls should be located at or near the base of the aerial structure. If the lower controls are used, the operator shall have a view of the elevated employee(s) or there shall be communication between the operator and the employee in the elevated aerial structure: *Provided*, That no employee shall be raised, lowered, or moved into or from the elevated position in any aerial manlift equipment unless there is another employee, not in the elevated aerial structure, available at the site to operate the lower controls, except as follows:

(a) Where there is a fixed method permanently attached to or part of the equipment which will permit an employee to descend from the elevated position without lowering the elevated structure; or

(b) Where there is a system which will provide operation from the elevated position in the event of failure or malfunction of the primary system.

Note: This section shall not be interpreted as an exception to any other rule in this chapter.

(19) Controls in aerial manlift equipment shall be protected from accidental operation. Controls of the outriggers shall also be protected from accidental operation. Such protection may be by guarding or equivalent means.

(20) The manufacturer's recommended maximum load limit shall be posted at a conspicuous place near each set of controls and shall be kept in a legible condition.

(21) The manufacturer's operator's instructional manual shall be kept on the vehicle.

(22) Operating instructions, proper sequence and maintenance procedures prescribed by the manufacturer for operation of the equipment shall be followed.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-375, filed 3/6/98, effective 5/6/98.]

WAC 296-45-385 Overhead lines. This section provides additional requirements for work performed on or near overhead lines and equipment.

(1) General.

(a) Before elevated structures and adjacent structures, such as poles or towers of the adjacent supporting poles, structures, and conductor supporting hardware, are subjected to such stresses as climbing or the installation or removal of equipment may impose, the employer shall ascertain that the structures are capable of sustaining the additional or unbalanced stresses. If the pole or other structure cannot withstand

the loads which will be imposed, it shall be braced or otherwise supported so as to prevent failure.

Note: Appendix C contains test methods that can be used in ascertaining whether a wood pole is capable of sustaining the forces that would be imposed by an employee climbing the pole. This paragraph also requires the employer to ascertain that the pole can sustain all other forces that will be imposed by the work to be performed.

(b) When poles are set, moved, or removed near exposed energized overhead conductors, the pole may not contact the conductors.

(c) When a pole is set, moved, or removed near an exposed energized overhead conductor, the employer shall ensure that each employee wears electrical protective equipment or uses insulated devices when handling the pole and that no employee contacts the pole with uninsulated parts of his or her body.

(d) To protect employees from falling into holes into which poles are to be placed, the holes shall be attended by employees or physically guarded whenever anyone is working nearby.

(2) Installing and removing overhead lines. The following provisions apply to the installation and removal of overhead conductors or cable.

(a) The employer shall use the tension stringing method, barriers, or other equivalent measures to minimize the possibility that conductors and cables being installed or removed will contact energized power lines or equipment.

(b) When conductors are being strung in or removed, they shall be kept under positive control to prevent accidental contact with energized circuit.

(c) The protective measures required by WAC 296-45-375(10)(c) for mechanical equipment shall also be provided for conductors, cables, and pulling and tensioning equipment when the conductor or cable is being installed or removed close enough to energized conductors that any of the following failures could energize the pulling or tensioning equipment or the wire or cable being installed or removed:

(i) Failure of the pulling or tensioning equipment;

(ii) Failure of the wire or cable being pulled; or

(iii) Failure of the previously installed lines or equipment.

(d) If the conductors being installed or removed cross over energized conductors in excess of 600 volts and if the design of the circuit-interrupting devices protecting the lines so permits, the automatic-reclosing feature of these devices shall be made inoperative.

(e) Before lines are installed parallel to existing energized lines, the employer shall make a determination of the approximate voltage to be induced in the new lines, or work shall proceed on the assumption that the induced voltage is hazardous. Unless the employer can demonstrate that the lines being installed are not subject to the induction of a hazardous voltage or unless the lines are treated as energized, the following requirements also apply:

(i) Each bare conductor shall be grounded in increments so that no point along the conductor is more than 2 miles (3.22 km) from a ground.

(ii) The grounds required in subsection (2)(e)(i) of this section shall be left in place until the conductor installation is completed between dead ends.

(iii) The grounds required in subsection (2)(e)(i) of this section shall be removed as the last phase of aerial cleanup.

(iv) If employees are working on bare conductors, grounds shall also be installed at each location where these employees are working, and grounds shall be installed at all open dead-end or catch-off points or the next adjacent structure.

(v) If two bare conductors are to be spliced, the conductors shall be bonded and grounded before being spliced.

(f) Reel handling equipment, including pulling and tensioning devices, shall be in safe operating condition and shall be leveled and aligned.

(g) Load ratings of stringing lines, pulling lines, conductor grips, load-bearing hardware and accessories, rigging, and hoists may not be exceeded.

(3) Pulling lines and accessories shall be inspected prior to each use and replaced or repaired when damaged or when there is a reasonable basis to doubt the dependability of such lines or accessories.

(4) Conductor grips may not be used on wire rope, unless the grip is specifically designed for this application.

(5) Reliable communications, through two-way radios or other equivalent means, shall be maintained between the reel tender and the pulling rig operator.

(6) The pulling rig may only be operated when it is safe to do so.

Note: Examples of unsafe conditions include employees in locations prohibited by subsection (7) of this section, conductor and pulling line hang-ups, and slipping of the conductor grip.

(7) While the conductor or pulling line is being pulled (in motion) with a power-driven device, employees are not permitted directly under overhead operations or on the cross arm, except as necessary to guide the stringing sock or board over or through the stringing sheave.

(8) Live-line bare-hand work is prohibited.

(9) When winches, trucks, or tractors are being used to raise poles, materials, to pull in wires, to pull slack or in any other operation, there shall be an operator at the controls unless the machinery or process is stopped.

(10) Leadworkers shall designate an employee to give signals when required.

(11) Raising poles, towers or fixtures in the close proximity of high voltage conductors shall be done under the supervision of a qualified employee.

(12) Employees shall not crawl over insulator strings but shall use a platform or other approved device to work from when making dead ends or doing other work beyond strings of insulators, at such distance that they cannot reach the work from the pole or fixture. While working on the platform or other device, they shall be secured with safety straps or a rope to prevent falling. The provision of this subsection does not apply to extra high voltage bundle conductors when the use of such equipment may produce additional hazard. Climbing over dead end assemblies is permissible only after they have been completed and pinned in the final position.

(13) Towers and structures. The following requirements apply to work performed on towers or other structures which support overhead lines.

(a) The employer shall ensure that no employee is under a tower or structure while work is in progress, except where the employer can demonstrate that such a working position is necessary to assist employees working above.

(b) Tag lines or other similar devices shall be used to maintain control of tower sections being raised or positioned, unless the employer can demonstrate that the use of such devices would create a greater hazard.

(c) The loadline may not be detached from a member or section until the load is safely secured.

(14) A transmission clipping crew shall have a minimum of two structures clipped in between the crew and the conductor being sagged.

(15) While on patrol at night and operating a motor vehicle on public highways, there shall be two employees, at least one of whom shall be a journey level lineworker or otherwise qualified employee. If repair to line or equipment is found to be of such nature as to require two lineworkers, work shall not proceed until additional help has been obtained provided that in cases of emergency where delay would increase the danger to life, limb, or substantial property, one employee may clear the hazard without assistance.

(16) Except during emergency restoration procedures, work shall be discontinued when adverse weather conditions would make the work hazardous in spite of the work practices required by this section.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make this work too hazardous to perform, except under emergency conditions.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-385, filed 3/6/98, effective 5/6/98.]

WAC 296-45-455 Line-clearance tree-trimming operations. This section provides additional requirements for line-clearance tree-trimming operations and for equipment used in these operations.

This section does not apply to qualified employees.

(1) Before an employee climbs, enters, or works around any tree, a determination shall be made of the nominal voltage of electric power lines posing a hazard to employees. However, a determination of the maximum nominal voltage to which an employee will be exposed may be made instead, if all lines are considered as energized at this maximum voltage.

(2) There shall be a second line-clearance tree trimmer within normal (that is, unassisted) voice communication under any of the following conditions:

(a) If a line-clearance tree trimmer is to approach more closely than 10 feet (305 cm) any conductor or electrical apparatus energized at more than 600 volts; or

(b) If branches or limbs being removed are closer to lines energized at more than 600 volts than the distances listed in Table 1, Table 4, and Table 5; or

(c) If roping is necessary to remove branches or limbs from such conductors or apparatus.

(3) Line-clearance tree trimmers shall maintain the minimum approach distances from energized conductors given in Table 1, Table 4, and Table 5.

(4) Branches that are contacting exposed energized conductors or equipment or that are within the distances specified in Table 1, Table 4, and Table 5 may be removed only through the use of insulating equipment.

Note: A tool constructed of a material that the employer can demonstrate has insulating qualities meeting WAC 296-45-305(1) are considered as insulated under this section if the tool is clean and dry.

(5) Ladders, platforms, and aerial devices may not be brought closer to an energized part than the distances listed in Table 1, Table 4, and Table 5.

(6) Line-clearance tree-trimming work may not be performed when adverse weather conditions make the work hazardous in spite of the work practices required by this section. Each employee performing line-clearance tree-trimming work in the aftermath of a storm or under similar emergency conditions shall be trained in the special hazards related to this type of work.

Note: Thunderstorms in the immediate vicinity, high winds, snow storms, and ice storms are examples of adverse weather conditions that are presumed to make line-clearance tree-trimming work too hazardous to perform safely.

(7) A tree trimmer may climb out of a basket into a tree or from a tree back into the basket so long as he is properly tied into the tree during the entire maneuver.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-455, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45505 Brush chippers. (1) Brush chippers shall be equipped with a locking device in the ignition system.

(2) Access panels for maintenance and adjustment of the chipper blades and associated drive train shall be in place and secure during operation of the equipment.

(3) Brush chippers not equipped with a mechanical infeed system shall be equipped with an infeed hopper of length sufficient to prevent employees from contacting the blades or knives of the machine during operation.

(4) Trailer chippers detached from trucks shall be chocked or otherwise secured.

(5) Each employee in the immediate area of an operating chipper feed table shall wear personal protective equipment as required by Subpart I of this Part.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45505, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45510 Sprayers and related equipment.

(1) Walking and working surfaces of sprayers and related equipment shall be covered with slip-resistant material. If slipping hazards cannot be eliminated, slip-resistant footwear or handrails and stair rails meeting the requirements of chapter 296-24 WAC, Part J-1, may be used instead of slip-resistant material.

(2) Equipment on which employees stand to spray while the vehicle is in motion shall be equipped with guardrails around the working area. The guardrail shall be constructed in accordance with chapter 296-24 WAC, Part J-1.

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[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45510, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45515 Stump cutters. (1) Stump cutters shall be equipped with enclosures or guards to protect employees.

(2) Each employee in the immediate area of stump grinding operations (including the stump cutter operator) shall wear personal protective equipment as required by WAC 296-45-25505.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45515, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45520 Backpack power units for use in pruning and clearing. (1) While a backpack power unit is running, no one other than the operator may be within 10 feet (305 cm) of the cutting head of a brush saw.

(2) A backpack power unit shall be equipped with a quick shutoff switch readily accessible to the operator.

(3) Backpack power unit engines shall be stopped for all cleaning, refueling, adjustments, and repairs to the saw or motor, except as the manufacturer's servicing procedures require otherwise.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45520, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45525 Rope. (1) Climbing ropes shall be used by employees working aloft in trees. These ropes shall have a minimum diameter of 0.5 inch (1.2 cm) with a minimum breaking strength of 2300 pounds (10.2 kN). Synthetic rope shall have elasticity of not more than 7 percent.

(2) Rope shall be inspected before each use and, if unsafe (for example, because of damage or defect), may not be used.

(3) Rope shall be stored away from cutting edges and sharp tools. Rope contact with corrosive chemicals, gas, and oil shall be avoided.

(4) When stored, rope shall be coiled and piled, or shall be suspended, so that air can circulate through the coils.

(5) Rope ends shall be secured to prevent their unraveling.

(6) Climbing rope may not be spliced to effect repair.

(7) A rope that is wet, that is contaminated to the extent that its insulating capacity is impaired, or that is otherwise not considered to be insulated for the voltage involved may not be used near exposed energized lines.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45525, filed 3/6/98, effective 5/6/98.]

WAC 296-45-45530 Fall protection. Each employee shall be tied in with a climbing rope and safety saddle when the employee is working above the ground in a tree, unless he or she is ascending into the tree.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-45530, filed 3/6/98, effective 5/6/98.]

WAC 296-45-465 Communication facilities. (1) Microwave transmission. The employer shall ensure that no employee looks into an open waveguide or antenna that is connected to an energized microwave source.

(2) If the electromagnetic radiation level within an accessible area associated with microwave communications systems exceeds the radiation protection guide given in chapter 296-62 WAC, Part J-1. The area shall be posted with the warning symbol described in chapter 296-62 WAC, Part J-1. The lower half of the warning symbol shall include the following statements or ones that the employer can demonstrate are equivalent:

Radiation in this area may exceed hazard limitations and special precautions are required. Obtain specific instruction before entering.

(3) When an employee works in an area where the electromagnetic radiation could exceed the radiation protection guide, the employer shall institute measures that ensure that the employee's exposure is not greater than that permitted by that guide. Such measures may include administrative and engineering controls and personal protective equipment.

(4) Power line carrier. Power line carrier work, including work on equipment used for coupling carrier current to power line conductors, shall be performed in accordance with the requirements of this section pertaining to work on energized lines.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-465, filed 3/6/98, effective 5/6/98.]

WAC 296-45-475 Substations. This section provides additional requirements for substations and for work performed in them.

(1) Access and working space. Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and working space about electric equipment in substations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1997. Installations meeting the ANSI provisions comply with WAC 296-45-475(1). An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with WAC 296-45-475(1) if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(a) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;

(b) That the configuration of the installation enables employees to maintain the minimum approach distances required by WAC 296-45-325(5) while they are working on exposed, energized parts; and

(c) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2-1997.

(2) Draw-out-type circuit breakers. When draw-out-type circuit breakers are removed or inserted, the breaker shall be in the open position. The control circuit shall also be rendered inoperative, if the design of the equipment permits.

(3) Substation fences. Conductive fences around substations shall be grounded. When a substation fence is expanded or a section is removed, fence grounding continuity shall be maintained, and bonding shall be used to prevent electrical discontinuity.

(4) Guarding of rooms containing electric supply equipment.

(a) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of subsection (4)(b) through (e) of this section under the following conditions:

(i) If exposed live parts operating at 50 to 150 volts to ground are located within 8 feet of the ground or other working surface inside the room or space;

(ii) If live parts operating at 151 to 600 volts and located within 8 feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under subsection (5)(a) of this section; or

(iii) If live parts operating at more than 600 volts are located within the room or space, unless:

(A) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts; or

(B) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an 8-foot height at 50 volts.

(b) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(c) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(d) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(e) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

(5) Guarding of energized parts.

(a) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in substations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1997. Installations meeting the ANSI provisions comply with subsection (5)(a) of this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with subsection (5)(a) of this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(i) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;

(ii) That each employee is isolated from energized parts at the point of closest approach; and

(iii) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2-1997.

(b) Except for fuse replacement and other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with

energized parts and to prevent tools or other equipment from being dropped on energized parts.

(c) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

(6) Substation entry.

(a) Upon entering an attended substation, each employee other than those regularly working in the station shall report his or her presence to the employee in charge in order to receive information on special system conditions affecting employee safety.

(b) The job briefing required by WAC 296-45-135 shall cover such additional subjects as the location of energized equipment in or adjacent to the work area and the limits of any de-energized work area.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-475, filed 3/6/98, effective 5/6/98.]

WAC 296-45-485 Power generation. This section provides additional requirements and related work practices for power generating plants.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-485, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48505 Interlocks and other safety devices. (1) Interlocks and other safety devices shall be maintained in a safe, operable condition.

(2) No interlock or other safety device may be modified to defeat its function, except for test, repair, or adjustment of the device.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-48505, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48510 Changing brushes. Before exciter or generator brushes are changed while the generator is in service, the exciter or generator field shall be checked to determine whether a ground condition exists. The brushes may not be changed while the generator is energized if a ground condition exists.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-48510, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48515 Access and working space. Sufficient access and working space shall be provided and maintained about electric equipment to permit ready and safe operation and maintenance of such equipment.

Note: Guidelines for the dimensions of access and workspace about electric equipment in generating stations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1997. Installations meeting the ANSI provisions comply with this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with this section if the employer can demonstrate that the installation provides ready and safe access based on the following evidence:

(1) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;

(2) That the configuration of the installation enables employees to maintain the minimum approach distances

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required by this section while they work on exposed, energized parts; and

(3) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by access and working space meeting ANSI C2-1997.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-48515, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48520 Guarding of rooms containing electric supply equipment. (1) Rooms and spaces in which electric supply lines or equipment are installed shall meet the requirements of this section under the following conditions:

(a) If exposed live parts operating at 50 to 150 volts to ground are located within eight feet of the ground or other working surface inside the room or space;

(b) If live parts operating at 151 to 600 volts and located within eight feet of the ground or other working surface inside the room or space are guarded only by location, as permitted under this section; or

(c) If live parts operating at more than 600 volts are located within the room or space; unless:

(i) The live parts are enclosed within grounded, metal-enclosed equipment whose only openings are designed so that foreign objects inserted in these openings will be deflected from energized parts; or

(ii) The live parts are installed at a height above ground and any other working surface that provides protection at the voltage to which they are energized corresponding to the protection provided by an eight-foot height at 50 volts.

(2) The rooms and spaces shall be so enclosed within fences, screens, partitions, or walls as to minimize the possibility that unqualified persons will enter.

(3) Signs warning unqualified persons to keep out shall be displayed at entrances to the rooms and spaces.

(4) Entrances to rooms and spaces that are not under the observation of an attendant shall be kept locked.

(5) Unqualified persons may not enter the rooms or spaces while the electric supply lines or equipment are energized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060, 98-07-009, § 296-45-48520, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48525 Guarding of energized parts. (1) Guards shall be provided around all live parts operating at more than 150 volts to ground without an insulating covering, unless the location of the live parts gives sufficient horizontal or vertical or a combination of these clearances to minimize the possibility of accidental employee contact.

Note: Guidelines for the dimensions of clearance distances about electric equipment in generating stations are contained in American National Standard-National Electrical Safety Code, ANSI C2-1997. Installations meeting the ANSI provisions comply with this section. An installation that does not conform to this ANSI standard will, nonetheless, be considered as complying with this section if the employer can demonstrate that the installation provides sufficient clearance based on the following evidence:

(a) That the installation conforms to the edition of ANSI C2 that was in effect at the time the installation was made;

(b) That each employee is isolated from energized parts at the point of closest approach; and

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(c) That the precautions taken when work is performed on the installation provide protection equivalent to the protection that would be provided by horizontal and vertical clearances meeting ANSI C2-1997.

(2) Except for fuse replacement or other necessary access by qualified persons, the guarding of energized parts within a compartment shall be maintained during operation and maintenance functions to prevent accidental contact with energized parts and to prevent tools or other equipment from being dropped on energized parts.

(3) When guards are removed from energized equipment, barriers shall be installed around the work area to prevent employees who are not working on the equipment, but who are in the area, from contacting the exposed live parts.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48525, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48530 Water or steam spaces. The following requirements apply to work in water and steam spaces associated with boilers:

(1) A designated employee shall inspect conditions before work is permitted and after its completion. Eye protection, or full face protection if necessary, shall be worn at all times when condenser, heater, or boiler tubes are being cleaned.

(2) Where it is necessary for employees to work near tube ends during cleaning, shielding shall be installed at the tube ends.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48530, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48535 Chemical cleaning of boilers and pressure vessels. The following requirements apply to chemical cleaning of boilers and pressure vessels:

(1) Areas where chemical cleaning is in progress shall be cordoned off to restrict access during cleaning. If flammable liquids, gases, or vapors or combustible materials will be used or might be produced during the cleaning process, the following requirements also apply:

(a) The area shall be posted with signs restricting entry and warning of the hazards of fire and explosion; and

(b) Smoking, welding, and other possible ignition sources are prohibited in these restricted areas.

(2) The number of personnel in the restricted area shall be limited to those necessary to accomplish the task safely.

(3) There shall be ready access to water or showers for emergency use.

Note: See chapter 296-24 WAC, Part B for requirements that apply to the water supply and to washing facilities.

(4) Employees in restricted areas shall wear protective equipment meeting the requirements of this chapter and including, but not limited to, protective clothing, boots, goggles, and gloves.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48535, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48540 Chlorine systems. (1) Chlorine system enclosures shall be posted with signs restricting entry

and warning of the hazard to health and the hazards of fire and explosion.

Note: See chapter 296-62 WAC for requirements necessary to protect the health of employees from the effects of chlorine.

(2) Only designated employees may enter the restricted area. Additionally, the number of personnel shall be limited to those necessary to accomplish the task safely.

(3) Emergency repair kits shall be available near the shelter or enclosure to allow for the prompt repair of leaks in chlorine lines, equipment, or containers.

(4) Before repair procedures are started, chlorine tanks, pipes, and equipment shall be purged with dry air and isolated from other sources of chlorine.

(5) The employer shall ensure that chlorine is not mixed with materials that would react with the chlorine in a dangerously exothermic or other hazardous manner.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48540, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48545 Boilers. (1) Before internal furnace or ash hopper repair work is started, overhead areas shall be inspected for possible falling objects. If the hazard of falling objects exists, overhead protection such as planking or nets shall be provided.

(2) When opening an operating boiler door, employees shall stand clear of the opening of the door to avoid the heat blast and gases which may escape from the boiler.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48545, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48550 Turbine generators. (1) Smoking and other ignition sources are prohibited near hydrogen or hydrogen sealing systems, and signs warning of the danger of explosion and fire shall be posted.

(2) Excessive hydrogen makeup or abnormal loss of pressure shall be considered as an emergency and shall be corrected immediately.

(3) A sufficient quantity of inert gas shall be available to purge the hydrogen from the largest generator.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48550, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48555 Coal and ash handling. (1) Only designated persons may operate railroad equipment.

(2) Before a locomotive or locomotive crane is moved, a warning shall be given to employees in the area.

(3) Employees engaged in switching or dumping cars may not use their feet to line up drawheads.

(4) Drawheads and knuckles may not be shifted while locomotives or cars are in motion.

(5) When a railroad car is stopped for unloading, the car shall be secured from displacement that could endanger employees.

(6) An emergency means of stopping dump operations shall be provided at railcar dumps.

(7) The employer shall ensure that employees who work in coal- or ash-handling conveyor areas are trained and knowledgeable in conveyor operation and in the requirements of this section.

(8) Employees may not ride a coal- or ash-handling conveyor belt at any time. Employees may not cross over the conveyor belt, except at walkways, unless the conveyor's energy source has been de-energized and has been locked out or tagged in accordance with WAC 296-45-175.

(9) A conveyor that could cause injury when started may not be started until personnel in the area are alerted by a signal or by a designated person that the conveyor is about to start.

(10) If a conveyor that could cause injury when started is automatically controlled or is controlled from a remote location, an audible device shall be provided that sounds an alarm that will be recognized by each employee as a warning that the conveyor will start and that can be clearly heard at all points along the conveyor where personnel may be present. The warning device shall be actuated by the device starting the conveyor and shall continue for a period of time before the conveyor starts that is long enough to allow employees to move clear of the conveyor system. A visual warning may be used in place of the audible device if the employer can demonstrate that it will provide an equally effective warning in the particular circumstances involved.

Exception: If the employer can demonstrate that the system's function would be seriously hindered by the required time delay, warning signs may be provided in place of the audible warning device. If the system was installed before November 20, 1995, warning signs may be provided in place of the audible warning device until such time as the conveyor or its control system is rebuilt or rewired. These warning signs shall be clear, concise, and legible and shall indicate that conveyors and allied equipment may be started at any time, that danger exists, and that personnel must keep clear. These warning signs shall be provided along the conveyor at areas not guarded by position or location.

(11) Remotely and automatically controlled conveyors, and conveyors that have operating stations which are not manned or which are beyond voice and visual contact from drive areas, loading areas, transfer points, and other locations on the conveyor path not guarded by location, position, or guards shall be furnished with emergency stop buttons, pull cords, limit switches, or similar emergency stop devices. However, if the employer can demonstrate that the design, function, and operation of the conveyor do not expose an employee to hazards, an emergency stop device is not required.

(a) Emergency stop devices shall be easily identifiable in the immediate vicinity of such locations.

(b) An emergency stop device shall act directly on the control of the conveyor involved and may not depend on the stopping of any other equipment.

(c) Emergency stop devices shall be installed so that they cannot be overridden from other locations.

(12) Where coal-handling operations may produce a combustible atmosphere from fuel sources or from flammable gases or dust, sources of ignition shall be eliminated or safely controlled to prevent ignition of the combustible atmosphere.

Note: Locations that are hazardous because of the presence of combustible dust are classified as Class II hazardous locations. See chapter 296-24 WAC, Part L.

(13) An employee may not work on or beneath overhanging coal in coal bunkers, coal silos, or coal storage areas, unless the employee is protected from all hazards posed by shifting coal.

(14) An employee entering a bunker or silo to dislodge the contents shall wear a body harness with lifeline attached. The lifeline shall be secured to a fixed support outside the bunker and shall be attended at all times by an employee located outside the bunker or facility.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48555, filed 3/6/98, effective 5/6/98.]

WAC 296-45-48560 Hydroplants and equipment.

Employees working on or close to water gates, valves, intakes, forebays, flumes, or other locations where increased or decreased water flow or levels may pose a significant hazard shall be warned and shall vacate such dangerous areas before water flow changes are made.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-48560, filed 3/6/98, effective 5/6/98.]

WAC 296-45-525 Special conditions.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-525, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52505 Capacitors. The following additional requirements apply to work on capacitors and on lines connected to capacitors.

Note: See WAC 296-45-335 through 296-45-345 for requirements pertaining to the de-energizing and grounding of capacitor installations.

(1) Before employees work on capacitors, the capacitors shall be disconnected from energized sources and, after a wait of at least 5 minutes from the time of disconnection, short-circuited.

(2) Before the units are handled, each unit in series-parallel capacitor banks shall be short-circuited between all terminals and the capacitor case or its rack. If the cases of capacitors are on ungrounded substation racks, the racks shall be bonded to ground.

(3) Any line to which capacitors are connected shall be short-circuited before it is considered de-energized.

(4) After removal from service, short circuits shall remain on capacitors in storage until returned to service.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52505, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52510 Current transformer secondaries. The secondary of a current transformer may not be opened while the transformer is energized. If the primary of the current transformer cannot be de-energized before work is performed on an instrument, a relay, or other section of a current transformer secondary circuit, the circuit shall be bridged so that the current transformer secondary will not be opened.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52510, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52515 Series streetlighting. (1) If the open-circuit voltage exceeds 600 volts, the series streetlighting circuit shall be worked in accordance with WAC 296-45-215 or 296-45-385, as appropriate.

(2) A series loop may only be opened after the streetlighting transformer has been de-energized and isolated from the source of supply or after the loop is bridged to avoid an open-circuit condition.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52515, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52520 Illumination. Sufficient illumination shall be provided to enable the employee to perform the work safely.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52520, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52525 Protection against drowning. (1) Whenever an employee may be pulled or pushed or may fall into water where the danger of drowning exists, the employee shall be provided with and shall use U.S. Coast Guard approved personal flotation devices.

(2) Each personal flotation device shall be maintained in safe condition and shall be inspected frequently enough to ensure that it does not have rot, mildew, water saturation, or any other condition that could render the device unsuitable for use.

(3) An employee may cross streams or other bodies of water only if a safe means of passage, such as a bridge, is provided.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52525, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52530 Employee protection in public work areas. (1) Traffic control signs and traffic control devices used for the protection of employees shall meet the requirements of chapter 296-155 WAC, Part E.

(2) Before work is begun in the vicinity of vehicular or pedestrian traffic that may endanger employees, warning signs or flags and other traffic control devices shall be placed in conspicuous locations to alert and channel approaching traffic.

(3) Where additional employee protection is necessary, barricades shall be used.

(4) Excavated areas shall be protected with barricades.

(5) At night, warning lights shall be prominently displayed.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52530, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52535 Backfeed. If there is a possibility of voltage backfeed from sources of cogeneration or from the secondary system (for example, backfeed from more than one energized phase feeding a common load), the requirements of WAC 296-45-325 apply if the lines or equipment are to be worked as energized, and the requirements of WAC 296-45-335 and 296-45-345 apply if the lines or equipment are to be worked as de-energized.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52535, filed 3/6/98, effective 5/6/98.]

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WAC 296-45-52540 Lasers. Laser equipment shall be installed, adjusted, and operated in accordance with WAC 296-155-155.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52540, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52545 Hydraulic fluids. Hydraulic fluids used for the insulated sections of equipment shall provide insulation for the voltage involved.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52545, filed 3/6/98, effective 5/6/98.]

WAC 296-45-52550 Foreign attachments and placards. Nails and unauthorized attachments should be removed before climbing above such attachments. When through bolts present a hazard to climbing, they shall be trimmed to a safe length.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-52550, filed 3/6/98, effective 5/6/98.]

WAC 296-45-545 Trolley maintenance, jumpering or bypassing. (1) Energized trolley wire shall be jumpered when it is to be opened or cut.

(2) Reaching over trolley wire(s) or system(s). Lineworkers shall not reach over trolley wire(s) unless properly protected by line hose or rubber blanket.

(3) Reaching across sectional insulators. Lineworkers shall not reach across section insulator(s), insulated spacer(s) or insulated approach.

(4) Polarity on either side of sectionalizing breakers. Since the polarity on both sides of a sectionalizing insulator may be different, it is required that prior to performance of work, tests be performed with approved testing equipment to determine whether or not the polarity is the same or different on one side of the sectional insulator as compared with the other.

(5) Working on hangers. More than one truck crew shall not work on hangers attached to the same span at the same time, without rubber protection.

(6) Workers on hangers of opposite polarity. Trolley hangers and ears of opposite polarity shall not be worked on at the same time when trolley wire is energized.

(7) Checking electric switches. When electric switches are checked for operation, making it necessary to short circuit the contactor to each trolley wire, tools with insulated handles shall be used.

(8) Short circuit due to use of noninsulated or conductive long handled tools. When a hazard of short circuit exists, due to use of noninsulated or conductive long handled tools, approved protective rubber equipment shall be used as provided in this chapter.

(9) Trolley feeders. When work is to be performed on street railway trolley feeders where it is necessary for workers to work from metal or other grounded poles or fixtures or on poles or fixtures on which grounds are maintained, the feeders shall be de-energized unless the poles or fixtures are insulated before the work is started with approved protective devices in such manner that employees cannot become grounded while working on the feeders, and employees shall wear approved rubber gloves.

(10) Truck driver shall remain at tower controls while workers are working on towers except when the aerial manlift equipment has been properly chocked to prevent uncontrolled movement. Tower trucks shall be equipped with a reliable signaling device between the employees working on the tower and the truck driver.

(11) Working on truck towers. Employees shall not stand on tower gates or railings. Work shall not be done from plank(s) placed on tower railings.

(12) Tower truck railings. Towers shall have standard railings and toeboards around the tower and all railings shall be constructed of wood, fiberglass or other nonmetallic material. All railings shall be a vertical height of not less than 36 inches or more than 42 inches from the floor of the platform to the upper surface of the top rail. Intermediate railings shall be midway between the floor and the underside of the top rail. Tower gates shall be so constructed as to prevent accidental opening.

(13) Tower truck decks shall be kept clear of tools, wire and other materials and tools shall be kept in proper storage area when not in use.

(14) Lineworkers shall not wear climbers or spurs while working on a tower truck.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-545, filed 3/6/98, effective 5/6/98.]

WAC 296-45-675 Rotorcraft/helicopter for power distribution and transmission line installation, construction and repair—Scope. (1) These standards which include WAC 296-45-675 shall apply to work being done on or near any rotorcraft, helicopter crane, or similar device when such device is for power distribution and transmission line construction, alteration, repair or similar work. These standards include work practices when such equipment is being or is about to be used and shall apply to the exclusion of any other standard should such other standard be in conflict with the standards contained herein.

(2) These rules shall be interpreted where necessary to achieve the protection of employees affected by the hazards particular to the helicopter operation and shall be so interpreted as not to conflict with any federal law or regulation governing the operation or maintenance of such craft.

[Order 76-38, § 296-45-675, filed 12/30/76.]

WAC 296-45-67503 Definitions. (1) "Cargo hooks." A device attached or suspended from an aircraft which is used to connect an external load to the aircraft through direct couplings or by lead lines. This unit has both mechanical and electrical locking/unlocking means.

(2) "Designated employees." Those employees selected or designated by the employer to work under or near helicopters who have first been instructed in hooking, unhooking, guiding and securing the load, including the signalperson, all of whom have been instructed in the hazards of helicopter work and who know the provisions of this section.

(3) "Downwash." A down and outward air column from the main rotor system.

(4) "Ground personnel or crew." Those employees who are physically and mentally capable, who are familiar with the hazards of helicopter use in power distribution and trans-

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mission line work, and who know these rules and the methods of operation.

(5) "Helicopter, " "helicopter crane, " and "rotorcraft." Those aircraft whose support in the air is derived solely from the reaction of a stream of air driven downward by propellers revolving around a vertical axis, which are designed for and capable of carrying external loads. The use of the word helicopter in these rules shall also mean helicopter crane, rotorcraft, or similar device.

(6) "Hooking and unhooking." That process by which an external load is either attached to or released from the cargo hook.

(7) "Positive guide system." A system or method of installing a load into position so that the load is capable of being released from the helicopter without being otherwise secured so that the load will remain in position permanently or until otherwise secured by physical means.

(8) "Rotors." That system of blades which rotates or revolves to supply lift or direction to the rotorcraft.

(9) "Approved rubber gloves." Rubber insulating gloves used for protection of electrical workers from electric shock while working on energized conductors and equipment.

(10) "Signalperson." That member of the ground crew that is designated by an employer to direct, signal and otherwise communicate with the operator of the helicopter.

(11) "Sling line." A strap, chain, rope or the like used to securely hold something being lifted, lowered, carried or otherwise suspended.

(12) "Sock line." A rope(s), cable(s) or similar line(s) which is used to pull a conductor line from a reel or to remove existing strung conductors from poles or towers.

(13) "Static charge." A stationary charge of electricity.

(14) "Tag line." A rope or similar device used to guide or control the direction or movement of a load.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-67503, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67503, filed 12/30/76.]

WAC 296-45-67505 Briefing. (1) Before work or a job involving helicopters begins, there shall be a discussion between all affected employees which shall include the ground crew, signalperson and pilot or operator of the helicopter. The discussion shall cover the particular hazards of the job, the methods of performing the work and the signals to be used. All employees shall, before the beginning of such work or job, understand in detail the hazards, the methods and the signals to be used and these regulations.

(2) Every employee before being allowed to work on or near helicopter(s) operating with or without load shall be advised and understand the hazards involved, the methods of performing the work, the signals being used and these regulations.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-67505, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67505, filed 12/30/76.]

WAC 296-45-67507 Signals. (1) The signals between the signalperson and the operator of the helicopter shall be those submitted to the Federal Aviation Agency for the particular procedure or job. In the event no signals have been

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submitted to the Federal Aviation Administration, a system of signaling shall be used which has been reduced to writing and which is capable of being clearly understood by all employees and others involved in the job.

(2) Should there occur a change in the hazards, method of performing the job, signals to be used, or other operating conditions during the course of any particular job, a conference shall immediately be held at which time all affected employees and others, including signalpersons, groundworkers, pilot(s), will be advised of such hazards or change of operation. No employee shall be permitted to work unless such employee and others fully understand the change(s) which have taken place.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-45-67507, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67507, filed 12/30/76.]

WAC 296-45-67509 Slings and tag lines. (1) Loads shall be properly slung so that there will be no slippage or shifting of the load and so that the load will not accidentally be dislodged from the helicopter.

(2) Tag lines shall be of such length as not to be capable of being accidentally drawn into or otherwise entering into the rotors.

(3) Pressed sleeves, wedged eyes, or equivalent means shall be used for all suspended loads.

[Order 76-38, § 296-45-67509, filed 12/30/76.]

WAC 296-45-67511 Cargo hooks. (1) All electrically operated cargo hooks shall have the electrical activating device which is so designed and installed as to prevent inadvertent or accidental operation. Such cargo hooks shall be equipped with an emergency mechanical or manual control for releasing the load. The electrical control shall be a double button single hand control.

(2) No electrical cargo hook shall be used unless, prior to that day's operation, the releases are tested and functioning properly, both electrically and mechanically (manually).

(3) No employee shall be permitted to work under a hovering helicopter(s) unless the cargo hooks used comply with Federal Aviation Administration regulations governing such hooks.

[Order 76-38, § 296-45-67511, filed 12/30/76.]

WAC 296-45-67513 Personal protective equipment. Personal protective equipment when working on, under or in the near vicinity of helicopters:

(1) All employees shall wear eye protection of such design as to prevent the likelihood of dust or other substances from contacting the eye(s) of employees.

(2) All employees shall wear hard hats which shall be secured on the employee's head by a chinstrap.

[Order 76-38, § 296-45-67513, filed 12/30/76.]

WAC 296-45-67515 Wearing apparel. No employee shall wear clothing or apparel which is either designed to or in fact can reasonably be expected to flap or otherwise react in a similar fashion in the downwash or air disturbance of a helicopter(s). No employee shall work on, under or in the

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near vicinity of a helicopter while wearing such apparel or clothing which flaps or moves to the extent that it presents a hazard in that it could be caught in the moving equipment, the hoist line, or otherwise interfere with the safe performance of the work.

[Order 76-38, § 296-45-67515, filed 12/30/76.]

WAC 296-45-67517 Loose gear and objects. All loose gear, including lunch boxes, rope, cardboard, wire covers and similar items shall be removed or secured or otherwise made fast before the helicopter is started or allowed to approach such area. In the event the gear is not secured or fastened, it shall be removed and located outside the downwash at least 100 feet from the helicopter.

[Order 76-38, § 296-45-67517, filed 12/30/76.]

WAC 296-45-67519 Housekeeping. All helicopter landing, loading and unloading areas shall be maintained in a neat and orderly fashion so as to reduce the likelihood of flying materials, tripping, or other hazards attendant to the work being performed.

[Order 76-38, § 296-45-67519, filed 12/30/76.]

WAC 296-45-67521 Operator's responsibility. (1) The helicopter operator shall be responsible for the size, weight and manner in which loads are connected to the helicopter.

(2) No load shall be made if the helicopter operator believes the lift cannot safely be performed. The employer shall make certain that the operator of the helicopter is able to freely exercise their prerogative and judgment as to safe operation of the helicopter itself concerning size, weight and manner by which loads are connected.

(3) No employee shall work on, under, near or in conjunction with a helicopter whose operation does not correspond with the foregoing provisions.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-45-67521, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67521, filed 12/30/76.]

WAC 296-45-67523 Hooking and unhooking loads. No employee shall perform work under hovering helicopters: *Provided*, That qualified and capable employees may function under such craft for that limited period of time necessary to guide, secure, hook or unhook the loads. When guiding, securing, hooking or unhooking the load at elevated positions, employees shall be assisted by and use a positive positioning guide system. When under hovering helicopters at any other location, the employee shall have a safe means of ingress and egress, including readily available escape route or routes in the event of an emergency. No other work or work-related activity other than the aforementioned shall be permitted under hovering helicopters. Bolting of or otherwise permanently securing the structures is prohibited under hovering helicopters except that in the event of an unforeseen contingency of an emergency nature which represents a substantial hazard to life or property, an employee may do such work as is necessary to preserve life or protect substantial property.

[Order 76-38, § 296-45-67523, filed 12/30/76.]

WAC 296-45-67525 Static charge. All loads shall be grounded with a grounding device capable of discharging either the actual or potential static charge before ground personnel either touch or come close enough to touch the suspended load, or protective rubber gloves shall be worn by all ground personnel either touching the suspended load or who are likely to touch the load.

[Order 76-38, § 296-45-67525, filed 12/30/76.]

WAC 296-45-67527 Load permitted. (1) Weight of the external load shall not exceed the manufacturer's load limit.

(2) A helicopter shall not pull any cable, rope or similar line which is at any point attached to a fixed object other than the helicopter itself. Helicopters may pull a free-wheeling sock line so long as the end of the sock line is not tied to a reel, truck, or other fixed object. Such line cannot be tied to or otherwise secured to the roll-off reel other than by having been wrapped around such reel.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-45-67527, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67527, filed 12/30/76.]

WAC 296-45-67529 Visibility. Employees shall keep clear of and outside the downwash of the helicopters except as necessary to perform a permitted activity. Where reasonably practicable, reduced vision of the operator and ground crew shall be eliminated.

[Order 76-38, § 296-45-67529, filed 12/30/76.]

WAC 296-45-67531 Signal systems. (1) Communication shall be maintained between the air crew and ground personnel at all times. Such signal systems shall be understood by the air crew and the ground crew, including signalpersons, prior to the hoisting of any load. There shall be constant radio and hand signals used. The signalperson shall have the sole and exclusive function during periods of loading and unloading of signaling and maintaining communications with the pilot. The signalperson shall be so dressed as to make their appearance distinguishable from other members of the ground crew by the operator of the craft. This may be by way of orange-colored gloves, vest, or other wearing apparel. In addition, the leadworker and one top person shall also have an operating transmitter and receiver.

(2) Designated employees may come within 50 feet of the helicopter when the rotor blades are turning, but no closer, other than to enter the craft or to hook or unhook the load or do other essential functions. Other employee(s) shall not come closer than 100 feet of the craft when it is operating.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-45-67531, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67531, filed 12/30/76.]

WAC 296-45-67533 Approaching the helicopter. Whenever approaching or leaving a helicopter with blades rotating, all employees shall remain in full view of pilot or operator and remain in a crouched position if within 50 feet of the helicopter. No employee shall approach the rear of the helicopter unless directly authorized and directed by the operator of such craft to be there at that time. All employees when operating or working within 50 feet of the helicopter

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with blades turning are subject to the direction of the helicopter operator. No employee shall enter or leave the helicopter unless and until the place at which they enter or leave such craft is large enough for the helicopter itself to land.

[Order 76-38, § 296-45-67533, filed 12/30/76.]

WAC 296-45-67535 In helicopter. (1) While in the helicopter, safety belts will remain fastened at all times except when pilot or operator instructs otherwise or while entering or leaving the helicopter.

(2) No smoking in the helicopter unless otherwise permitted by the pilot.

(3) All rack cargo will be secured prior to and during takeoff and flight.

(4) All internal cargo will be secured or otherwise held.

(5) No gear shall be thrown toward or placed in front of the cockpit on or near plexiglass enclosure.

(6) No employee shall lean against or rub the plexiglass.

(7) No employee shall ride in or work under or near a helicopter with less than 15 minutes reserve fuel.

(8) No employee shall have sharp objects in their pocket while sitting in or on the helicopter.

(9) No employee shall touch any switch, knob, instrument, or other control or device in the cockpit unless specifically directed by the operator.

(10) No cargo shall be thrown into pans or cargo rack.

(11) No employee shall obscure or otherwise obstruct the pilot's ability to visually see the instruments or flight path during flight or operation.

(12) No employee shall attempt to slow or stop the rotorcraft blades by hand unless directed or instructed to do so and aided by the pilot.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-45-67535, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67535, filed 12/30/76.]

WAC 296-45-67537 Sling and rigging. (1) The sling used for the external load shall be inspected each day before use. An employee designated as rigger, who shall be capable of properly inspecting the rigging, shall inspect the sling.

(2) No sling shall be used unless it has a minimum tensile strength of four times the load which will be carried or is being carried.

(3) No sling shall be used unless upon inspection it is determined to be in good condition and capable of the work which is to be performed.

[Order 76-38, § 296-45-67537, filed 12/30/76.]

WAC 296-45-67539 Personnel. All ground personnel shall be physically and mentally able to perform the work to which they are assigned, including being knowledgeable in these rules. There shall be a sufficient number of ground personnel so as to be able to safely guide, secure, hook and unhook the load.

[Order 76-38, § 296-45-67539, filed 12/30/76.]

WAC 296-45-67541 Fires. Open fires shall not be permitted in any area in which said fires will be affected by the

downwash of the rotors, nor shall any employee smoke in an area subject to the downdraft of the rotor.

[Order 76-38, § 296-45-67541, filed 12/30/76.]

WAC 296-45-67543 General. No employee shall work under or in the near vicinity of helicopters unless the operator has a valid license for operating the craft, knows the signals to be used, has been present at the last briefing held and knows these rules. No employee shall work under or near such craft if the operator is under the influence of intoxicating beverages or prescription medications which affect his/her ability, nor shall any employee work under or near such craft if the operator is careless or engages in any negligent or reckless operation of the helicopter.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-45-67543, filed 9/30/94, effective 11/20/94; Order 76-38, § 296-45-67543, filed 12/30/76.]

WAC 296-45-67545 Refueling operations. (1) Under no circumstances shall the refueling of any type helicopter with either aviation gasoline or Jet B (Turbine) type fuel be permitted while the engines are running.

(2) Helicopters using Jet A (Turbine-Kerosene) type fuel may be refueled with engines running provided the following criteria is met:

(a) No unauthorized persons shall be allowed within fifty feet of the refueling operation or fueling equipment.

(b) A minimum of one thirty-pound fire extinguisher, or a combination of same, good for class A, B and C fires, shall be provided within one hundred feet on the upwind side of the refueling operation.

(c) All fueling personnel shall be thoroughly trained in the refueling operation and in the use of the available fire extinguishing equipment they may be expected to utilize.

(d) There shall be no smoking, open flames, exposed flame heaters, flare pots, or open flame lights within fifty feet of the refueling area or fueling equipment. All entrances to the refueling area shall be posted with "NO SMOKING" signs.

(e) Due to the numerous causes of static electricity, it shall be considered present at all times. Prior to starting refueling operations, the fueling equipment and the helicopter shall be grounded and the fueling nozzle shall be electrically bonded to the helicopter. The use of conductive hose shall not be accepted to accomplish this bonding. All grounding and bonding connections shall be electrically and mechanically firm, to clean unpainted metal parts.

(f) To control spills, fuel shall be pumped either by hand or power. Pouring or gravity flow shall not be permitted. Self-closing nozzles or deadman controls shall be used and shall not be blocked open. Nozzles shall not be dragged along the ground.

(g) In case of a spill, the fueling operation shall be immediately stopped until such time as the person-in-charge determines that it is safe to resume the refueling operation.

(h) When ambient temperatures have been in the one hundred degrees Fahrenheit range for an extended period of time, all refueling of helicopters with the engines running shall be suspended until such time as conditions become suitable to resume refueling with the engines running.

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(3) Helicopters with their engines stopped being refueled with aviation gasoline or Jet B (Turbine) type fuel, shall also comply with subsection (2)(a) through (g) of this section.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-45-67545, filed 5/15/89, effective 6/30/89.]

WAC 296-45-900 Appendices. Nonmandatory.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-900, filed 3/6/98, effective 5/6/98.]

WAC 296-45-901 Appendix A—Nonmandatory.

TABLE 2
AC Live Work Minimum Approach Distance With Transient Overvoltage Factor

Maximum anticipated per-unit transient overvoltage	Distance to employee in feet-inches, phase to ground						
	Air, and clear live-line tool						
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	550	800
1.5						6-0	9-8
1.6						6-6	10-8
1.7						7-0	11-8
1.8						7-7	12-8
1.9						8-1	13-9
2.0	2-5	2-9	3-0	3-10	5-3	8-9	14-11
2.1	2-6	2-10	3-2	4-0	5-5	9-4	
2.2	2-7	2-11	3-3	4-1	5-9	9-11	
2.3	2-8	3-0	3-4	4-3	6-1	10-6	
2.4	2-9	3-1	3-5	4-5	6-4	11-3	
2.5	2-9	3-2	3-6	4-6	6-8		
2.6	2-10	3-3	3-8	4-8	7-1		
2.7	2-11	3-4	3-9	4-10	7-5		
2.8	3-0	3-5	3-10	4-11	7-9		
2.9	3-1	3-6	3-11	5-1	8-2		
3.0	3-2	3-7	4-0	5-3	8-6		

TABLE 3
AC Live Work Minimum Approach Distance With Transient Overvoltage Factor

Maximum anticipated per-unit transient overvoltage	Distance to employee in feet-inches, phase to ground						
	Air, and clear live-line tool						
	Maximum phase-to-phase voltage in kilovolts						
	121	145	169	242	362	550	800
1.5						7-4	12-1
1.6						8-9	14-6
1.7						10-2	17-2
1.8						11-7	19-11
1.9						13-2	22-11
2.0	3-7	4-1	4-8	6-1	8-7	14-10	26-0
2.1	3-7	4-2	4-9	6-3	8-10	15-7	
2.2	3-8	4-3	4-10	6-4	9-2	16-4	
2.3	3-9	4-4	4-11	6-6	9-6	17-2	
2.4	3-10	4-5	5-0	6-7	9-11	18-1	
2.5	3-11	4-6	5-2	6-9	10-4		
2.6	4-0	4-7	5-3	6-11	10-9		
2.7	4-1	4-8	5-4	7-0	11-2		
2.8	4-1	4-9	5-5	7-2	11-7		
2.9	4-2	4-10	5-6	7-4	12-1		
3.0	4-3	4-11	5-8	7-6	12-6		

TABLE 4
DC Live Work Minimum Approach Distance With Transient Overvoltage Factor

Maximum anticipated per-unit transient overvoltage	Distance to employee in feet, conductor to ground				
	Air, and clear live-line tool				
	Maximum phase-to-phase voltage in kilovolts				
	250	400	500	600	750
1.5 or lower	3-8	5-3	6-9	8-7	10-11
1.6	3-10	5-7	7-4	9-5	13-1
1.7	4-1	6-0	7-11	10-3	14-4
1.8	4-3	6-5	8-7	11-2	15-9

TABLE 5
Altitude Correction Factor

Altitude		Correction factor
(m)	(ft)	
900	3000	1.00
1200	4000	1.02
1500	5000	1.05
1800	6000	1.08
2100	7000	1.11
2400	8000	1.14
2700	9000	1.17
3000	10,000	1.20
3600	12,000	1.25
4200	14,000	1.30
4800	16,000	1.35
5400	18,000	1.39
6000	20,000	1.44

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-901, filed 3/6/98, effective 5/6/98.]

WAC 296-45-903 Appendix B—Protection from step and touch potentials—Nonmandatory.**I. "Introduction"**

When a ground fault occurs on a power line, voltage is impressed on the "grounded" object faulting the line. The voltage to which this object rises depends largely on the voltage on the line, on the impedance of the faulted conductor, and on the impedance to "true," or "absolute," ground represented by the object. If the object causing the fault represents a relatively large impedance, the voltage impressed on it is essentially the phase-to-ground system voltage. However, even faults to well grounded transmission towers or substation structures can result in hazardous voltages.⁽¹⁾ The degree of the hazard depends upon the magnitude of the fault current and the time of exposure.

Footnote⁽¹⁾ This appendix provides information primarily with respect to employee protection from contact between equipment being used and an energized power line. The information presented is also relevant to ground faults to transmission towers and substation structures; however, grounding systems for these structures should be designed to minimize the step and touch potentials involved.

II. "Voltage-gradient distribution"**A. Voltage-gradient distribution curve**

The dissipation of voltage from a grounding electrode (or from the grounded end of an energized grounded object) is called the ground potential gradient. Voltage drops associated with this dissipation of voltage are called ground potentials. Figure A is a typical voltage-gradient distribution curve (assuming a uniform soil texture). This graph shows that voltage decreases rapidly with increasing distance from the grounding electrode.

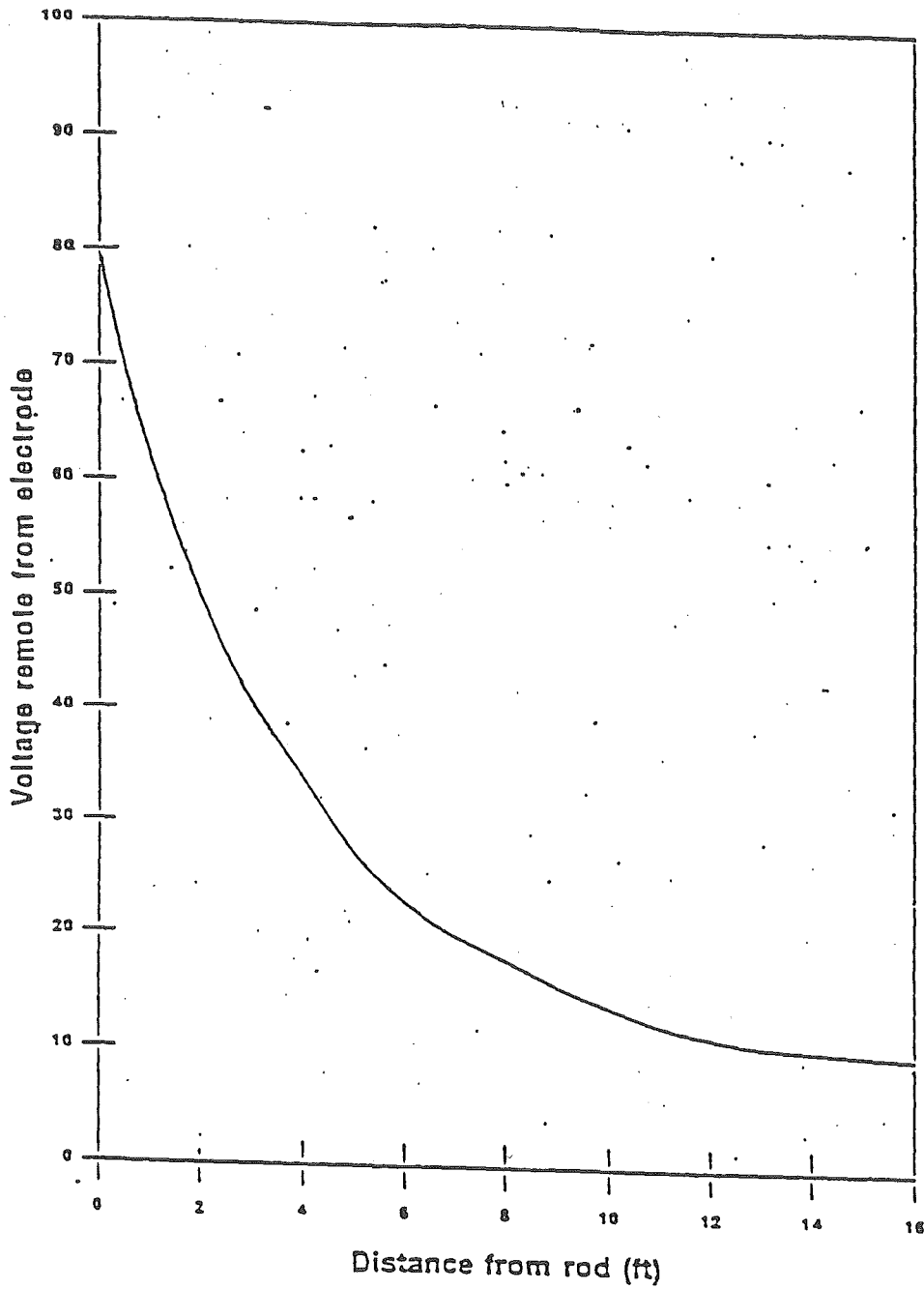


Figure A - Typical Voltage-Gradient Distribution Curve

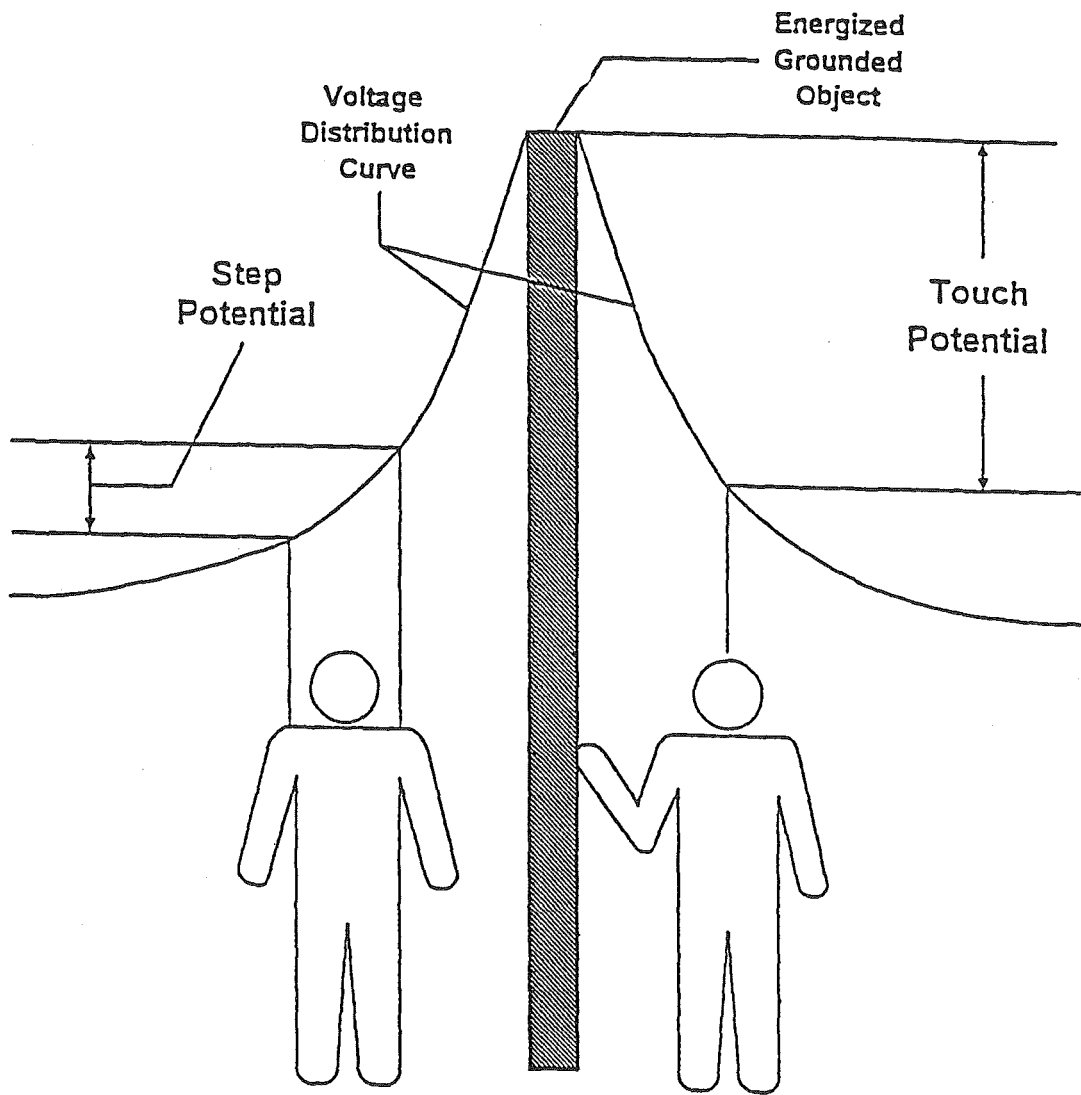


Figure B - Step and Touch Potentials

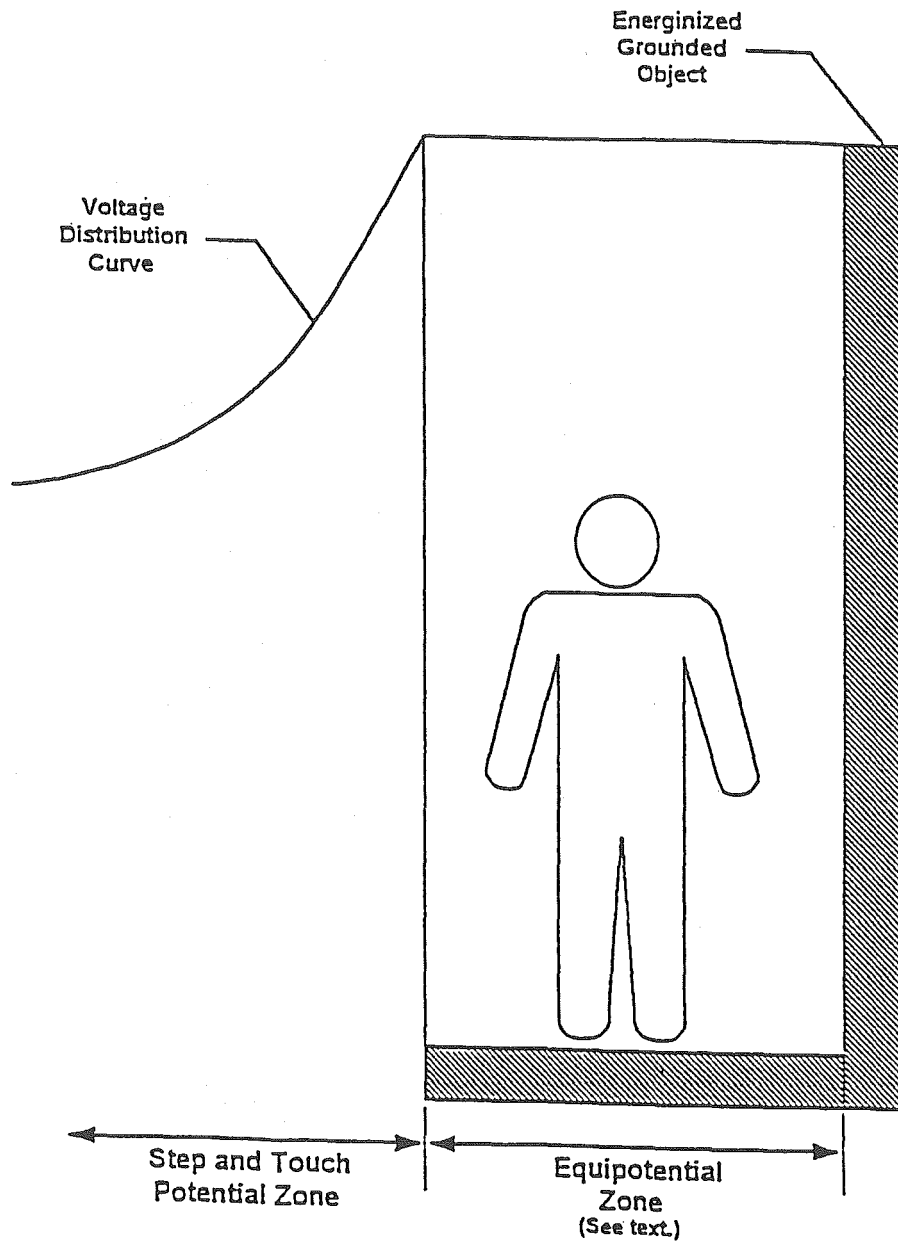


Figure C – Protection from Ground-Potential Gradients

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-903, filed 3/6/98, effective 5/6/98.]

WAC 296-45-905 Appendix C—Methods of inspecting and testing wood poles—Nonmandatory.

I. "Introduction"

When work is to be performed on a wood pole, it is important to determine the condition of the pole before it is climbed. The weight of the employee, the weight of equipment being installed, and other working stresses (such as the removal or retensioning of conductors) can lead to the failure of a defective pole or one that is not designed to handle the additional

stresses.⁽¹⁾ For these reasons, it is essential that an inspection and test of the condition of a wood pole be performed before it is climbed.

Footnote⁽¹⁾

A properly guyed pole in good condition should, at a minimum, be able to handle the weight of an employee climbing it. If the pole is found to be unsafe to climb or to work from, it must be secured so that it does not fail while an employee is on it. The pole can be secured by a line truck boom, by ropes or guys, or by lashing a new pole alongside it. If a new one is lashed alongside the defective pole, work should be performed from the new one.

(1999 Ed.)

II. "Inspection of wood poles"

Wood poles should be inspected by a qualified employee for the following conditions:⁽²⁾

Footnote⁽²⁾ The presence of any of these conditions is an indication that the pole may not be safe to climb or to work from. The employee performing the inspection must be qualified to make a determination as to whether or not it is safe to perform the work without taking additional precautions.

A. General condition

The pole should be inspected for buckling at the ground line and for an unusual angle with respect to the ground. Buckling and odd angles may indicate that the pole has rotted or is broken.

B. Cracks

The pole should be inspected for cracks. Horizontal cracks perpendicular to the grain of the wood may weaken the pole. Vertical ones, although not considered to be a sign of a defective pole, can pose a hazard to the climber, and the employee should keep his or her gaffs away from them while climbing.

C. Holes

Hollow spots and woodpecker holes can reduce the strength of a wood pole.

D. Shell rot and decay

Rotting and decay are cutout hazards and are possible indications of the age and internal condition of the pole.

E. Knots

One large knot or several smaller ones at the same height on the pole may be evidence of a weak point on the pole.

F. Depth of setting

Evidence of the existence of a former ground line substantially above the existing ground level may be an indication that the pole is no longer buried to a sufficient extent.

G. Soil conditions

Soft, wet, or loose soil may not support any changes of stress on the pole.

H. Burn marks

Burning from transformer failures or conductor faults could damage the pole so that it cannot withstand mechanical stress changes.

III. "Testing of wood poles"

The following tests are recognized as acceptable methods of testing wood poles:

A. Hammer test

Rap the pole sharply with a hammer weighing about 3 pounds, starting near the ground line and continuing upwards circumferentially around the pole to a height of approximately 6 feet. The hammer will produce a clear sound and rebound sharply when striking sound wood. Decay pockets will be indicated by a dull sound or a less pronounced hammer rebound. Also, prod the pole as near the ground line as possible using a pole prod or a screwdriver with a blade at least 5 inches long. If substantial decay is encountered, the pole is considered unsafe.

B. Rocking test

Apply a horizontal force to the pole and attempt to rock it back and forth in a direction perpendicular to the line. Caution must be exercised to avoid causing power lines to swing together. The force may be applied either by pushing with a

pike pole or pulling with a rope. If the pole cracks during the test, it shall be considered unsafe.

[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-905, filed 3/6/98, effective 5/6/98.]

Chapter 296-46 WAC**SAFETY STANDARDS—INSTALLING ELECTRIC WIRES AND EQUIPMENT—ADMINISTRATIVE RULES****WAC**

296-46-090	Foreword.
296-46-100	Approval for conductors and equipment.
296-46-110	Marking of disconnecting means.
296-46-130	Classification or definition of occupancies.
296-46-140	Plan review for educational, institutional or health care facilities and other buildings.
296-46-155	Wiring methods for designated building occupancies.
296-46-180	Meter installation.
296-46-21008	Branch circuits.
296-46-21052	Receptacles.
296-46-220	Branch circuit and feeder calculations.
296-46-225	Outside branch circuits and feeders.
296-46-23001	Service requirements.
296-46-23028	Service or other masts.
296-46-23040	Service conductors.
296-46-23062	Service equipment.
296-46-30001	Support of raceways and cables in suspended ceilings.
296-46-316	Duct bank conductor ampacities.
296-46-324	Knob-and-tube wiring.
296-46-336	Nonmetallic cable systems.
296-46-348	Electrical metallic tubing.
296-46-360	Amusement rides or structures, carnivals, circuses, and similar traveling shows.
296-46-365	Concerts, motion picture productions, stage shows, and similar shows.
296-46-370	(Reserved.)
296-46-422	Water heater circuit.
296-46-45001	Transformers.
296-46-480	Location of pad-mounted transformers.
296-46-490	Location of total underground transformers.
296-46-495	Electrical work permits and fees.
296-46-50002	On-site sewage disposal systems.
296-46-514	Gasoline dispensing and service stations.
296-46-553	Boat moorages, floating buildings, and similar installations.
296-46-600	Electrical signs.
296-46-670	Definitions.
296-46-680	Electrical equipment associated with spas, hot tubs, swimming pools or hydromassage bathtubs.
296-46-700	Emergency systems.
296-46-702	Optional standby systems.
296-46-710	Identification of cables.
296-46-725	Class 2 and Class 3 cables.
296-46-770	Optical fiber cables.
296-46-910	Inspection fees.
296-46-915	Electrical contractor license, administrator certificate and examination, and copy fees.
296-46-920	Civil penalty.
296-46-930	Electrical contractor license and administrator certificate designation.
296-46-935	Exemptions.
296-46-940	Electrical contractor license.
296-46-950	Administrators certificate.
296-46-960	Revocation or suspension of a contractor license or administrator certificate.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-46-010,	296-46-020, 296-46-030, 296-46-040, 296-46-050, 296-46-060. [Filed 9/22/60, effective 12/1/60.] Repealed by Order 69-2, filed 2/28/69, effective 4/1/69.
296-46-115	Definitions. [Statutory Authority: RCW 19.28.060, 81-06-037 (Order 81-5), § 296-46-115, filed 2/27/81, effective 4/1/81.] Repealed by 83-23-053 (Order 83-32), filed 11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.

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[Statutory Authority: RCW 49.17.010, [49.17].040, [49.17].050 and [49.17].060. 98-07-009, § 296-45-905, filed 3/6/98, effective 5/6/98.]

Chapter 296-46 WAC**SAFETY STANDARDS—INSTALLING ELECTRIC WIRES AND EQUIPMENT—ADMINISTRATIVE RULES****WAC**

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296-46-370	(Reserved.)
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296-46-480	Location of pad-mounted transformers.
296-46-490	Location of total underground transformers.
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296-46-553	Boat moorages, floating buildings, and similar installations.
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296-46-670	Definitions.
296-46-680	Electrical equipment associated with spas, hot tubs, swimming pools or hydromassage bathtubs.
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296-46-702	Optional standby systems.
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296-46-725	Class 2 and Class 3 cables.
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296-46-920	Civil penalty.
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296-46-935	Exemptions.
296-46-940	Electrical contractor license.
296-46-950	Administrators certificate.
296-46-960	Revocation or suspension of a contractor license or administrator certificate.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-46-010,	296-46-020, 296-46-030, 296-46-040, 296-46-050, 296-46-060. [Filed 9/22/60, effective 12/1/60.] Repealed by Order 69-2, filed 2/28/69, effective 4/1/69.
296-46-115	Definitions. [Statutory Authority: RCW 19.28.060, 81-06-037 (Order 81-5), § 296-46-115, filed 2/27/81, effective 4/1/81.] Repealed by 83-23-053 (Order 83-32), filed 11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.

- 296-46-120 Workmanship. [Order 72-7, § 296-46-120, filed 6/7/72; Order 69-2, § 296-46-120, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-150 Wiring methods for designated building occupancies. [Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-150, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-150, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-150, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-150, filed 7/17/84. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-150, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-150, filed 1/31/78; Order 75-25, § 296-46-150, filed 8/4/75; Order 74-43, § 296-46-150, filed 12/19/74; Order 72-7, § 296-46-150, filed 6/7/72; Order 69-2, § 296-46-150, filed 2/28/69, effective 4/1/69.] Repealed by 97-12-016, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600.
- 296-46-160 Service requirements. [Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-160, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-160, filed 7/17/84; Order 69-2, § 296-46-160, filed 2/28/69, effective 4/1/69.] Repealed by 90-19-015, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
- 296-46-165 Service ampacity. [Order 72-7, § 296-46-165, filed 6/7/72.] Repealed by Order 74-43, filed 12/19/74.
- 296-46-170 Clearance of service drop for single family or duplex residences. [Order 69-2, § 296-46-170, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-190 Current transformers. [Order 69-2, § 296-46-190, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-200 Service entrance conductors. [Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-200, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-200, filed 7/17/84. Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-200, filed 1/31/78; Order 74-43, § 296-46-200, filed 12/19/74; Order 73-7, § 296-46-200, filed 5/17/73; Order 69-2, § 296-46-200, filed 2/28/69, effective 4/1/69.] Repealed by 90-19-015, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
- 296-46-210 Service entrance cable. [Order 69-2, § 296-46-210, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-230 Service entrance. [Order 74-43, § 296-46-230, filed 12/19/74; Order 72-7, § 296-46-230, filed 6/7/72; Order 69-2, § 296-46-230, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-240 Service mast. [Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-240, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-240, filed 7/17/84; Order 69-2, § 296-46-240, filed 2/28/69, effective 4/1/69.] Repealed by 90-19-015, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
- 296-46-242 Transformer neutral grounding. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-242, filed 1/31/78.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-244 Utility conductor limitations. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-244, filed 1/31/78.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-250 Safe wiring label. [Order 69-2, § 296-46-250, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.
- 296-46-260 Direct burial cable. [Order 75-25, § 296-46-260, filed 8/4/75; Order 72-7, § 296-46-260, filed 6/7/72; Order 69-2, § 296-46-260, filed 2/28/69, effective 4/1/69.] Repealed by Order 74-43, filed 12/19/74 and later adopted, as amended, by Order 75-25, filed 8/4/75.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.
- 296-46-265 Conductors of different systems. [Order 74-43, § 296-265 (codified as WAC 296-46-265), filed 12/19/74.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.
- 296-46-270 Metallic plumbing lines. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-270, filed 1/31/78; Order 69-2, § 296-46-270, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-280 Garbage disposal, waste disposal or waste compactor appliances and dishwasher circuits. [Order 72-7, § 296-46-280, filed 6/7/72; Order 69-2, § 296-46-280, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-290 Range circuit. [Order 69-2, § 296-46-290, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-300 Water heaters. [Order 75-25, § 296-46-300, filed 8/4/75; Order 74-43, § 296-46-300, filed 12/19/74; Order 69-2, § 296-46-300, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-310 Clothes dryers. [Order 69-2, § 296-46-310, filed 2/28/69, effective 4/1/69.] Repealed by Order 72-7, filed 6/7/72.
- 296-46-320 Electric heating. [Order 74-43, § 296-46-320, filed 12/19/74; Order 73-7, § 296-46-320, filed 5/17/73; Order 72-7, § 296-46-320, filed 6/7/72; Order 69-2, § 296-46-320, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.
- 296-46-330 Bathroom receptacles. [Order 69-2, § 296-46-330, filed 2/28/69, effective 4/1/69.] Repealed by Order 72-7, filed 6/7/72.
- 296-46-335 Unfinished areas. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-335, filed 2/27/81, effective 4/1/81; Order 74-43, § 296-46-335, filed 12/19/74; Order 72-7, § 296-46-335, filed 6/7/72.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-340 Recreation room. [Order 69-2, § 296-46-340, filed 2/28/69, effective 4/1/69.] Repealed by Order 74-43, filed 12/19/74.
- 296-46-350 Emergency systems. [Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-350, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-350, filed 7/17/84. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-350, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-350, filed 1/31/78; Order 72-7, § 296-46-350, filed 6/7/72; Order 69-2, § 296-46-350, filed 2/28/69, effective 4/1/69.] Repealed by 90-19-015, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
- 296-46-355 Mobile home connections. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-355, filed 2/27/81, effective 4/1/81.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-380 Rockcrushers. [Order 69-2, § 296-46-380, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-390 Woodworking plants. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-390, filed 1/31/78; Order 69-2, § 296-46-390, filed 2/28/69, effective 4/1/69.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-400 Mobile homes. [Order 69-2, § 296-46-400, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098

	(Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.		11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.
296-46-401	License fee. [Order 71-17, § 296-46-401, filed 12/7/71.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.	296-46-510	Definitions. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-510, filed 1/31/78; Order 74-43, § 296-46-510, filed 12/19/74.] Repealed by 81-06-037 (Order 81-5), filed 2/27/81, effective 4/1/81. Statutory Authority: RCW 19.28.060.
296-46-40101	Administrator fees. [Order 74-43, § 296-46-401, (codified as WAC 296-46-40101), filed 12/19/74.] Repealed by 81-06-037 (Order 81-5), filed 2/27/81, effective 4/1/81. Statutory Authority: RCW 19.28.060.	296-46-515	Officers. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-515, filed 1/31/78; Order 74-43, § 296-46-515, filed 12/19/74.] Repealed by 81-06-037 (Order 81-5), filed 2/27/81, effective 4/1/81. Statutory Authority: RCW 19.28.060.
296-46-402	Fees. [Order 75-25, § 296-46-402, filed 8/4/75; Order 74-43, § 296-46-402, filed 12/19/74; Order 71-17, § 296-36-402 (codified as WAC 296-46-402), filed 12/7/71.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.	296-46-517	Health care facilities. [Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-517, filed 9/10/90, effective 10/11/90.] Repealed by 93-06-072, filed 3/2/93, effective 4/2/93. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
296-46-410	Conductor termination. [Order 69-2, § 296-46-410, filed 2/28/69, effective 4/1/69.] Repealed by Order 72-7, filed 6/7/72.	296-46-520	Internal management. [Order 74-43, § 296-46-520, filed 12/19/74.] Repealed by 81-06-037 (Order 81-5), filed 2/27/81, effective 4/1/81. Statutory Authority: RCW 19.28.060.
296-46-420	Nonmetallic cable systems—Ground-fault circuit interrupter protection—Knob and tube wiring. [Statutory Authority: RCW 19.28.060. 88-15-063 (Order 88-14), § 296-46-420, filed 7/18/88. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-420, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-420, filed 7/17/84; Order 69-2, § 296-46-420, filed 2/28/69, effective 4/1/69.] Repealed by 90-19-015, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.	296-46-525	Board duties. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-525, filed 1/31/78; Order 74-43, § 296-46-525, filed 12/19/74.] Repealed by 81-06-037 (Order 81-5), filed 2/27/81, effective 4/1/81. Statutory Authority: RCW 19.28.060.
296-46-424	Residential occupancies, ground fault circuit interrupters. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-424, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-424, filed 1/31/78; Order 75-25, § 296-46-424, filed 8/4/75.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.	296-46-530	Hearings. [Order 74-43, § 296-46-530, filed 12/19/74.] Repealed by 83-23-053 (Order 83-32), filed 11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.
296-46-425	Construction sites. [Order 74-43, § 296-46-425, filed 12/19/74.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.	296-46-535	Appearance and practice before advisory board. [Order 74-43, § 296-46-535, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-426	Bonding agricultural structures and equipment. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-426, filed 1/31/78; Order 74-43, § 296-46-426, filed 1/3/75.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.	296-46-540	Solicitation of business unethical. [Order 74-43, § 296-46-540, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-450	Grounded neutral conductor. [Order 69-2, § 296-46-450, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.	296-46-545	Standards of ethical conduct. [Order 74-43, § 296-46-545, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-460	Terminating immediately inside an outside building wall. [Order 75-25, § 296-46-460, filed 8/4/75; Order 72-7, § 296-46-460, filed 6/7/72; Order 69-2, § 296-46-460, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060.	296-46-550	Appearance by former employee. [Order 74-43, § 296-46-550, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-492	Electrical license and administrator certificate designation. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-492, filed 1/31/78.] Repealed by 83-23-053 (Order 83-32), filed 11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.	296-46-55001	Mobile or manufactured homes. [Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-55001, filed 9/10/90, effective 10/11/90.] Repealed by 93-06-072, filed 3/2/93, effective 4/2/93. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600.
296-46-493	Electrical contractor license and administrator certificate fees. [Statutory Authority: RCW 19.28.060 and 19.28.210. 82-18-036 (Order 82-29), § 296-46-493, filed 8/26/82. Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-493, filed 1/31/78.] Repealed by 83-23-053 (Order 83-32), filed 11/14/83. Statutory Authority: RCW 19.28.120 and 19.28.510.	296-46-555	Former employee as expert witness. [Order 74-43, § 296-46-555, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-500	Electrical advisory board. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-500, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-500, filed 1/31/78; Order 74-43, § 296-46-500, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.	296-46-560	Computation of time. [Order 74-43, § 296-46-560, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-501	Board of electrical examiners. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-501, filed 2/27/81, effective 4/1/81.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.	296-46-565	Administrative Procedure Act. [Order 74-43, § 296-46-565, filed 12/19/74.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
296-46-506	Responsibilities of electrical contractors administrator certificate holders—Revocation of certificates—Appeals. [Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-506, filed 2/27/81, effective 4/1/81.] Repealed by 83-23-053 (Order 83-32), filed	296-46-590	Electric heating. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-590, filed 1/31/78.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
		296-46-59005	Appendix A—Residential heat loss tables. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-59005, filed 1/31/78. Formerly Appendix A.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
		296-46-59010	Appendix B—Outdoor design temperatures. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-59010, filed 1/31/78. Formerly Appendix B.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
		296-46-900	Appendix C—Drawing E-103. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-900, filed 1/31/78; Order 75-25, Appendix C—Drawing E-103 (codified as WAC 296-46-900), filed 8/4/75; Order 72-7, Appendix C, filed 6/7/72.] Repealed by 84-

- 15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- 296-46-905 Appendix D—Drawing E-104. [Order 75-25, Appendix D (codified as WAC 296-46-905), filed 8/4/75; Order 72-7, Appendix D, filed 6/7/72.] Repealed by 84-15-051 (Order 84-10), filed 7/17/84. Statutory Authority: RCW 19.28.010 and 19.28.060.
- Appendix A Residential heat loss tables. [Order 72-7, Appendix A—Residential heat loss tables, filed 6/7/72; Order 69-2, Appendix A—Electric heat loss calculation, filed 2/28/69, effective 4/1/69.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060. Later promulgation, see WAC 296-46-59005.
- Appendix B Outdoor design temperatures—Charts. [Order 72-7, Appendix B—Outdoor design temperatures—Charts, filed 6/7/72.] Repealed by 78-02-098 (Order 77-31), filed 1/31/78. Statutory Authority: RCW 19.28.060. Later promulgation, see WAC 296-46-59010.

Reviser's note: The 1978 Edition of National Electrical Code (NFPA No. 70-1978) was adopted by the department of labor and industries on January 1, 1978. [Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), filed 1/31/78.]

WAC 296-46-090 Foreword. The 1996 edition of the National Electrical Code (NFPA 70 - 1996) including Appendixes A, B, and C, the 1993 edition of Centrifugal Fire Pumps (NFPA 20 - 1993) and the 1993 edition of Emergency and Standby Power Systems (NFPA 110 - 1993) are hereby adopted by reference as part of this chapter. Other codes, manuals, and reference works referred to in this chapter are available for inspection and review in the Olympia office of the electrical section of the department during business hours. Where there is any conflict between this chapter and the National Electrical Code (NFPA 70), Centrifugal Fire Pumps (NFPA 20) or Emergency and Standby Power Systems (NFPA 110), the requirements of this chapter shall be observed. Where there is any conflict between Centrifugal Fire Pumps (NFPA 20) or Emergency and Standby Power Systems (NFPA 110) and the National Electrical Code (NFPA 70), the National Electrical Code shall be followed.

Electrical inspectors will give information as to the meaning or application of the National Electrical Code, the standard on Centrifugal Fire Pumps and the standard on Emergency and Standby Power Systems and this chapter, but will not lay out work or act as consultants for contractors, owners, or users.

The department is authorized to enforce city electrical ordinances where those governmental agencies do not make electrical inspections under an established program.

At the time of inspection, electrical wiring or equipment subject to this chapter must be sufficiently accessible to permit the inspector to visually inspect the installation to verify conformance with the National Electrical Code and any other electrical requirements of chapter 296-46 WAC. Visual inspection of cables or raceways shall not be required where cables or raceways are fished according to the National Electrical Code. Wires pulled into raceway shall not be considered concealed.

[Statutory Authority: Chapter 19.28 RCW. 97-24-033, § 296-46-090, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-090, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-090, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-090, filed 9/10/90, effective 10/11/90.]

(1999 Ed.)

WAC 296-46-100 Approval for conductors and equipment. In order to meet the minimum electrical safety standards for installations, all materials, devices, appliances, and equipment, not exempted in RCW 19.28.010, shall conform to applicable standards recognized by the department or be listed by an electrical products testing laboratory accredited by the department. Listed materials and equipment must be used in electrical installations when a recognized published electrical product safety standard exists to test the materials and equipment, and when two or more manufacturers have products that are listed and labeled in that product category.

Custom built machinery and equipment will not be required to be listed by an accredited products testing laboratory. However, the department will require such unlisted equipment to be field evaluated and approved for safety by a firm recognized by the department to perform the evaluation using acceptable standards. Department electrical inspectors may also inspect and approve industrial control panels and utilization equipment for compliance with codes, rules, and standards recognized by the department, on a case-by-case basis consistent with WAC 296-46-670.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-100, filed 5/29/98, effective 6/30/98.]

WAC 296-46-110 Marking of disconnecting means. Where electrical equipment is installed to obtain a series combination rating, the identification as required by Section 110-22 shall be in the form of an adhesive label or decal or similar approved means that is suitable for the environment and is substantially yellow in color. The words "CAUTION - SERIES RATED SYSTEM" shall be printed or engraved on the label or decal in block letters at least 1/2 inch high and in a contrasting color.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-110, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-110, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-110, filed 7/17/84. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-110, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-110, filed 1/31/78; Order 74-43, § 296-46-110, filed 12/19/74; Order 72-7, § 296-46-110, filed 6/7/72; Order 69-2, § 296-46-110, filed 2/28/69, effective 4/1/69.]

WAC 296-46-130 Classification or definition of occupancies. Occupancies shall be classified and defined by the agency that registers or licenses their operation, as follows:

(1) Educational facility refers to a building or portion of a building used primarily for educational purposes and shall include buildings used for the gathering of groups of six or more persons for purposes of instruction. Educational occupancy includes, but is not restricted to: Schools, colleges, academies, and universities.

(2) Institutional facility refers to a building or portion of a building used primarily for detention and correctional occupancies where some degree of restraint or security is required. Such occupancies shall include, but are not restricted to: Penal institutions, reformatories, jails, detention centers, correctional centers, and residential-restrained care.

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(3) Health or personal care facility. Health or personal care facility refers to buildings or parts of buildings that contain but are not limited to facilities such as a hospital, nursing home, alcoholism hospital, psychiatric hospital, boarding home, alcoholism treatment facility, maternity home, birth center or childbirth center, residential treatment facility for psychiatrically impaired children and youths, and renal hemodialysis clinics that are licensed by the department of social and health services; and medical, dental or chiropractic offices or clinics, outpatient or ambulatory surgical clinics, and such other health care occupancies where patients who may be unable to provide for their own needs and safety without the assistance of another person are treated.

(a) "Hospital" means any institution, place, building, or agency providing accommodations, facilities and services over a continuous period of twenty-four hours or more, for observation, diagnosis, or care of two or more individuals not related to the operator who are suffering from illness, injury, deformity, or abnormality, or from any other condition for which obstetrical, medical, or surgical services would be appropriate for care or diagnosis.

(b) "Nursing home unit" or "long-term care unit" means a group of beds for the accommodation of patients who, because of chronic illness or physical infirmities require skilled nursing care and related medical services but are not acutely ill and not in need of the highly technical or specialized services ordinarily a part of hospital care.

(c) "Boarding home" means any home or other institution, however named, which is advertised, announced, or maintained for the express or implied purpose of providing board and domiciliary care to three or more aged persons not related by blood or marriage to the operator. It shall not include any home, institution, or section thereof which is otherwise licensed and regulated under the provisions of state law providing specifically for the licensing and regulation of such home, institution, or section thereof.

(d) "Private alcoholism hospital" means an institution, facility, building, or equivalent designed, organized, maintained, and operated to provide diagnosis, treatment, and care of individuals demonstrating signs or symptoms of alcoholism, including the complications of associated substance use and other medical diseases that can be appropriately treated and cared for in the facility and providing accommodations, medical services, and other necessary services over a continuous period of twenty-four hours or more for two or more individuals unrelated to the operator, provided that this chapter shall not apply to any facility, agency, or other entity which shall be both owned and operated by a public or governmental body.

(e) "Alcoholism treatment facility" means a private place or establishment, other than a licensed hospital, operated primarily for the treatment of alcoholism.

(f) "Private psychiatric hospital" means an institution, facility, building, or agency specializing in the diagnosis, care, and treatment of individuals demonstrating signs and/or symptoms of mental disorder as defined in RCW 71.05.020(2), and providing accommodations and other necessary services over a continuous period of twenty-four hours or more for two or more individuals not related to the operator, provided that this chapter shall not apply to any facility,

agency, or other entity which shall be both owned and operated by a public or governmental body.

(g) "Maternity home" means any home, place, hospital, or institution in which facilities are maintained for the care of four or more women, not related by blood or marriage to the operator, during pregnancy or during or within ten days after delivery: *Provided, however,* That this definition shall not apply to any hospital approved by the American College of Surgeons, American Osteopathic Association or its successor.

(h) "Birth center" or "childbirth center" means a type of maternity home which is a house, building, or equivalent organized to provide facilities and staff to support a birth service, provided that the birth service is limited to low-risk maternal clients during the intrapartum period.

(i) "Ambulatory surgical facility" means a facility, not a part of a hospital, providing surgical treatment to patients not requiring inpatient care in a hospital. This term does not include a facility in the offices of private physicians or dentists, whether for individual or group practice, if the privilege of using such facility is not extended to physicians or dentists outside the individual or group practice. (NEC; Ambulatory Health Care Center.)

(j) "Hospice care center" means any building, facility, place, or equivalent, organized, maintained, and operated specifically to provide beds, accommodations, facilities, and services over a continuous period of twenty-four hours or more for palliative care of two or more individuals, not related to the operator, who are diagnosed as being in the latter stages of an advanced disease which is expected to lead to death.

(k) "Renal hemodialysis clinic" is a facility in a building or part of a building which is approved to furnish the full spectrum of diagnostic, therapeutic, and rehabilitative services required for the care of renal dialysis patients (including inpatient dialysis furnished directly or under arrangement). (NEC; Ambulatory Health Care Center.)

(l) "Medical, dental, and chiropractic clinic" means any clinic or physicians office where patients are not regularly kept as bed patients for twenty-four hours or more. **Electrical plan review not required.**

(m) "Residential treatment facility for psychiatrically impaired children and youth" means a residence, place, or facility designed and organized to provide twenty-four hour residential care and long-term individualized, active treatment for clients who have been diagnosed or evaluated as psychiatrically impaired.

(n) "Adult residential rehabilitation center" means a residence, place, or facility designed and organized primarily to provide twenty-four hour residential care, crisis and short-term care and/or long-term individualized active treatment and rehabilitation for clients diagnosed or evaluated as psychiatrically impaired or chronically mentally ill as defined herein or in chapter 71.24. RCW.

(o) "Group care facility" means a facility other than a foster-family home maintained and operated for the care of a group of children on a twenty-four-hour basis.

(4) Licensed day care centers.

(a) "Child day care center" means a facility providing regularly scheduled care for a group of children one month of

age through twelve years of age for periods less than twenty-four hours; except, a program meeting the definition of a family child care home shall not be licensed as a day care center without meeting the requirements of WAC 388-150-020 (5)(a).

(b) "School-age child care center" means a program operating in a facility other than a private residence accountable for school-age children when school is not in session. It shall meet department licensing requirements, provide adult supervised care, and a variety of developmentally appropriate activities.

(c) "Family child day care home" means the same as "family child care home" and "a child day care facility" licensed by the state, located in the family abode of the person or persons under whose direct care and supervision the child is placed, for the care of twelve or fewer children, including children who reside at the home. **Electrical plan review not required.**

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-130, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-130, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-130, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-130, filed 7/17/84. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-130, filed 2/27/81, effective 4/1/81; Order 72-7, § 296-46-130, filed 6/7/72; Order 69-2, § 296-46-130, filed 2/28/69, effective 4/1/69.]

WAC 296-46-140 Plan review for educational, institutional or health care facilities and other buildings. (1) Plan review is a part of the electrical inspection process; its primary purpose is to determine that loads are calculated per the proper NEC or WAC article or section and that conductors and equipment are adequately sized and rated to the calculated load. All electrical plans for new or altered electrical installations in educational, institutional, and health or personal care occupancies classified or defined in WAC 296-46-130 shall be reviewed and approved by the department before the electrical installation or alteration is begun. Plans for these electrical installations within cities that perform electrical inspections within their jurisdiction, and provide an electrical plan review program that equals or exceeds the department's program in plans examiner minimum qualifications per RCW 19.28.070, shall be submitted to that city for review rather than to the department, unless the agency licensing or regulating the installation specifically requires review by the department. Approved plans shall be available on the job site for use during the electrical installation or alteration and for use by the electrical inspector. Refer plans for department review to the Electrical Inspection Section, Department of Labor and Industries, P.O. Box 44460, Olympia, Washington 98504-4460. Please refer to WAC 296-46-910 for required fees for plan review.

(2) Plans to be reviewed by the department must be legible, identify the name and classification of the facility, clearly indicate the scope and nature of the installation and the person or firm responsible for the electrical plans. The plans shall clearly show the electrical installation or alteration in floor plan view, include switchboard and/or panelboard schedules and when a service or feeder is to be installed or altered, shall include a riser diagram, load calcu-

lation, fault current calculation and interrupting rating of equipment. Where existing electrical systems are to supply additional loads, the plans shall include documentation that proves adequate capacity and ratings.

(3) Plan review for new or altered electrical installations of other types of construction may be voluntarily requested by the owner or other interested parties.

(4) For existing structures where additions or alterations to feeders and services are proposed, NEC Article 220 shall govern, except that, in addition to the provisions of Paragraph 220-35 (1) Exception, the following is required:

(a) The date of the measurements.

(b) A diagram of the electrical system identifying the point(s) of measurement.

(c) Building demand measured continuously on the highest-loaded phase of the feeder or service over a thirty-day period, with demand peak clearly identified. (Peak demand shall be defined as the maximum average demand over a fifteen-minute interval.)

(5) Due to their minimal load requirements, plan review of the following limited energy systems will not be required: Fire alarm, nurse call, intrusion or security alarm, intercom, public address, music, energy management, programmed clock, data, cable television, or telephone.

(6) When a service or feeder is affected five percent or less by the addition or alteration of five or less branch circuits, plan review may be requested from the local inspection office. Permission for such small project plan review shall be granted at the discretion of the electrical inspection field supervisor, the plans examiner supervisor, or the chief electrical inspector.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-140, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-140, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-140, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-140, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-140, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-140, filed 7/17/84. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-140, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-140, filed 1/31/78; Order 74-43, § 296-46-140, filed 12/19/74; Order 72-7, § 296-46-140, filed 6/7/72; Order 69-2, § 296-46-140, filed 2/28/69, effective 4/1/69.]

WAC 296-46-155 Wiring methods for designated building occupancies. Wiring methods, equipment and devices for health or personal care, educational and institutional facilities as defined or classified in WAC 296-46-130 and for places of assembly for one hundred or more persons shall comply with Tables 1 and 2 and the notes thereto. For determining the occupant load of places of assembly, the methods of the currently adopted edition of the Uniform Building Code shall be used.

Table 1
Health or Personal Care Facilities
Electrical System - Wiring Methods

Health or Personal Care Facility Type	Power and Lighting	Emergency Power and Lighting	Limited Energy Systems	Patient Care Areas	Plan Review
Hospital	1	4	1	3	YES
Nursing home unit or long-term care unit	1	1	1	3	YES
Boarding home or assisted living facility	1	1	1		YES
Private alcoholism hospital	1	1	1	3	YES
Alcoholism treatment facility	1	1	1		YES
Private psychiatric hospital	1	1	1	3	YES
Maternity home	1	1	1	3	YES
Birth center or childbirth center	1	1	1	3	NO
Ambulatory surgery facility	1	1	1	3	YES
Hospice care center	1		1		NO
Renal hemodialysis clinic	1	1	1	3	YES
Medical, dental, and chiropractic clinic	1	1	1	3	NO
Residential treatment facility for psychiatrically impaired children and youth	1	1	1	3	YES
Adult residential rehabilitation center	1	1	1		YES
Group care facility	1	1	1		NO

Table 2
Educational and Institutional Facilities,
Places of Assembly or other facilities
Electrical System - Wiring Methods

Educational, Institutional or Other Facility Type	Power and Lighting	Emergency Power and Lighting	Limited Energy Systems	Plan Review Required
Educational	2	2	1	YES
Institutional	2	2	1	YES
Places of Assembly for 100 or more persons	1	1	1	NO

Educational, Institutional or Other Facility Type	Power and Lighting	Emergency Power and Lighting	Limited Energy Systems	Plan Review Required
Child day care center	1	1	1	NO
School-age child care center	1	1	1	NO
Family child day care home, family child care home, or child day care facility	1	1	1	NO

Notes to Tables 1 and 2

1. Wiring methods in accordance with the National Electrical Code.
2. Metallic or nonmetallic raceways, MI, MC, or AC cable.
3. Wiring methods in patient care areas shall comply with 1996 NEC article 517-13.
4. Emergency system wiring shall comply with 1996 NEC article 517-30 (c)(3).

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-155, filed 5/29/98, effective 6/30/98.]

WAC 296-46-180 Meter installation. Except as otherwise permitted by the serving utility, the height of the center of the service meter shall not be more than 7 feet or less than 5 feet above finished grade or the floor below the meter. Secondary instrument transformer conductors for metering shall not be permitted in the service raceway.

[Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-180, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-180, filed 7/17/84; Order 74-43, § 296-46-180, filed 12/19/74; Order 69-2, § 296-46-180, filed 2/28/69, effective 4/1/69.]

WAC 296-46-21008 Branch circuits. (Reserved.)

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-21008, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-21008, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-21008, filed 9/10/90, effective 10/11/90.]

WAC 296-46-21052 Receptacles. (1) Floor receptacle outlets shall be in compliance with NEC 370-27(b).

(2) Tamper resistant receptacles are required in licensed day care facilities and pediatric or psychiatric patient care areas for 15 or 20 ampere, 125 volt receptacles. Tamper resistant receptacles shall, by construction, limit improper access to energized contacts.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-21052, filed 5/29/98, effective 6/30/98; 97-24-033, § 296-46-21052, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-21052, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-21052, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-21052, filed 9/10/90, effective 10/11/90.]

WAC 296-46-220 Branch circuit and feeder calculations. (1) Where unfinished spaces adaptable to future dwelling unit living area are not readily accessible to the service or branch circuit panelboard, circuits shall be taken to the area and terminated in a suitable box. The box shall contain an

identification of the intended purpose of the circuit(s). Adequate space and capacity shall be provided in the branch circuit panelboard serving the intended load.

(2) Occupancy lighting loads. In determining feeder and service entrance conductor sizes and equipment ratings, the currently adopted Washington state energy code unit lighting power allowance table and footnotes may be used in lieu of NEC Table 220-3 (b).

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-220, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-220, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-220, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-220, filed 7/17/84. Statutory Authority: RCW 19.28.060. 78-02-098 (Order 77-31), § 296-46-220, filed 1/31/78; Order 72-7, § 296-46-220, filed 6/7/72; Order 69-2, § 296-46-220, filed 2/28/69, effective 4/1/69.]

WAC 296-46-225 Outside branch circuits and feeders. For the purpose of Article 225-8 (b) of the National Electrical Code, the branch circuit or feeder raceway or cable shall extend no more than 15 feet inside a building or structure. A building supplied by a single feeder, with proper overcurrent protection where the conductors receive their supply, shall be permitted to exclude from the 15 foot measurement that portion of the feeder run within a crawl space and outside of the building structural elements and insulation envelope.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-225, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-225, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-225, filed 3/2/93, effective 4/2/93.]

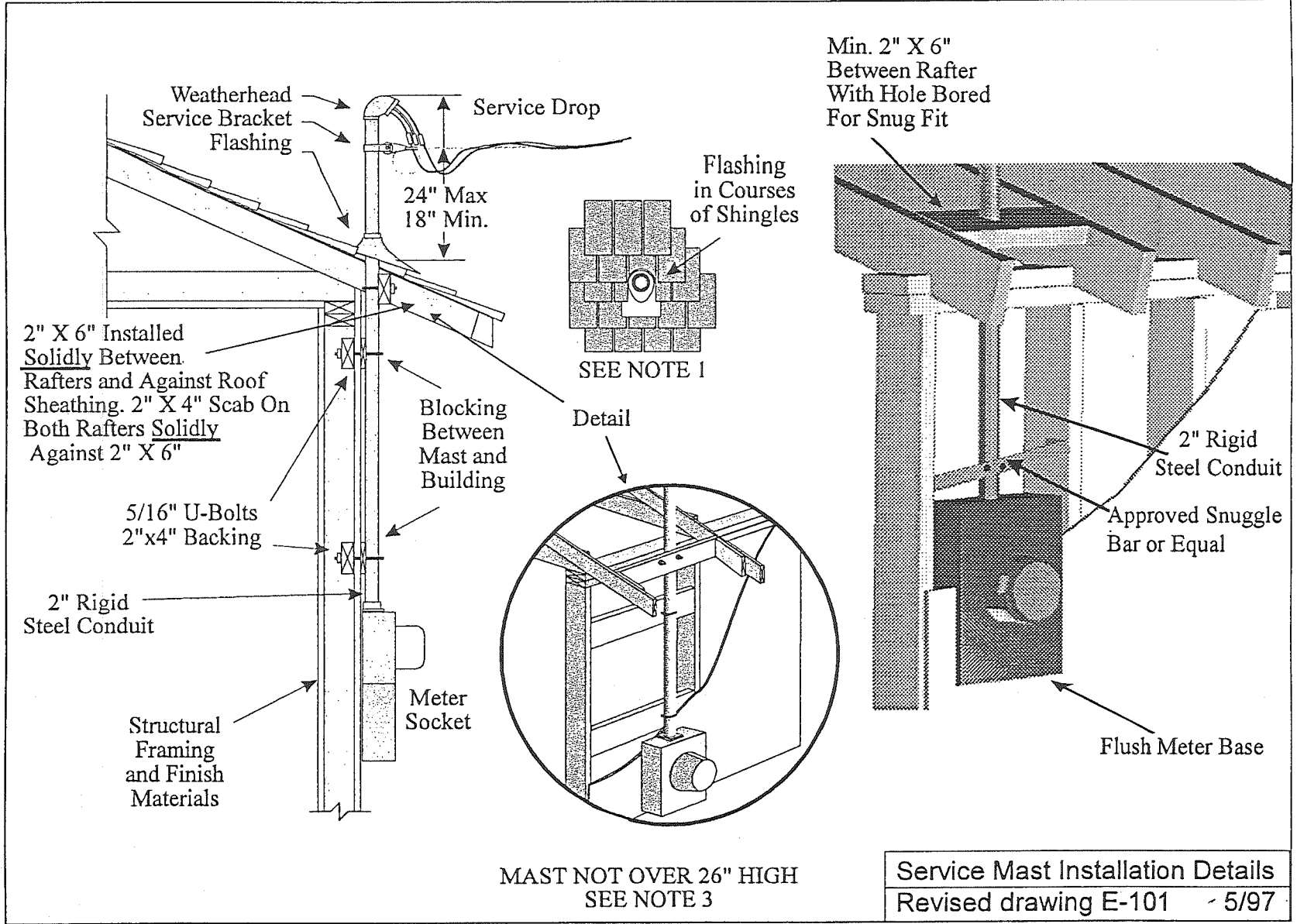
WAC 296-46-23001 Service requirements. (1) The serving utility shall be consulted by the owner, the owner's agent, or the contractor making the installation regarding the service entrance location and meter equipment requirements before installing the service and equipment. Provisions for a meter and related equipment, an attachment of a service drop, or an underground service lateral shall be made at a location acceptable to the serving utility. The point of attachment for a service drop shall permit the clearances required by the National Electrical Code.

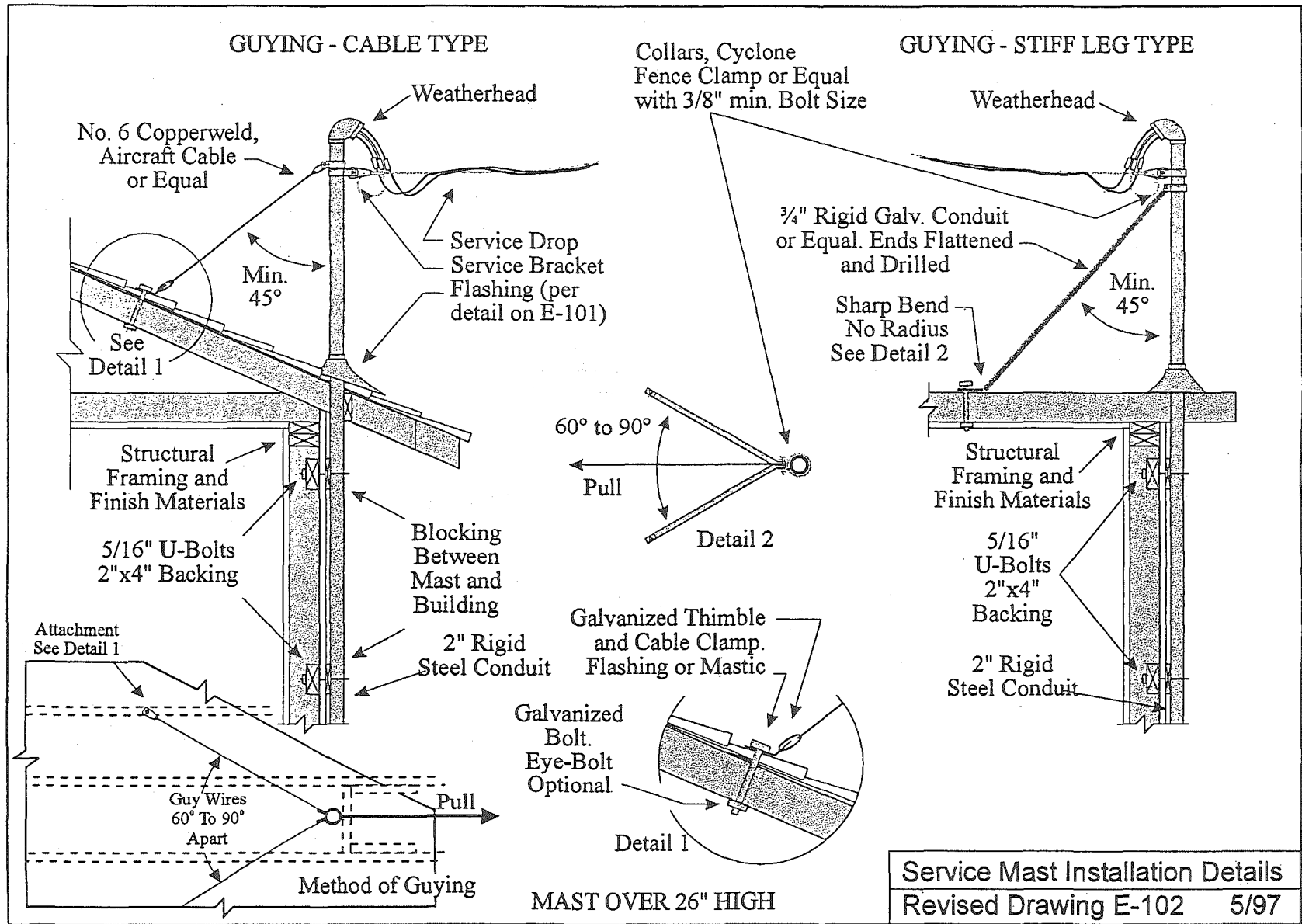
(2) A fire wall shall have a minimum two-hour rating as defined by the Uniform Building Code to be considered a building separation in accordance with Article 100 of the National Electrical Code. Buildings of more than one hour fire rated construction shall have a fire wall separation in compliance with the Uniform Building Code.

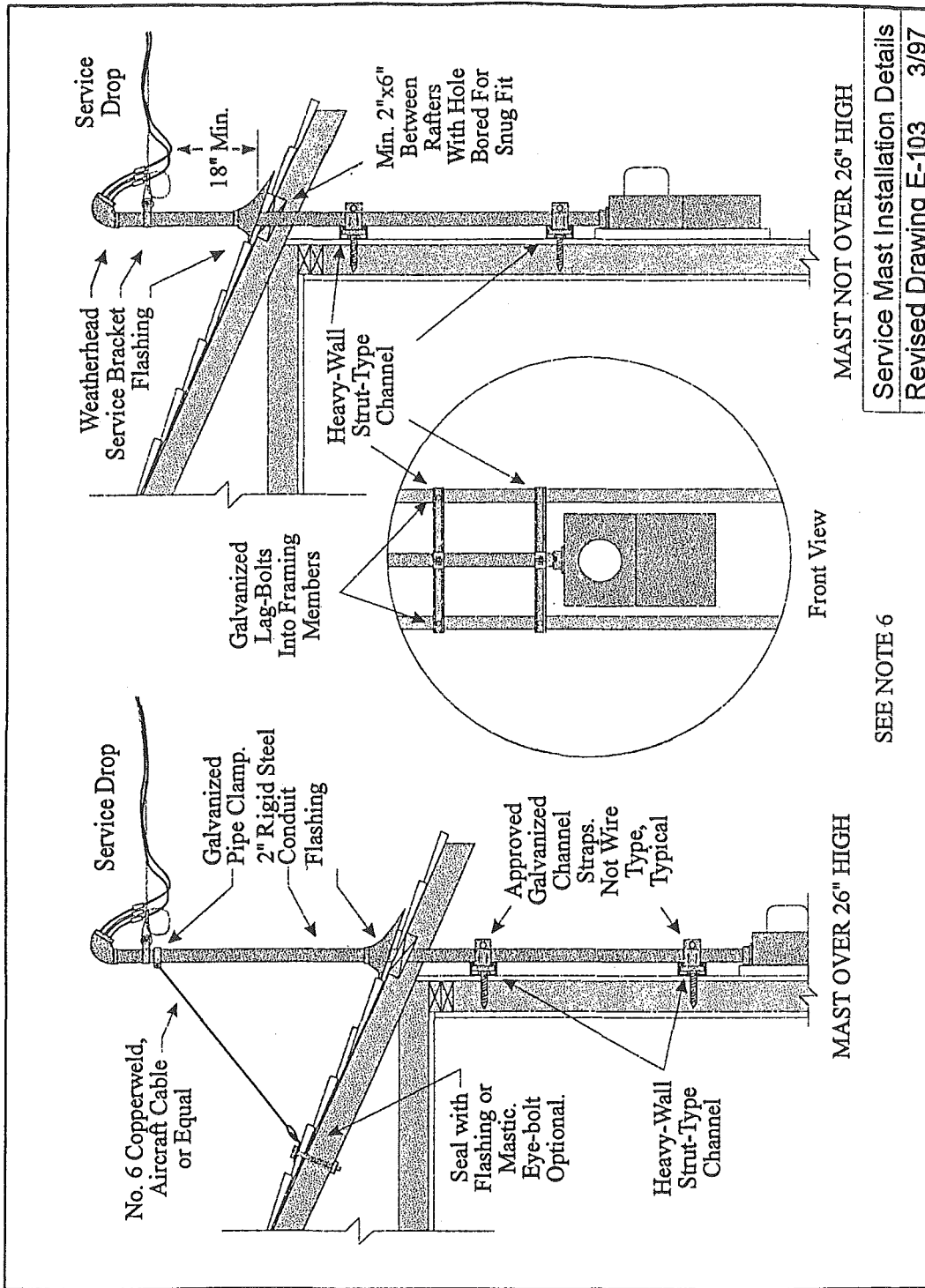
[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-23001, filed 9/10/90, effective 10/11/90.]

WAC 296-46-23028 Service or other masts. Conduit extended through the roof to provide means of attaching the service drop or other conductors shall be no smaller than 2-inch rigid steel galvanized conduit, shall provide a structurally sound attachment for the conductors and shall be equipped with a properly installed flashing at the roof line. The installation shall comply with drawings E-101 and/or E-102, or shall provide equivalent strength by other approved

means. Masts for altered or relocated installations shall be permitted to comply with drawing E-103.







MAST NOT OVER 26" HIGH
 Service Mast Installation Details
 Revised Drawing E-103 3/97

SEE NOTE 6

MAST OVER 26" HIGH

Notes to drawings E-101, E-102, and E-103.

1. An approved roof flashing shall be installed on each mast where it passes through a roof. Plastic, nonhardening mastic shall be placed between lead-type flashings and the conduit. Neoprene type flashings shall also be permitted to be used.
2. Masts shall be braced, secured, and supported in such a manner that no pressure from the attached conductors will be exerted on a roof flashing, meter base, or other enclosures.
3. Utilization of couplings for a mast are permitted only below the point the mast is braced, secured, or supported.
4. Except as otherwise required by the serving utility, service mast support guys shall be installed if the service drop attaches to the mast more than 24 inches above the roof line or if the service drop is greater than 100 feet in length from the pole or support. Masts for

5. support of other than service drops shall comply with this requirement as well.
6. Intermediate support masts shall be installed in an approved manner with methods identical or equal to those required for service masts. For altered services, where it is impractical to install U bolt mast supports due to interior walls remaining closed, it shall be permissible to use other alternate mast support methods such as heavy gauge, galvanized, electrical channel material that is secured to two or more wooden studs with 5/16 inch diameter or larger galvanized lag bolts.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-23028, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-23028, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060,

19.28.010(1) and 19.28.600. 90-19-015, § 296-46-23028, filed 9/10/90, effective 10/11/90.]

WAC 296-46-23040 Service conductors. (1) Service entrance conductors shall extend at least 18 inches from the service head to permit connection to the service drop.

(2)(a) The installation of service conductors not exceeding 600 volts nominal, within a building or structure shall be limited to the following methods: Galvanized or aluminum rigid metal conduit; galvanized intermediate metal conduit; wireways; busways; auxiliary gutters; rigid nonmetallic conduit; cablebus; or mineral-insulated, metal-sheathed cable (type MI).

(b) The installation of service conductors exceeding 600 volts, nominal, within a building or structure shall be limited to the following methods: Galvanized rigid metal conduit; galvanized intermediate metal conduit; metal-clad cable that is exposed for its entire length; cablebus; or busways.

(3) Service conductors under the exclusive control of the serving utility, where installed within a building or structure shall be installed in rigid steel galvanized conduit or Schedule 80 nonmetallic conduit. The grounded service conductor shall be permitted to be identified with a yellow jacket or with one or more yellow stripes.

(4) Multiple-occupancy buildings. A second or additional underground service lateral to a building having more than one occupancy shall be permitted to be installed at a location separate from other service laterals to the building provided that all the following conditions are complied with:

(a) Each service lateral is sized in accordance with the National Electrical Code for the calculated load to be served by the conductors;

(b) Each service lateral terminates in service equipment that is located in or on a unit served by the service equipment;

(c) The service laterals originate at the same transformer or power supply;

(d) The service equipment is separated at least fifteen feet from other service equipment in or on the building; and

(e) A permanent directory, suitable for the environment, is placed at each service equipment location that identifies all other service equipment locations in or on the building and the area or units served by each.

Exception: Service laterals for two-family dwellings are permitted to terminate in meter enclosures that are permitted to be located less than 15 feet apart.

(5) The service raceway or cable shall extend no more than fifteen feet inside a building or structure.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-23040, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-23040, filed 9/10/90, effective 10/11/90.]

WAC 296-46-23062 Service equipment. (1) Service equipment, sub-panels, and similar electrical equipment shall be installed so that they are readily accessible and shall not be installed in bathrooms, clothes closets, shower rooms, cupboards, or attics, or above washers, clothes dryers, or plumbed-in fixtures. All indoor service equipment and sub-panel equipment shall be adequately illuminated.

(2) Temporary construction service equipment shall not be used for other than construction purposes and shall be dis-

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connected when the permanent service is connected unless an extension for a definite period of time is granted by the department.

(3) Equipment ground fault protection systems required by the National Electrical Code shall be tested prior to being placed into service to verify proper installation and operation of the system as determined by the manufacturer's published instructions. The test shall be performed by a firm that has qualified personnel and proper equipment to perform the tests required. A copy of the manufacturer's performance testing instructions and a signed, written performance test record must be provided for the inspectors records.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-23062, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-23062, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-23062, filed 9/10/90, effective 10/11/90.]

WAC 296-46-30001 Support of raceways and cables in suspended ceilings. Raceways, cables, and boxes shall be permitted to be supported from Number 12 and larger wires under the following conditions:

(1) Raceways and cables are not larger than 3/4 inch trade size.

(2) No more than two raceways or cables are supported by a support wire.

(3) Raceways and cables are secured to the support wires by fittings designed and manufactured for the purpose.

(4) The support wires are securely fastened to the structural ceiling and to the ceiling grid system.

(5) The raceways or cables serve equipment that is located within the ceiling cavity or is mounted on or supported by the ceiling grid system.

(6) Where not prohibited by the building code official.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-30001, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-30001, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-30001, filed 9/10/90, effective 10/11/90.]

WAC 296-46-316 Duct bank conductor ampacities.

(1) For the purpose of determining ampacities of conductors in underground duct bank installations where:

(a) The ducts maintain at least 7 1/2" on center spacing

(b) The loads served are calculated according to the provisions of the currently adopted edition of the NEC Article 220.

(c) Derating of conductors required by Note 8, to the aforementioned tables, shall still apply when the conductors within an individual duct exceeds three conductors.

The ampacities of insulated copper conductors 2,001 through 8,000 volts and ninety degrees C rated and installed in underground ducts containing not more than three conductors shall be as follows:

SIZE AWG OR MCM	AMPACITY COPPER
6	85
4	110
2	145
1	170

[Title 296 WAC—p. 1071]

SIZE AWG OR MCM	AMPACITY COPPER
1/0	195
2/0	220
3/0	250
4/0	290
250	320
350	385
500	470
750	585
1,000	670

(2) It shall be permissible to determine the ampacities of conductors from the tables and accompanying notes in Appendix B of the National Electrical Code for applications covered directly by the tables.

(3) Underground conductors whose ampacity is determined from the National Electrical Code Table 310-16 shall be derated in accordance with Note 8 to Ampacity Tables of 0 to 2000 volts, where stacked or bundled (less than 2-inch spacing) a distance equal to 10 feet or 10 percent of the circuit length, whichever is less.

(4) All neutral conductors of 208/120 3 phase 4-wire wye system supplying electrical power to areas used for office occupancy shall be considered to be a current carrying conductor in accordance with Note 10 (c) to Tables 310 of the NEC.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-316, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-316, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060. 88-15-063 (Order 88-14), § 296-46-316, filed 7/18/88. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-316, filed 5/1/87.]

WAC 296-46-324 Knob-and-tube wiring. The provision of Section 324-4 of the National Electrical Code shall not be construed to prohibit the installation of loose or rolled thermal insulating material in spaces containing existing knob-and-tube wiring provided that all the following conditions are met:

(1) The wiring shall be surveyed by an appropriately licensed electrical contractor who shall certify that the wiring is in good condition with no evidence of improper overcurrent protection, conductor insulation failure or deterioration, and with no improper connections or splices. Repairs, alterations, or extensions of or to the electrical system shall be inspected by an electrical inspector as defined in RCW 19.28.070.

(2) The insulation shall meet Class I specifications as identified in the Uniform Building Code, with a flame spread factor of twenty-five or less as tested using ASTM E84-81a. Foam insulation shall not be used with knob-and-tube wiring.

(3) All knob-and-tube circuits shall have overcurrent protection in compliance with the 60 degree C column of Table 310-16 of the National Electrical Code. Overcurrent protection shall be either circuit breakers or Type S fuses. The Type S fuse adapters shall not accept a fuse of an ampacity greater than that permitted in this chapter.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-324, filed 9/10/90, effective 10/11/90.]

[Title 296 WAC—p. 1072]

WAC 296-46-336 Nonmetallic cable systems. All electrical equipment grounding conductors for nonmetallic cable systems shall be completely made up at the time of the inspection.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-336, filed 9/10/90, effective 10/11/90.]

WAC 296-46-348 Electrical metallic tubing. (1) In addition to complying with the provisions of Article 348 of the National Electrical Code, electrical metallic tubing shall not be installed in direct contact with the earth or in concrete on or below grade. See also section 300-6 of the National Electrical Code.

(2) Electrical metallic tubing shall not be installed as the wiring method for service entrance conductors inside a building. Existing electrical metallic tubing, installed prior to October 1984, which is properly grounded and used for service entrance conductors may be permitted to remain if the conduit is installed in a nonaccessible location and of the proper size for the installed conductors.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-348, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-348, filed 8/29/86.]

WAC 296-46-360 Amusement rides or structures, carnivals, circuses, and similar traveling shows. (1) Electrical installations. Service equipment, separately derived systems, feeders and circuits for each amusement ride, structure or concession and the interconnection of each ride, structure or concession, shall comply with Article 525 of the National Electrical Code and this chapter.

(2) Flexible multiconductor cords shall be connected to equipment by approved connectors designed for the purpose or by listed cord caps. Individual conductors of multiconductor cords in sizes #2 AWG and larger shall be permitted to be connected by listed and labeled connection systems in accordance with Article 520-53(K) of the National Electrical Code. Where conductors are connected individually by such connection systems, the outer jacket of multiconductor cord shall be secured to the electrical equipment independent from the receptacles and plugs by approved cable grips that are installed in a manner to prevent pressure from being applied to the receptacles and plugs.

(3) Individual, single conductor, insulated, portable power cable, in addition to complying with Section 525-13 of the National Electrical Code, shall comply with the following:

(a) All conductors of the feeder or circuit including the equipment grounding conductor originate in the same electrical equipment and terminate in the same equipment.

(b) All conductors of the feeder or circuit including the ungrounded, grounded, and equipment grounding conductors are run together, except for portions installed within approved cable protection systems.

(c) The cables are secured to the electrical equipment independent from the cable receptacles and plugs by approved cable grips that prevent pressure from being applied to the connectors.

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(d) The cables are connected to electrical equipment by approved listed and labeled connection systems in compliance with Section 520-53(K) of the National Electrical Code.

(4) Disconnecting means. A separate, enclosed, externally operable fused switch or circuit breaker, shall be installed on each amusement ride, structure or concession to disconnect all electrical equipment. The disconnecting means shall be readily accessible and identified as the disconnecting means. Where more than one power supply is employed, the disconnecting means shall be grouped.

(5) Rotating equipment. Components of amusement rides or structures that rotate more than three hundred sixty degrees and which have electrically operated equipment, shall be supplied by approved collector rings that shall be totally enclosed or located so they are accessible to authorized personnel only. The collector rings shall be factory produced with an equipment grounding segment having a voltage and current rating that equals or exceeds the rating of the current carrying segments. Collector rings shall have an ampacity not less than one hundred twenty-five percent of the full-load current of the largest device served plus the full-load current of all other devices served. Collector rings for control and signal purposes shall have an ampacity not less than one hundred twenty-five percent of the full-load current of the largest device served plus the full-load current of all other devices served.

(6) Equipment grounding. All noncurrent carrying metal parts of amusement rides and structures shall be grounded by an equipment grounding conductor routed with the feeder or circuit conductors in accordance with the National Electrical Code and these rules. The metallic structure shall not be used as a current carrying conductor.

Exception: The metallic structure shall be permitted to be used as the return path for low voltage systems that do not exceed thirty volts, provided that the ungrounded conductors are protected by an overcurrent device in accordance with the National Electrical Code and the system is factory built for such use.

(7) Existing amusement rides, concessions or games electrical systems shall comply with the National Electrical Code and shall be maintained in full compliance. Where new amusement rides, concessions or games are purchased, manufactured or constructed, or where existing rides, concessions or games have major modification, the electrical system shall comply with this chapter and the edition of the National Electrical Code in effect at that time. All rides, concessions, and games shall be identified in or on the disconnecting means as well as by make, model and serial number in records furnished to the department with the edition of the National Electrical Code the electrical system is intended to comply with.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-360, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-360, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-360, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-360, filed 8/29/86. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-360, filed 7/17/84; Order 69-2, § 296-46-360, filed 2/28/69, effective 4/1/69.]

WAC 296-46-365 Concerts, motion picture productions, stage shows, and similar shows. (1) Service equip-

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ment, separately derived systems, feeders and circuits for concerts, motion picture productions, stage shows, and similar shows, shall comply with the National Electrical Code and this chapter.

(2) All feeders that are field installed shall be of a type and size identified in Article 520-53(h).

(3) Ampacity of cords and cables shall be determined from the appropriate table 400-5(a) or 400-5(b) in the National Electrical Code including all notes thereto.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-365, filed 3/2/93, effective 4/2/93.]

WAC 296-46-370 (Reserved.)

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-370, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-370, filed 5/1/87. Statutory Authority: RCW 19.28.010 and 19.28.060. 84-15-051 (Order 84-10), § 296-46-370, filed 7/17/84; Order 75-25, § 296-46-370, filed 8/4/75; Order 72-7, § 296-46-370, filed 6/7/72; Order 69-2, § 296-46-370, filed 2/28/69, effective 4/1/69.]

WAC 296-46-422 Water heater circuit. Water heaters which have a rated circuit load in excess of 3,500 watts at 240 volts shall be provided with branch circuit conductors not smaller than No. 10 AWG copper or equal.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-422, filed 3/2/93, effective 4/2/93. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-422, filed 5/1/87.]

WAC 296-46-45001 Transformers. (1) Dry type transformers shall be rated not less than the load served as determined in accordance with Article 220 of the National Electrical Code.

(2) A readily accessible, externally operable, load break rated disconnecting means and overcurrent protection shall be provided on the line side of power transformers. Overcurrent protection shall comply with Article 450 of the National Electrical Code.

(3) See WAC 296-46-480 for location of pad-mounted transformers and WAC 296-46-490 for location of total underground transformers.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-45001, filed 9/10/90, effective 10/11/90.]

WAC 296-46-480 Location of pad-mounted transformers. (1) A pad-mounted transformer installation is an installation of an oil-filled transformer outdoors in which installation of all bushings, handholes, and live and operating parts are guarded by a solid metal enclosure secured so that they are accessible to authorized qualified personnel only. This does not prohibit the use of approved glass monitoring devices or properly baffled ventilators.

(2) If a pad-mounted transformer is to be installed next to a structure of combustible material, it shall not be installed closer than eight feet to the structure. This eight foot separation shall be measured from the nearest metal portion of the pad-mounted transformer installation to the nearest building features required to be safeguarded. If there are overhanging eaves or roof lines of combustible material on a standard sin-

gle story structure, the eight foot measurement should be made to provide eight feet of clear space between the eaves and the nearest metal portion of the pad-mounted transformer installed outside a vertical line extended from the ends of the eaves to the ground if this distance is at least eight feet horizontally from all combustible walls. In addition, the grade of the ground at the location of the pad-mounted transformer shall be such that any oil leaking from the transformer will flow away from the building and will not form pools. As an exception to subsection (2) of this section, in an urban residential area that has an improved alleyway, and in which a pad-mounted transformer is to be installed next to a nonhabited structure of combustible material the transformer shall not be installed closer than two feet to the structure.

(3) Pad-mounted transformers shall not be installed nearer than two feet, measured horizontally, to a noncombustible building surface having no doors, windows, or other openings closer to the transformer than eight feet.

(4) Pad-mounted transformers should not be located where they are exposed to damage by automobiles, trucks, or other mobile machinery. If transformers are installed in areas subject to traffic other than pedestrian traffic, they shall be provided with additional guarding.

(5) Pad-mounted transformer installations shall be effectively grounded as provided in Section 250-51 of the National Electrical Code.

[Statutory Authority: RCW 19.28.010 and 19.28.060, 84-15-051 (Order 84-10), § 296-46-480, filed 7/17/84. Statutory Authority: RCW 19.28.060, 78-02-098 (Order 77-31), § 296-46-480, filed 1/31/78; Order 69-2, § 296-46-480, filed 2/28/69, effective 4/1/69.]

WAC 296-46-490 Location of total underground transformers. Enclosures for total underground oil filled transformers shall not be located within eight feet of a doorway or fire escape. Adequate space shall be maintained above the total underground transformer enclosure so that a boom may be used to lift the transformer.

[Statutory Authority: RCW 19.28.010 and 19.28.060, 84-15-051 (Order 84-10), § 296-46-490, filed 7/17/84; Order 69-2, § 296-46-490, filed 2/28/69, effective 4/1/69.]

WAC 296-46-495 Electrical work permits and fees.

(1) Where an electrical work permit is required by chapter 19.28 RCW or this chapter, inspections shall not be made, equipment energized, nor services connected unless an electrical work permit is completely and legibly filled out and readily available, and all applicable inspection fees have been paid. The classification or type of facility to be inspected and the scope of the electrical work to be performed shall be clearly shown on the electrical work permit. The address where the inspection is to be made shall be identifiable from the street, road or highway that serves the premises. Driving directions and/or a legible map must be provided for the inspectors' use.

(2) Except for emergency repairs to existing electrical systems, electrical work permits shall be obtained prior to beginning the installation or alteration. An electrical work permit for emergency repairs to existing electrical systems shall be obtained no later than the next business day.

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(3) The electrical work permit application shall be posted on the job site at a conspicuous location prior to beginning electrical work and at all times electrical work is performed.

(4) Electrical work permits shall expire one year after the date of purchase unless electrical work is actively and consistently in progress and inspections requested. Electrical work permits for temporary construction activity shall expire ninety days after suspended construction and no later than one year after purchase. Refunds are not available for expired electrical work permits.

(5) Fees shall be paid in accordance with the inspection fee schedule WAC 296-46-910.

(6) Each person, firm, partnership, corporation, or other entity shall furnish an electrical work permit for the installation, alteration, or other electrical work performed or to be performed by that entity. Each electrical work permit application shall be signed by the electrical contractor's administrator (or designee) or the person, or authorized representative of the firm, partnership, corporation, or other entity that is performing or responsible for the electrical installation or alteration.

(7) An electrical work permit is required for installation, alteration, or maintenance of electrical systems except for replacement of circuit breakers or fuses, for replacement of lamps, snap switches, receptacle outlets or heating elements, replacement of a lighting fixture ballast with an exact same ballast, replacement of contactors, relays, timers, starters, or similar control components or for plug-in appliances or travel trailers.

[Statutory Authority: Chapter 19.28 RCW, 98-12-042, § 296-46-495, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600, 93-06-072, § 296-46-495, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-495, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW, 87-10-030 (Order 87-07), § 296-46-495, filed 5/1/87. Statutory Authority: RCW 19.28.060 and 19.28.210, 85-20-065 (Order 85-16), § 296-46-495, filed 9/27/85. Statutory Authority: RCW 19.28.060, 78-02-098 (Order 77-31), § 296-46-495, filed 1/31/78.]

WAC 296-46-50002 On-site sewage disposal systems.

(1) Pumping chambers for sewage, effluent, or grinder pumps in both on-site and septic tank effluent pump (S.T.E.P.) disposal systems shall be considered unclassified when not more than five residential units are connected to the system or when nonresidential systems have residential loading characteristics and all of the following general installations requirements are complied with.

(a) The pumping chamber shall be adequately vented. Venting may be accomplished through the building or structure plumbing vents where adequate or by a direct 2" minimum vent to the atmosphere.

(b) Equipment that in normal operation may cause an arc or spark shall not be installed in any pumping chamber.

(c) Float switches installed in an unclassified location shall be hermetically sealed to prevent the entrance of gases or vapors.

(d) Junction boxes, conduits and fittings installed in the septic atmosphere shall be of the noncorrosive type, installed to prevent the entrance of gases or vapors.

(e) Where a conduit system is installed between the pumping chamber and the control panel, motor disconnect, or

power source, an approved sealing fitting shall be installed to prevent the migration of gases or vapors from the pumping chamber, and shall remain accessible.

(f) Wire splices in junction boxes installed in pumping chambers, shall be suitable for wet locations.

(g) Submergence of the pumping motor shall be guaranteed by the design of the pump or by redundant off floats.

(2) Nonresidential loading characteristics shall be certified by a Washington state registered professional engineer, engaged in the business of wastewater management systems design. Documentation that is signed and stamped by the engineer shall be provided to the electrical inspector prior to the inspection.

(3) Any residential or nonresidential system that has building or structure floor drains being discharged into the system shall be classified as Class I Division I.

(4) Pumping chamber access covers shall be permitted to be covered by gravel, light aggregate, or noncohesive granulated soil, and shall be accessible for excavation. Access covers that are buried, shall have their location identified at the electrical panel or other approved prominent location.

(5) Secondary treatment effluent pumping chambers such as sandfilters are unclassified, and require no special wiring methods.

Inspection approval is required prior to covering or concealing any portion of the septic electrical system, including the pump. New septic and effluent tanks containing electrical wires and equipment shall be inspected and approved by the department prior to being loaded with sewage.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-50002, filed 5/29/98, effective 6/30/98.]

WAC 296-46-514 Gasoline dispensing and service stations. The gasoline pump disconnecting means or operator shall be substantially red in color and identified with a sign as the emergency disconnecting means. The disconnecting means or operator shall be readily accessible and shall be located outdoors and within sight of the gasoline pump or dispenser it controls. For multicircuit installations an electrically held contactor shall be permitted to be used.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-514, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-514, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-514, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-514, filed 5/1/87.]

WAC 296-46-553 Boat moorages, floating buildings, and similar installations. Docks, wharves, boat moorage's, floating buildings, and similar facilities in addition to complying with the appropriate sections of Article 553 or Article 555 of the National Electrical Code shall have a service rated disconnect located on the shoreline. Extra-hard usage portable power cable may only be used when extending a feeder between the structures indicated above where flexibility is required and must be connected to an approved wiring method within the first 15 feet of the end where flexibility is required.

Where shore power is provided, each floating building or boat moorage berth shall have a disconnecting means located

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within sight of and not more than fifty feet from each floating building or berth. The disconnecting means shall be installed adjacent to but not in or on the floating building. Conductors operating in excess of 600 volts, nominal shall not be installed on floating portions of marinas, docks, or wharves. Refer to the Fire Protection Standard for Marinas and Boatyards, NFPA 303 for additional information.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-553, filed 5/28/97, effective 6/30/97.]

WAC 296-46-600 Electrical signs. (1) Portable outdoor signs. A weatherproof receptacle outlet that is weatherproof with the supply cord connected shall be installed within six feet of each electrical sign. Extension cords shall not be permitted to supply portable outdoor signs. All new portable outdoor electrical signs shall be listed and labeled by an electrical testing laboratory that is accredited by the department. Existing portable signs that are not listed and labeled or do not have ground-fault circuit-interrupter protection, as required by section 600-11 of the National Electrical Code, shall have ground-fault circuit-interrupter protection provided in the branch circuit that supplies the portable sign.

(2) Awning signs. Lighting fixtures in outdoor awnings shall be listed as suitable for wet locations and be connected by a wiring method suitable for wet locations. Fluorescent lighting fixtures shall be located at least six inches from the awning fabric. Incandescent lamps or fixtures shall be located at least eighteen inches from the awning fabric. A disconnecting means shall be located as per NEC 600-2.

Exception: Listed awning signs shall be installed in compliance with the manufacturer's instructions and the National Electrical Code.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-600, filed 9/10/90, effective 10/11/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-600, filed 8/29/86.]

WAC 296-46-670 Definitions. (1) Definitions.

(a) RCW 19.28.005(9) "Industrial control panel" means a factory-wired or user-wired assembly of industrial control equipment such as motor controllers, switches, relays, power supplies, computers, cathode ray tubes, transducers, and auxiliary devices. The panel may include disconnect means and motor branch circuit protective devices.

These assemblies are used in industrial, manufacturing, and food processing plants.

(b) "Industrial plants" do not include:

(i) Municipal or other government facilities.

(ii) Educational facilities or portions thereof.

(iii) Institutional facilities or portions thereof.

(iv) Other installations not used for direct production purposes.

(c) "Manufacturing plants" do not include:

(i) Home workshops.

(ii) Municipal or other governmental facilities.

(iii) Education facilities or portions thereof.

(iv) Institutional facilities or portions thereof.

(v) Other installations not used for direct production purposes.

(d) "Food processing plants" do not include:

(i) Restaurants.

(ii) Farming, ranching, or dairy farm operations.

(e) "Utilization equipment" is the machine or machines and its integral components which are controlled by the "industrial control panel(s)" defined in this section.

(2) "Industrial control panels" will be determined to meet the minimum electrical safety standards for installations by:

(a) Listing, labeling, or other indication of acceptability (including a report of field evaluation) by a testing laboratory accredited for such category of equipment by the department; or

(b) Report of field evaluation by a firm approved by the department to perform the evaluation; or

(c) Inspection by department electrical inspectors for compliance with codes and rules adopted under this chapter; or

(d) Special department inspection requested by "industrial control panel" owner or agent.

(3) "Utilization equipment" will be determined to comply with codes and rules for installation by:

(a) Listing, labeling, or other indication of acceptability (including a report of field evaluation) by a testing laboratory accredited for such category of equipment by the department; or

(b) Inspections by department electrical inspectors.

(4) Fees for special inspections by the department required under subsection (2)(d) of this section, including the time to prepare reports, will be calculated under WAC 296-46-910 (5)(n).

(5) Fees for the inspections by the department under subsections (2)(a), (b), (c) and (3)(a), (b) of this section will be included in the electrical work permit fee calculated for the installation and will not be a separate inspection fee as required under subsection (4) of this section.

(6) Requests for the special inspections under subsection (2)(d) of this section will be on department furnished forms that identify the request as an "industrial control panel" inspection.

(7) Procedures for the special inspection:

(a) The department may require that electrical power to the industrial control panel be deenergized and locked out or disconnected while performing the inspection.

(b) The department may authorize use of the industrial control panel prior to its inspection.

(c) All components of the industrial control panel shall be marked in compliance with NEC Section 110-21. The special inspection requestor shall supply a statement from the manufacturer stating the industrial control panel and its components conform to the requirements of the National Electrical Code, currently adopted Edition; chapter 296-46 WAC; and other standards currently adopted by the department and that they are safe for the intended use. This statement will be furnished to the department prior to a special inspection being performed and will become a part of the permanent special inspection file kept by the department.

(d) Deficiencies:

(i) Will be referenced by the department citing the appropriate code or rule by publication and section (it is expected that the inspector, when asked, will explain his or her interpretation of the code or rule, identifying the deficiency).

(ii) Will be required to be corrected prior to approval by the department.

(iii) Will be required to be corrected, and the department will be notified of such corrections within fifteen days of the date the deficiency was formally identified by the department; or when a longer time is requested by the customer, the department will determine an appropriate time frame consistent with the reason for the request.

The department may authorize the industrial control panel to be, or remain, energized and in service while the deficiencies are being corrected.

(e) Inspection, approval, and correction notices will be in triplicate. A copy will be given to the owner or operator of the facility and to the permittee.

[Statutory Authority: RCW 19.28.010, 19.28.060 and 19.28.250. 94-01-005, § 296-46-670, filed 12/1/93, effective 1/1/94.]

WAC 296-46-680 Electrical equipment associated with spas, hot tubs, swimming pools or hydromassage bathtubs. (1) Electrical installations. In addition to complying with the statute, the National Electrical Code, and this chapter, the installation shall comply with electrical testing laboratory standards applicable to the specific equipment or installation.

(2) Package spa or hot tubs. Electrical heating, pumping, filtering, and/or control equipment installed within five feet of a spa or hot tub shall be listed as a package with the spa or hot tub.

(3) Skid packs. A factory assembly of electrical heating, pumping, filtering, and/or control equipment (skid pack) which shall be installed more than five feet from a spa or hot tub and shall be listed as a package unit.

(4) Field assembly of listed electrical equipment for a spa, hot tub, or swim spa. Field installed, listed electrical equipment (as distinguished from recognized components) for a hot tub, spa, or swim spa shall be permitted to be located at least five feet from the hot tub, spa or swim spa, provided that:

(a) The heater is listed as a "spa heater or swimming pool heater"; and

(b) The pump is listed as a "spa pump" or "swimming pool/spa pump" (the pump may be combined with a filter assembly); and

(c) Other listed equipment such as panelboards, conduit, and wire are suitable for the environment and comply with the applicable codes.

(5) Field assembly of listed electrical equipment for swimming pools. Field installed, listed electrical equipment (as distinguished from recognized components) for a swimming pool shall be permitted to be located at least five feet from the swimming pool provided that:

(a) The heater is listed as a "swimming pool heater or a spa heater"; and

(b) The pump is listed as a "swimming pool pump" or "spa pump" or "swimming pool/spa pump"; and

(c) Other equipment such as panelboards, conduit, and wire are suitable for the environment and comply with the applicable codes.

(6) Hydromassage bathtubs. Hydromassage bathtubs shall be listed as a unit and bear a listing mark which reads "hydromassage bathtub."

(7) Manufacturers instructions shall be followed as a part of the listing requirements.

The field assembly or installation of "recognized components" shall not be permitted.

The five foot separation of electrical components may be reduced by the installation of a permanent barrier, such as a solid wall, fixed glass windows or doors, etc. The five foot separation will be determined by the shortest path or route that a cord can travel from the spa, hot tub, swim spa, or swimming pool to an object.

(8) Replacement of electrical equipment. Electrical components which have failed and require replacement shall be replaced with identical products unless the replacement part is no longer available, in which case, a similar product may be substituted provided that the electrical characteristics are identical and that the mechanical and grounding integrity of the equipment is maintained. Recognized components or listed equipment will be permitted to be replaced in kind. Cut-away type display models will not be expected to bear a listing mark and shall not be sold for other than display purposes.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-680, filed 3/2/93, effective 4/2/93. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-680, filed 5/1/87; 86-18-041 (Order 86-23), § 296-46-680, filed 8/29/86.]

WAC 296-46-700 Emergency systems. (1) Exit and emergency lights shall be installed in accordance with the National Electrical Code, Article 700, and currently adopted edition of the Uniform Building Code in all health or personal care facilities defined in WAC 296-46-130, educational facilities, institutional facilities, hotels, motels, and places of assembly for one hundred or more persons. Installation shall be made in strict accordance with the National Electrical Code, Article 700.

(2) Junction boxes for fire alarm systems other than the surface raceway type, shall be substantially red in color. Power-limited fire protective signalling circuit conductors shall be durably and plainly marked in or on junction boxes or other enclosures to indicate that it is a power-limited fire protective signalling circuit. Conductors for light, heat, or power shall not be installed in any enclosure, raceway, cable, compartment, outlet box, or similar fitting containing fire alarm conductors.

(3) All boxes and enclosures, including transfer switches, generators, and power panels for emergency systems and circuits shall be permanently marked with an adhesive label or decal or similar approved means that is suitable for the environment and is substantially red in color.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-700, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-700, filed 3/2/93, effective 4/2/93; 90-19-015, § 296-46-700, filed 9/10/90, effective 10/11/90.]

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WAC 296-46-702 Optional standby systems. Optional standby systems derived from portable generators shall meet all of the requirements of NEC Article 702.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-702, filed 3/2/93, effective 4/2/93.]

WAC 296-46-710 Identification of cables. Each cable operating at over 600v and installed as customer owned systems shall be legibly marked at each termination point and at each point the cable is accessible. The required marking shall include; phase designation, operating voltage, and circuit number if applicable.

[Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 93-06-072, § 296-46-710, filed 3/2/93, effective 4/2/93.]

WAC 296-46-725 Class 2 and Class 3 cables. Class 2 and Class 3 cables shall be secured in compliance with Section 336-18 of the National Electrical Code and shall be secured to boxes in compliance with Section 370-17 of the National Electrical Code. Raceways for Class 2 and Class 3 conductors shall be installed in compliance with Chapter 3 of the National Electrical Code.

[Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-725, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-725, filed 9/10/90, effective 10/11/90.]

WAC 296-46-770 Optical fiber cables. Optical fiber cables shall be secured in compliance with Section 336-18 of the National Electrical Code.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-770, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, 19.28.010(1) and 19.28.600. 90-19-015, § 296-46-770, filed 9/10/90, effective 10/11/90.]

WAC 296-46-910 Inspection fees. To calculate the inspection fees, the amperage is based on the conductor ampacity or the overcurrent device rating. The inspection fees shall be calculated from sections (1) through (5) below. However, the total fee shall not be less than the number of progress inspection (one-half hour) units times the progress inspection fee rate from subsection (5) MISCELLANEOUS (k) below.

- (1) RESIDENTIAL
 - (a) Single and two family residential (new construction)
 - (i) First 1300 sq. ft. or less \$ 64.50
 - Each additional 500 sq. ft. or portion of \$ 20.75

Note: Square footage is the area included within the surrounding exterior walls of a building exclusive of any interior courts. (This includes any floor area in an attached garage, basement, or unfinished living space.)

"Inspected with the service" or "inspected at the same time" means all wiring is to be ready for inspection during the initial inspection trip.

- (ii) Each outbuilding or detached garage inspected with the service \$ 27.00
- (iii) Each outbuilding or detached garage inspected separately \$ 42.50
- (iv) Each swimming pool - inspected with the service \$ 42.50
- (v) Each swimming pool - inspected separately \$ 64.50
- (vi) Each hot tub, spa, or sauna - inspected with the service \$ 27.00
- (vii) Each hot tub, spa, or sauna - inspected separately \$ 42.50

- (viii) Each septic pumping system - inspected with the service \$ 27.00
- (ix) Each septic pumping system - inspected separately \$ 42.50
- (b) Multi-family residential and miscellaneous multi-family residential structures, services and feeders (new construction)

Each service and/or feeder

Service Ampacity	Service	Feeder
0 to 200	\$ 69.50	\$ 20.75
201 to 400	86.25	42.50
401 to 600	118.50	59.25
601 to 800	151.75	81.00
801 and over	216.25	162.25

- (c) Single family or multi-family altered services including circuits
- (i) Each altered service and/or altered feeder

Service Ampacity	Service or Feeder
0 to 200	\$ 59.25
201 to 600	86.25
over 600	130.00

- (ii) Maintenance or repair of meter or mast (no alterations to service or feeder) \$ 32.25
- (d) Single or multi-family residential circuits only (no service inspection)
- (i) 1 to 4 circuits (see note) \$ 42.50
- Except: Water heater load control devices installed in residences as part of an energy conservation program 26.00
The \$ 26.00 permit fee for water heater load control devices will expire on December 31, 2001
- (ii) Each additional circuit (see note) 5

Note: Altered or added circuit fees are calculated per panelboard. Total cost of the alterations in an individual panel should not exceed the cost of a complete altered service or feeder of the same rating, as shown in subsection (1) RESIDENTIAL (c)(i) (table) above.

- (e) Mobile homes, modular homes, mobile home parks, and RV parks
- (i) Mobile home or modular home service or feeder only \$ 42.50
- (ii) Mobile home service and feeder 69.50
- (iii) Mobile home park sites and RV park sites
- (A) First site service or site feeder 42.50
- (B) Each additional site service; or additional site feeder inspected at the same time as the first service or feeder 27.00

Note: For master service installations, see subsection (2).

(2) COMMERCIAL/INDUSTRIAL

- (a) New service or feeder and additional new feeders inspected at the same time (includes circuits)

Service/ Feeder Ampacity	Service/ Feeder	Additional Feeder inspected at the same time
0 to 100	\$ 69.50	\$ 42.50
101 to 200	86.25	54.00
201 to 400	162.25	64.50
401 to 600	189.25	75.75
601 to 800	244.50	103.00
801 to 1000	298.50	124.75
Over 1000	325.50	173.75

Note: For large COMMERCIAL/INDUSTRIAL projects that include multiple feeders, "inspected at the same time" can be interpreted to include additional inspection trips for a single project. The additional inspections must be for electrical work specified on the permit at the time of purchase. The permit fee for such projects shall be calculated from (2) (a) (i) (table) above. However, the total fee shall not be less than the number of progress inspection (one-half hour) units times the progress inspection fee rate from subsection (5) MISCELLANEOUS (k) below.

- (ii) Over 600 volts surcharge \$ 54.00
- (b) Altered services or feeders (no circuits)

Service Ampacity	Service/ Feeder
0 to 200	\$ 69.50
201 to 600	162.25
601 to 1000	244.50
Over 1000	271.50

- (ii) Over 600 volts surcharge \$ 54.00
- (iii) Maintenance or repair of meter or mast (no alteration to the service or feeder) 59.25
- (c) Circuits only
- (i) First five circuits per branch circuit panel \$ 54.00
- (ii) Each additional circuit per branch circuit panel 5

Note: Altered/added circuit fees are calculated per panelboard. Total cost of the alterations in a panel (or panels) should not exceed the cost of a new feeder (or feeders) of the same rating, as shown in subsection (2) COMMERCIAL/INDUSTRIAL (a)(i) (table) above.

(3) TEMPORARY SERVICES

Note: Temporary electrical power and lighting installations are intended to be used during the period of construction, remodeling, maintenance, repair, or demolition of buildings, structures, equipment, or similar activities. Temporary electrical power and lighting installations are allowed during emergencies and for tests, experiments, and developmental work. Temporary electrical power and lighting installations are allowed for a period not to exceed 90 days for Christmas decorative lighting and similar purposes. Temporary wiring shall be removed immediately upon completion of construction or purpose for which the wiring was installed.

- (a) Residential \$ 37.25
- (b) Commercial/industrial

Ampacity	Service or Feeder	Additional Feeder
0 to 100	\$ 42.50	20.75
101 to 200	54.00	27.00
201 to 400	64.50	32.25
401 to 600	86.25	42.50
Over 600	97.75	48.75

(c) Temporary stage or concert productions

Ampacity	Service or Feeder	Additional Feeder
0 to 100	\$ 42.50	\$ 20.75
101 to 200	54.00	27.00
201 to 400	64.50	32.25
401 to 600	86.25	42.50
Over 600	97.75	48.75

Note: Temporary stage or concert inspections requested outside of normal business hours will be subject to the portal to portal hourly fees in subsection (5) MISCELLANEOUS (m). The fee for such after hours inspections shall be the greater of the fee from (3) TEMPORARY SERVICES (c) (table) or the portal to portal fee.

(4) IRRIGATION MACHINES, PUMPS AND EQUIPMENT

- (a) Each tower when inspected at the same time as a service and feeder (per subsection (2) COMMERCIAL/INDUSTRIAL above) \$ 5

- (b) Towers - when not inspected at the same time as a service and feeders - one to six towers 64.50
- Each additional tower 5

- (5) MISCELLANEOUS - commercial/industrial and residential
 - (a) Thermostats
 - (i) First thermostat \$ 32.25
 - (ii) Each additional thermostat inspected at the same time as the first 10.25

Note: Thermostat is defined as:
 (A) A device that interrupts electrical current while performing its function of controlling building, zonal, or room environmental air temperature; or
 (B) In the case of environmental air temperature control by the use of sensors which do not interrupt current but rather transmit data to a zonal or central processing unit, "thermostat" shall be considered to be the circuit extending from the central processing unit to the local controller. At times this local unit could control several zones or rooms individually or in concert.

- (b) Low voltage fire alarm and burglar alarm. Includes nurse call, intercom, security systems, and similar low energy circuits and equipment
 - (i) First 2500 sq. ft. or less \$ 37.25
 - (ii) Each additional 2500 sq. ft. or portion thereof 10.25
- (c) Signs and outline lighting
 - (i) First sign (no service included) \$ 32.25
 - (ii) Each additional sign inspected at the same time on the same bldg. or structure 15.50
- (d) Berth at a marina or dock \$ 42.50
- Each additional berth inspected at the same time 27.00
- (e) Yard pole, pedestal, or other meter loops only \$ 42.50

- Meters installed remote from service equipment: Inspected at same time as service, temporary service or other installations 10.25
- (f) Emergency inspections requested outside normal work hours. Regular fee plus surcharge of \$ 81.00
- (g) Generators, refer to appropriate residential or commercial new service or feeder section
- (h) Annual permit fee for plant location employing regular electrical maintenance staff - each inspection two hour maximum.

	Fee	Inspections
1 to 3 plant electricians	\$1,553.25	12
4 to 6 plant electricians	3,107.75	24
7 to 12 plant electricians	4,661.25	36
13 to 25 plant electricians	6,215.75	52
more than 25 plant electricians	7,770.25	52

- (i) Carnival inspections
 - (i) First field inspection each year
 - (A) Each ride and generator truck \$ 15.50
 - (B) Each remote distribution equipment, concession or gaming show 5
 - (C) If the calculated fee for first field inspection of (A) and (B) above is less, the minimum inspection fee shall be: 81.00
 - (ii) Subsequent inspections
 - (A) First 10 rides, concessions, generators, remote distribution equipment or gaming show \$ 81.00
 - (B) Each additional ride, concession, generator, remote distribution equipment or gaming show 5
 - (iii) Single concession, not part of a carnival \$ 42.50
 - (j) Trip fees
 - (i) Requests by property owners to inspect existing installations \$ 64.50
 - (ii) Submitter notifies the department that work is ready for inspection when it is not ready 32.25
 - (iii) Additional inspection required because submitter has provided the wrong address 32.25
 - (iv) More than one additional inspection required to inspect corrections; or for repeated neglect, carelessness, or improperly installed electrical work 32.25

- (v) Each trip necessary to remove a noncompliance notice 32.25
- (vi) Corrections have not been made in the prescribed time, unless an exception has been requested and granted. 32.25
- (vii) Installations that are covered or concealed before inspection 32.25
- (k) Progress inspections
 - On partial or progress inspections, each one-half hour \$ 32.25

Note: The fees calculated in main sections (1) through (5) shall apply to all electrical work. This section is intended to be applied to a permit where the permit holder has requested additional inspections beyond the normal number for the type of installation. Additional progress inspections shall be charged at the rate in (k) above.

- (l) Plan review fee
 - (i) Fee is thirty-five percent of the electrical work permit fee as determined by WAC 296-46-495, plus a plan review submission fee of \$ 54.00
 - (ii) Supplemental submissions of plans per hour or fraction of an hour \$ 64.50
 - (iii) Plan review shipping and handling fee \$ 15.50
 - (m) Other inspections
 - Inspections not covered by above inspection fees shall be charged portal to portal per hour \$ 64.50
 - (n) Refund processing fee
 - All requests for permit fee refunds will be assessed a processing fee \$ 10.50
 - (o) Variance request processing fee
 - This fee is nonrefundable once the transaction has been made \$ 64.50

[Statutory Authority: RCW 34.05.356 (1)(f). 98-22-063, § 296-46-910, filed 11/2/98, effective 12/3/98. Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-910, filed 5/29/98, effective 6/30/98; 97-24-033, § 296-46-910, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-910, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1), 19.28.600 and 19.28.210(6). 92-08-102, § 296-46-910, filed 4/1/92, effective 5/2/92. Statutory Authority: RCW 19.28.060 and 19.28.210(6). 90-17-041, § 296-46-910, filed 8/10/90, effective 9/10/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-910, filed 5/1/87. Statutory Authority: RCW 19.28.060 and 19.28.210. 85-20-065 (Order 85-16), § 296-46-910, filed 9/27/85. Statutory Authority: RCW 19.28.210. 83-16-058 (Order 83-20), § 296-46-910, filed 8/2/83. Statutory Authority: RCW 19.28.060 and 19.28.210. 82-18-036 (Order 82-29), § 296-46-910, filed 8/26/82. Statutory Authority: RCW 19.28.060. 81-06-037 (Order 81-5), § 296-46-910, filed 2/27/81, effective 4/1/81; 78-02-098 (Order 77-31), § 296-46-910, filed 1/31/78.]

WAC 296-46-915 Electrical contractor license, administrator certificate and examination, and copy fees.

- (1) General or specialty contractor license (per twenty-four month period) \$ 216.25
- (2)(a) Administrator certificate examination application (nonrefundable) \$ 27.00
- (b) Administrator first-time examination fee \$ 62.25
- (c) Administrator re-test examination fee \$ 72.75
- (3) Administrator original certificate (submitted with application) \$ 64.50
- (4) Administrator certificate renewal (per twenty-four month period) \$ 81.00
- (5) Late renewal of administrator certificate (per twenty-four month period) \$ 162.25
- (6) Transfer of administrator designation \$ 32.25
- (7) Certified copy of each document (maximum \$ 45.75 per file)
 - \$ 20.75 first document
 - \$2 each additional document
- (8) Reinstatement of a general or specialty contractor's license after a suspension \$ 43.50

- (9) Reinstatement of an administrator's certificate after a suspension \$ 43.50
- (10) Refund processing fee
All requests for refunds will be assessed a processing fee \$ 10.50

Note: Failure to appear for an examination results in forfeiture of the examination fee.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-915, filed 5/29/98, effective 6/30/98; 97-24-033, § 296-46-915, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-915, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.010(1), 19.28.600, 19.28.120(2) and 19.28.510(2). 92-08-102, § 296-46-915, filed 4/1/92, effective 5/2/92. Statutory Authority: RCW 19.28.060, 19.28.120(2) and 19.28.510(2). 90-17-041, § 296-46-915, filed 8/10/90, effective 9/10/90. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-915, filed 8/29/86.]

WAC 296-46-920 Civil penalty. A person, firm, partnership, corporation or other entity that violates a provision of chapter 19.28 RCW, chapter 296-46 or 296-401 WAC is liable for a civil penalty based upon the following schedule.

- (1) Offering to perform, submitting a bid for, installing or maintaining conductors or equipment that convey or utilize electrical current without having an unexpired, unrevoked and unsuspended electrical contractor license.
 - First offense: \$ 500
 - Second offense: \$ 1,000
 - Third offense: \$ 3,000
 - Each offense thereafter: \$ 5,000
- (2) Employing an individual for the purposes of RCW 19.28.510 through 19.28.620 who does not possess a valid certificate of competency or training certificate.
 - First offense: \$ 100
 - Second offense: \$ 350
 - Each offense thereafter: \$ 500
- (3) Working as an electrician or electrical trainee in the electrical construction trade without having a valid certificate of competency or electrical training certificate.
 - First offense: \$ 100
 - Second offense: \$ 250
 - Each offense thereafter: \$ 500
- (4) Employing electricians and trainees in an improper ratio.
 - First offense: \$ 250
 - Second offense: \$ 350
 - Each additional offense: \$ 500
- (5) Failing to provide supervision to an electrical trainee as required by RCW 19.28.510.
 - First offense: \$ 250
 - Second offense: \$ 350
 - Each additional offense: \$ 500

- (6) Working as an electrical trainee without proper supervision as required by RCW 19.28.510.
 - First offense: \$ 50
 - Second offense: \$ 100
 - Each additional offense: \$ 250

- (7) Performing electrical installations, alterations or maintenance outside the scope of the firm's specialty electrical contractors license.
 - First offense: \$ 250
 - Second offense: \$ 500
 - Each additional offense: \$ 1,000

- (8) Selling or exchanging electrical equipment associated with spas, hot tubs, swimming pools or hydro-massage bathtubs which is not listed and labeled by an approved electrical testing laboratory.
 - First offense: \$ 500
 - Second offense: \$ 1,000
 - Each additional offense: \$ 2,000

Definition: The sale or exchange of electrical components associated with hot tubs, spas, swimming pools or hydromassage bathtubs means: "Sell, offer for sale, advertise, display for sale, dispose of by way of gift, loan, rental, lease, premium, barter or exchange."

- (9) Covering or concealing installations prior to inspection.
 - First offense: \$ 500
 - Second offense: \$ 1,000
 - Each additional offense: \$ 2,000

- (10) Failing to make corrections within fifteen days of notification by the department.
 - First offense: \$ 250
 - Second offense: \$ 500
 - Each additional offense: \$ 1,000

Exception: Where an extension has been requested and granted, this penalty applies to corrections not completed within the extended time period.

- (11) Failing to obtain an electrical work permit prior to beginning the installation or alteration. Exception: In cases of emergency repairs to existing electrical systems, this penalty will not be charged if the permit is obtained no later than the business day following completion of the emergency repair.
 - First offense: \$ 250
 - Homeowner: \$ 50
 - Second offense: \$ 500
 - Each additional offense: \$ 1,000

(12) Violating RCW 19.28.125(2) duties of the electrical administrator RCW 19.28.125 (2)(a) through (f).	First offense:	\$ 100
	Second offense:	\$ 500
	Each offense thereafter:	\$ 1,000
(13) Violating any of the provisions of chapter 19.28 RCW or chapters 296-46 or 296-401 WAC which are not identified in subsections (1) through (11) of this section.	First offense:	\$ 250
	Second offense:	\$ 500
	Each additional offense:	\$ 1,000

(14) Each day that a violation occurs will be a separate offense. A violation will be a "second" or "additional" offense only if it occurs within one year from the first violation.

(15) In case of continued, repeated or gross violation of the provisions of chapter 19.28 RCW, chapter 296-46 or 296-401 WAC or if property damage or bodily injury occurs as a result of the failure of a person, firm, partnership, corporation, or other entity to comply with chapter 19.28 RCW, the department may double the penalty amounts shown in subsections (1) through (13) of this section.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-920, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, [19.28.]210(6), [19.28.]350 and [19.28.]600. 97-12-016, § 296-46-920, filed 5/28/97, effective 6/30/97. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 87-10-030 (Order 87-07), § 296-46-920, filed 5/1/87; 86-18-041 (Order 86-23), § 296-46-920, filed 8/29/86.]

WAC 296-46-930 Electrical contractor license and administrator certificate designation. See RCW 19.28.120.

(1) General electrical license and/or administrator's certificate encompasses all phases and all types of electrical installations.

(2) Specialty (limited) electrical licenses and/or administrator's certificates are as follows:

(a) Residential (02): Limited to the wiring of one and two family dwellings, or multifamily dwellings not exceeding three floors above grade. All wiring to be in nonmetallic sheathed cable, except service and/or feeders. This specialty does not include wiring commercial occupancies such as motels, hotels, offices, or stores.

(b)(i) Pump and irrigation (03): Limited to the electrical connection of domestic and irrigation water pumps, circular irrigating systems and related pumps and pump houses. This specialty includes circuits, feeders, controls, and services to supply said pumps.

(ii) Domestic well (03A): Limited to the extension of a branch circuit, which is supplied and installed by others, to pump controllers; pressure switches; alarm sensors; and water pumps which do not exceed 7 1/2 horsepower at 230 volts AC single phase.

(c) Signs (04): Limited to placement and connection of signs and outline lighting, the electrical supply, related controls and associated circuit extensions thereto; and the installation of a maximum 60 ampere, 120/240 volt single phase service to supply power to a remote sign only.

(d) Domestic appliances (05): Limited to the electrical connection of household appliances and the wiring thereto; such as hot water heaters, ranges, dishwashers, clothes dryers, oil and gas furnaces, and similar appliances. This specialty includes circuits to the appliances; however, it does not include the installation of service and/or feeders or circuits to electric furnaces and heat pump equipment.

(e) Limited energy system (06): Limited to the installation of signaling and power limited circuits and related equipment. This specialty includes the installation of fire protection signaling systems, intrusion alarms, nonutility owned communications systems, and such similar low energy circuits and equipment.

(f)(i) Nonresidential maintenance (07): Limited to maintenance, repair and replacement of electrical equipment and conductors on industrial or commercial premises. This specialty certificate of license does not include maintenance activities in hotel, motel, or dwelling units.

(ii) Nonresidential lighting maintenance and lighting retrofit (07A): Limited to working within the housing of existing nonresidential lighting fixtures for work related to repair, service, maintenance of lighting fixtures and installation of energy efficiency lighting retrofit upgrades. This specialty includes replacement of lamps, ballasts, sockets and the installation of listed lighting retrofit reflectors and kits. All work is limited to the fixture body, except remote located ballasts may be replaced or retrofitted with approved products. This specialty does not include installing new fixtures or branch circuits; moving or relocating existing fixtures; or altering existing branch circuits.

This specialty contractor must employ an administrator who holds a nonresidential lighting maintenance and lighting retrofit administrator certificate; or a nonresidential maintenance administrator; or a general administrator. This specialty contractor must adhere to the ratio requirements for trainee supervision in RCW 19.28.510 for specialty electricians to trainees. A specialty lighting maintenance and retrofit specialty technician is allowed to supervise a maximum of two trainees on the same job site. A contractor must obtain an electrical permit and request inspection for all retrofit installations.

The contractor must have a documented electrical lighting maintenance safety training program for all employees working under this specialty contractor license.

(3) Combination specialty electrical contractor license. The department may issue a combination specialty electrical contractor license to a firm which qualifies for more than one specialty electrical contractor license. The license shall plainly indicate the specialty licenses which are included in the combination electrical contractor license.

(4) Combination specialty electrical administrator certificate. The department may issue a combination specialty administrator certificate to an individual who qualifies for more than one specialty administrators' certificate. The combination specialty administrators' certificate shall plainly indicate the specialty administrators' certificate the holder has qualified for.

[Statutory Authority: Chapter 19.28 RCW. 98-12-042, § 296-46-930, filed 5/29/98, effective 6/30/98; 97-24-033, § 296-46-930, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-930, filed 8/29/86.]

WAC 296-46-935 Exemptions. (1) Definitions. The following definitions apply throughout this section.

(a) "Electrical equipment" includes electric lines, wires, apparatus, materials, and equipment.

(b) "License" means a license required under RCW 19.28.120.

(c) "Point of contact" means the point at which a customer's electrical system connects to the serving electrical utilities system.

(d) "Solicit" means to initiate the sale of services by advertisement or other means of offering one's services.

(e) For the purposes of RCW 19.28.200, electrical equipment not owned by a utility is "under the control of the serving electrical utility":

(i) If the equipment is located in a vault, room, closet, or similar enclosure that is secured by a lock or seal such that access is restricted to the serving electrical utilities personnel; or

(ii) If the serving electrical utility is obligated by contract to maintain the equipment and the contract provides that access to the equipment is restricted to the serving electrical utilities personnel.

(f) "Utility system" means electrical equipment owned by or under the control of a serving electrical utility that is used for the transmission or distribution of electricity from the source of supply to the point of contact at the premises or property to be supplied.

(g) "Utilization voltage" means the voltage level employed by the utilities customer for connection to lighting fixtures, motors, heaters, or other electrically operated equipment other than power transformers.

(2) Utility system exemption. Neither a serving electrical utility nor a contractor employed by the serving electrical utility is required to have a license for work on the "utility system" or on service connections or on meters and other apparatus or appliances used to measure the consumption of electricity.

(3) Street lighting exemption. A serving electrical utility is not required to have a license to work on electrical equipment used in the lighting of streets, alleys, ways, or public areas or squares.

(4) Customer owned equipment exemption. A serving electrical utility is not required to have a license to work on electrical equipment owned by a commercial, industrial, or public institution customer if:

(a) The utility has not solicited such work; and

(b) Such equipment:

(i) Is located outside a building or structure; and

(ii) The work performed is on the primary side of the customer's transformer(s) which produces power at the customer's utilization voltage.

(5) Independent power production equipment exemption. A serving electrical utility is not required to have a license to work on electrical equipment owned by a customer that is an independent power producer if:

(a) The customer has entered into an agreement to sell electricity to a utility or to a third party; and

(b) The electrical equipment is used to transmit electricity from the terminals of an electrical generating unit located

on premises used by the customer to the point of interconnection with the utility system.

(6) Exempted equipment and installations. No person, firm, partnership, corporation, or other entity is required to have a license for work on electrical equipment and installations thereof that are exempted by RCW 19.28.010.

(7) Exemption from inspection.

(a) The work of a serving electrical utility and its contractors on the utility system is not subject to inspection.

(b) Work covered by the National Electrical Code is subject to inspection except for work exempted by Section 90-2(B)(5) of the 1981 edition of the National Electrical Code.

(8) Permits to be obtained by customers. Whenever a serving electrical utility does work for a customer under one of the exemptions in this section and the work is subject to inspection, the customer is responsible for obtaining all permits that are required.

[Statutory Authority: RCW 19.28.060, 93-03-048, § 296-46-935, filed 1/15/93, effective 2/15/93.]

WAC 296-46-940 Electrical contractor license. (1) The department shall issue an electrical contractor license to a person, firm, partnership, corporation or other entity that complies with RCW 19.28.120 which shall expire twenty-four months following the date of issue. The department may issue an electrical contractor license for a period greater or less than twenty-four months for the purpose of equalizing the number of electrical contractor licenses which expire each month. The department shall prorate the electrical contractor license fee according to the number of months in the license period. All subsequent licenses shall be issued for a twenty-four month period.

(2) Cash or securities deposit release. A cash or security deposit which has been filed with the department in lieu of a surety bond, shall not be released until one year after the date the electrical contractor notifies the department in writing, that the person, firm, partnership, corporation, or other entity who (which) has been issued the electrical contractor license, has ceased to do business in the state of Washington.

(3) Manufacturers of electrical products shall be allowed to utilize their factory-trained personnel to perform initial calibration, testing, adjustment, modification incidental to the startup and check out of the equipment, or replacement of components within the confines of the specific product, without permit or required licensing, provided: The product has not been previously energized and/or is within the manufacturer's warranty. Modifications, as designated above, shall not include changes to the original intended configuration nor changes or contact with externally field-connected components. The manufacturers will be responsible for obtaining any required reapproval/recertification from the original listing agent.

[Statutory Authority: Chapter 19.28 RCW, 98-12-042, § 296-46-940, filed 5/29/98, effective 6/30/98. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW, 86-18-041 (Order 86-23), § 296-46-940, filed 8/29/86.]

WAC 296-46-950 Administrators certificate. (1) The department shall issue an administrator certificate to a person who qualifies for a certificate in accordance with RCW

19.28.125. The first certificate issued shall expire on the person's birthdate at least one year and not more than three years from the date of issue. If a person was born in an even numbered year, the certificate shall expire on the holder's even numbered birthdate. If the person was born in an odd numbered year, the certificate shall expire on the holder's odd numbered birthdate. The department shall prorate the administrators certificate fee according to the number of months or major portions of months in a certificate period. All subsequent certificates shall be issued for a twenty-four month period. The signature of a person who desires to renew their certificate shall be notarized.

(2) Effective July 1, 1987, an administrator designated on the electrical contractor license shall be a member of the firm who shall fulfill the duties of a full-time supervisory employee, or be a full-time supervisory employee. In determining whether the person is a member of the firm, the department shall require that the person is named as the sole proprietor, a partner or an officer in a corporation as shown on the electrical contractor license application on file with the department. In determining whether a person is a full-time supervisory employee, the department shall consider whether the person is on the electrical contractor's full-time payroll; receives a regular salary or wage similar to other employees; has supervisory responsibility for work performed by the electrical contractor and carries out the duties shown in RCW 19.28.125(2).

(3) The department may deny an application for an administrator's certificate for up to two years if the applicant's previous administrator's certificate has been revoked for a serious violation and all appeals concerning the revocation have been exhausted.

A serious violation is a violation of chapter 19.28 RCW, chapter 296-46 or 296-401 WAC that creates a hazard of fire or a danger to life safety. A serious violation is also a violation that presents imminent danger to the public. Imminent danger to the public is present when installations of wire and equipment that convey electric current have been installed in such a condition that a fire-hazard or a life-safety hazard is present. Imminent danger to the public is also present when unqualified, uncertified, or fraudulently certified electricians or administrators; or unlicensed or fraudulently licensed contractors are continuously or repeatedly performing or supervising the performance of electrical work covered under chapter 19.28 RCW. A certified electrician is considered qualified, provided the electrician is working within his or her certification.

[Statutory Authority: Chapter 19.28 RCW. 97-24-033, § 296-46-950, filed 11/25/97, effective 12/29/97. Statutory Authority: RCW 19.28.060, 19.28.600 and chapter 19.28 RCW. 86-18-041 (Order 86-23), § 296-46-950, filed 8/29/86.]

WAC 296-46-960 Revocation or suspension of a contractor license or administrator certificate. The department has the power, in the case of one or more acts of serious noncompliance with the provisions of this chapter, to revoke or suspend for such a period as it determines, any electrical contractor license or electrical administrator certificate issued under chapter 19.28 RCW.

(1999 Ed.)

Serious noncompliance: Serious noncompliance with the provisions of chapter 19.28 RCW, includes but is not limited to the following:

- (1) Failure to correct a serious violation that presents imminent danger as defined in WAC 296-46-950(3); or
- (2) Submitting a fraudulent document to the department; or
- (3) Continuous noncompliance with the provisions of chapter 19.28 RCW, chapter 296-46 or 296-401 WAC. For the purposes of this section, continuous noncompliance shall be defined as three or more citations demonstrating a reckless disregard of the electrical law, rules, or regulations within a period of six months; or where it can be otherwise demonstrated that the contractor or administrator has continuously failed to comply with the applicable electrical standards; or
- (4) Failure to make any books or records, or certified copies thereof, available to the department for an audit to verify the hours of experience submitted by an electrical trainee.

[Statutory Authority: Chapter 19.28 RCW. 97-24-033, § 296-46-960, filed 11/25/97, effective 12/29/97.]

**Chapter 296-49A WAC
DIRECTOR'S FACTORY ASSEMBLED
STRUCTURES ADVISORY BOARD**

WAC

296-49A-010	What definitions apply to this chapter?
296-49A-020	What is the purpose of these rules?
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WAC 296-49A-010 What definitions apply to this chapter? "Board" is the director's factory assembled structures advisory board.

"Department" is the Washington state department of labor and industries.

"Director" is the director of the department of labor and industries.

"Section" is the factory assembled structures (FAS) section of the department.

[Statutory Authority: RCW 43.22.340 and 43.22.420. 97-16-043, § 296-49A-010, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-020 What is the purpose of these rules? The primary purpose of these rules is to establish a uniform means of communication between the department and persons, firms or corporations engaged in the manufacture of factory assembled structures. Generally, this communication will involve either proposed WAC rule revisions or the operation of the section.

[Statutory Authority: RCW 43.22.340 and 43.22.420. 97-16-043, § 296-49A-020, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-030 What is the purpose of the board?

The purpose of the board, as authorized by RCW 43.22.420, is to advise the director on all matters pertaining to the enforcement of chapter 43.22 RCW including but not limited to standards of body and frame design, construction and plumbing, heating and electrical installations, minimum inspection procedures and the adoption of rules and regulations pertaining to the manufacture of factory assembled structures, manufactured (mobile) homes, commercial coaches, recreational vehicles, and recreational park trailers.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-030, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-040 Who are the members and officers of the board? The board has nine members. Each is appointed by the director to a four-year term. The members must represent consumer interests, regulated industries and allied professionals. Consequently, the composition of the board will be:

- Two members representing consumers;
- Two members representing manufactured housing;
- Two members representing factory built structures;
- One member representing recreational vehicles and recreational park trailers;
- One member representing building officials; and
- One member who will either be an architect or an engineer.

The board will elect a chairperson and vice-chairperson. The department's chief prefab building specialist shall serve as secretary of the board.

According to RCW 43.03.050 and 43.03.060, each board member shall be paid travel expenses. Those expenses will be paid out of department appropriations upon the presentation of a voucher approved by the director or the director's designee.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-040, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-050 When does the board meet? The board holds regular quarterly meetings on the third Thursday of February, May, August and November. If needed, the director may call special meetings. Regular and special meetings are open to the public.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-050, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-060 How are board meetings conducted? The board must adopt written rules of procedure governing its internal management. These rules must include *Roberts' Rules of Order, Revised*. Upon written request, copies of these rules of procedure must be provided to all interested persons.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-060, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-070 What are the duties of the board?

(1) Every three years the board must review existing FAS rules and recommend revisions if needed. Also, the board must review any new rules and regulations proposed by the

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director and make recommendations regarding their adoption.

(2) The board may periodically develop administrative procedures, organizational plans and rules for improving the operation of the section and submit them to the director for consideration.

(3) Upon the request of the director, the board will assist in the administrative interpretation of national codes and Washington state rules and regulations regarding all matters pertaining to the enforcement of chapter 43.22 RCW and the manufacture of factory assembled structures, manufactured (mobile) homes, commercial coaches, recreational vehicles, and recreational park trailers. This interpretative assistance will include but will not be limited to standards of body and frame design, construction and plumbing, heating and electrical installations, and minimum inspection procedures.

However, the board will neither function as a board of appeals nor will it render decisions regarding the application or interpretation of any adopted rule or regulation to any person, firm or corporation engaged in the business of manufacturing factory assembled structures.

(4) At any board meeting, the board must consider any written proposals made by any person, firm or corporation regarding new rules and regulations or changes in administrative procedures related to the section.

However, these written proposals must be submitted to the board's secretary at least fifteen days prior to the meeting so that they can be included on the meeting agenda and in the meeting packet distributed to board members. If the parties submitting these proposals wish to address them at that meeting, their proposals must be accompanied by a written request to address the board.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-070, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-080 Who can speak at board meetings? Any person, firm or corporation can speak at board meetings. **However**, those persons, firms and corporations wishing to formally address the board regarding specific proposals relating to any FAS rule adoptions, amendments or repeals or changes in the section's administrative procedures must be in good ethical standing with the board. (See WAC 296-49A-100.)

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-080, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-090 Can a person appearing before the board solicit business? The board considers it unethical for anyone appearing before the board to use any kind of solicitor to solicit business or to solicit business through circulars, advertisements or by personal communications or interviews unwarranted by personal relations. It is permissible to publish or circulate business cards.

[Statutory Authority: RCW 43.22.340 and 43.22.420, 97-16-043, § 296-49A-090, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-100 What standards of ethical conduct are expected of board members and persons appearing before the board? Anyone serving on the board or appearing before it must adhere to the standards described in

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"Ethics and the Appearance of Fairness," *State of Washington Boards and Commissions Membership Handbook*. Failure to conform to these standards may result in forfeiting the opportunity to either appear before the board or serve as a member.

[Statutory Authority: RCW 43.22.340 and 43.22.420. 97-16-043, § 296-49A-100, filed 7/31/97, effective 12/1/97.]

WAC 296-49A-110 What statute governs the adoption of FAS rules and regulations? All FAS rules and regulations will be adopted according to chapter 34.05 RCW, the Administrative Procedure Act.

[Statutory Authority: RCW 43.22.340 and 43.22.420. 97-16-043, § 296-49A-110, filed 7/31/97, effective 12/1/97.]

**Chapter 296-50 WAC
SAFETY STANDARDS—MANUFACTURE OF
EXPLOSIVES**

WAC

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WAC 296-50-010 Foreword. These safety standards are promulgated under and by authority of RCW 49.16.010, 49.16.080, 49.16.090, 49.16.100 and 49.16.050 by hearing held at Olympia June 28, 1957 for the purpose of direction and guidance of manufacturers of explosives in order to comply with RCW 49.16.030. ". . . to render the work and place of work safe . . ." They shall become effective August 15, 1957. Attention is called to RCW 70.74.010 which reads as follows: "The term 'explosive' or 'explosives' whenever used in this act, shall be held to mean and include any chemical compound or mechanical mixture, that is commonly used or intended for the purpose of producing an explosion that contains any oxidizing and combustible units, or other ingredients in such proportions, quantities or packing, that an ignition by fire, by friction, by concussion, by percussion or by detonator or any part of the compound or mixture may cause such a sudden generation of highly heated gases that the resultant gaseous pressures are capable of producing destructive effects on contiguous objects or of destroying life and limb."

[Foreword, filed 3/23/60, effective 8/15/57.]

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WAC 296-50-020 Introductory. For reasons of brevity the safety educational standards as set forth in the general safety standards of the state of Washington, are not reprinted here but attention is called to several educational requirements contained in the above named standards.

[Introductory clause, filed 3/23/60, effective 8/15/57.]

WAC 296-50-030 Management's responsibility. (1) Report directly to the division of safety, Olympia, by telephone or telegraph (collect), immediately, any accident resulting in an immediate or probable fatality.

(2) Equipment involved in an accident resulting in an immediate fatality, shall not be moved, until a representative of the division of safety investigates the accident and releases such equipment, except where removal is essential to prevent further accident. Where necessary to remove the victim such equipment may be moved only to the extent of making possible such removal.

(3) Immediately upon notification of accident, department representative shall inform employer when investigator will be available. If circumstances exist whereby investigation will be delayed, department representative may permit employer to proceed with normal job operations.

(4) Upon arrival of division of safety investigator, employer shall assign to assist the investigator, the immediate supervisor and all employees who were eye witnesses to the accident, or whoever the investigator deems necessary to complete his investigation. Each witness shall give his own version and there shall be no discriminatory action taken for anyone testifying in any investigation.

(5) To prohibit any employee from working on or being in the vicinity of any job while under the influence of or affected by intoxicants. Employers shall be responsible for the actions of any employee known to be in an intoxicated condition while on the job.

(6) Assume the responsibility of work assignment so that no member of any production or maintenance crew shall be required to work in a position or location so isolated from other members of the crew that he is not in ordinary calling distance in case of an emergency.

(7) Make sure that every man has been trained for the work he is assigned to and has been thoroughly instructed in his duties and responsibilities.

[Rule 1, filed 3/23/60, effective 8/15/57.]

WAC 296-50-040 Employee's responsibility. He shall not report to the job while under the influence of intoxicants and shall not use intoxicants or drugs covered by the federal narcotics act while on the job.

To advise inexperienced fellow employees of safe ways to do their work and warn them of dangers to be guarded against.

Employees shall wear, use and properly care for personal protective safety equipment issued to them and return same to employer on termination of employment.

Workmen exposed to overhead hazards shall wear approved safety hats.

Employees should wear safety shoes when their feet are exposed to hazards of falling materials.

Safety inspector plan.

Settlement of disputes (safety inspectors).
 Safety committee plan.
 Settlement of disputes (safety committee).
 Safety educational reports.
 Safety bulletin board.

[Rule 2, filed 3/23/60, effective 8/15/57.]

WAC 296-50-050 Minimum requirements for first aid. (1) RCW 51.36.030 provides that: "Every employer, who employs less than fifty workmen, shall keep at his plant a first aid kit equipped as required by the department with materials for first aid to his injured workmen. Every employer who employs within a radius of one-half mile of any plant or establishment fifty or more workmen, shall keep one first aid station equipped as required by the department with materials for first aid to his injured workmen, and shall cooperate with the department in training one or more employees in first aid to the injured. The maintenance of such first aid kits and stations shall be deemed to be a part of any educational standards established under the provisions of sections 7734 and 7736."*

(2) Adequate provisions for the first aid treatment of injured persons shall be maintained at all times in every industrial establishment and on every operation covered by the act.

(3) Employers shall arrange to have as many workmen as possible take a full course in first aid training.

(4) There shall be at least one employee who has either a Red Cross, U.S. Bureau of Mines, or department of labor and industries current first aid certificate available during all operating hours in each plant, department or branch establishment employing less than 15 persons. (A current first aid certificate is one which is less than 3 years old.)

(5) There shall be at least two employees who have either Red Cross, U.S. Bureau of Mines, or department of labor and industries current first aid certificates available during all operating hours in each plant, department, or branch establishment employing more than 15 persons. (A current first aid certificate is one which is less than 3 years old.)

[Rule 3, filed 3/23/60, effective 8/15/57.]

***Reviser's note:** Section 7734 above is now RCW 49.16.050. Section 7736, which was repealed by Laws of 1927, section 19, page 762, read as follows: "The educational standards for coal mines and coal mining shall be prescribed by a board hereby created to be known as the 'state mining board' consisting of two members to be appointed by the state safety board."

For later law see RCW 43.22.120 et seq. and 78.40.780 et seq.

WAC 296-50-060 First-aid kit. (1) A first-aid kit shall be available on small construction jobs, line crews, and other transient or short duration jobs. On all such operations, or at small plants or division establishments employing less than fifty workmen, there shall be a first-aid kit containing the following supplies or their equals as recognized by the plant or establishment medical director or medical consultant, or by the department of labor and industries.

1 package iodine applicators (not less than 6) and 1 package antiseptic applicators (not less than 6) containing some other approved antiseptic.

1 package aromatic spirits of ammonia ampoules and 1 package of ammonia inhalants in ampoules.

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1 package water soluble base burn treatment.
 6 triangle bandages 40" size.
 1 tourniquet - buckle type.
 1 1/2" x 5 yards Z. O. adhesive (sterilized).
 6 compress bandages 4" x 4" pads (sterilized and individually wrapped in water proof packages).
 4 compress bandages 2" x 2" pads (sterilized and individually wrapped in water proof packages).
 2 2" roller bandages (sterilized).
 6 3" x 3" gauze pads (sterilized and individually wrapped).
 1 package 3/4" x 1" water proof adhesive compresses (100 in package).
 1 pair scissors and 1 pair tweezers.
 Proper antidotes for poisons to which workers may be exposed.

1 package approved eye dressing.

A chart showing clearly the pressure points and tourniquet points of the human body shall be fastened on the inside of the cover or door of the container for ready reference.

(2) All crew trucks, power shovels, cranes, locomotives, loaders, cats, logging trucks, speeders, freight trucks and similar equipment and vehicles shall be equipped with a standard dust and moisture proof first-aid kit (a moisture proof kit is one having a rubber seal around the inside of either of the closing edges to keep moisture from entering kit when closed) containing the following items:

1 package iodine applicators (not less than 6) and 1 package antiseptic applicators (not less than 6) containing some other approved antiseptic.

4 triangle bandages 40".

3 2" compress bandages.

3 4" compress bandages.

1 package 3/4" or 1" waterproof adhesive compresses (16 in package).

1 tourniquet - buckle type.

1 pair scissors and 1 pair tweezers.

1 package aromatic spirits of ammonia ampoules for internal use.

1 package ammonia inhalants in ampoules.

1 package water soluble base burn treatment.

2 packages 3" x 3" sterile gauze pads—4 to a package.

1 package 18" x 36" gauze (sterile).

1 package 36" x 36" gauze (sterile).

1 package approved eye dressing.

2 2" roller bandages (sterilized).

1 chart showing clearly the pressure points and tourniquet points of the human body shall be fastened on the inside of the cover of the container for ready reference.

(3) In addition to the first-aid kit which must be kept on the equipment or at the place of work, there shall be available within the closest practicable distance from the operations (not to exceed 1/2 mile) the following items:

1 set of arm and leg splints.

2 all wool blankets (properly protected and marked).

1 stretcher.

(4) First-aid instructors will, upon request, be furnished to industries by the division of safety of the department of labor and industries.

(5) All foremen, supervisors, or persons in direct charge of crews should have either a Red Cross, U.S. Bureau of Mines, or department of labor and industries current first-aid certificate; it being understood that a certificate is void 3 years from date of issue.

(6) Workers whose injuries require the use of a stretcher or ambulance or while being transported by other means shall be accompanied to the hospital by an attendant other than the driver. This attendant shall be first-aid trained if possible, and shall ride with the patient.

(7) All ambulances used to transport injured workers shall be equipped with a fracture board as approved by the department of labor and industries.

(8) All drivers of ambulances transporting workmen covered by industrial insurance shall be trained in basic and advanced first aid as approved by the department of labor and industries.

(9) Immediate and proper transportation shall be provided for injured persons requiring the same, and such transportation shall have precedence over all other transportation under the control of the firm or party upon whose operation the accident occurs.

(10) All first-aid kits shall be kept filled and maintained in proper condition.

(11) When practical, a poster shall be fastened and maintained either on or in the cover of each first-aid cabinet and at or near all phones plainly stating the phone numbers of all available doctors, hospitals, and ambulance service within the district of the employer.

(12) Every fixed establishment employing more than 200 persons shall have a first aid room plainly designated as such. It shall be well lighted and well ventilated, kept spotlessly clean and orderly, provided with hot and cold running water, and fully equipped at all times. There shall be either a person who has a current first-aid certificate, or a trained nurse in charge of the first-aid room.

[Rule 4, filed 3/23/60, effective 8/15/57.]

WAC 296-50-070 First-aid room. (1) The minimum first-aid supplies to be kept in the first-aid room shall be:

- 1 package iodine applicators (not less than 24 in a package) and 1 package antiseptic applicators (not less than 24 in a package) containing some other approved antiseptic.
- 1 package aromatic spirits of ammonia ampoules and 1 package ammonia inhalants in ampoules.
- 2 packages water soluble base burn treatment.
- 6 triangle bandages 40" size.
- 1 tourniquet - buckle type.
- 1 1" x 5 yds. Z. O. adhesive (sterilized).
- 1 2" x 5 yds. Z. O. adhesive (sterilized).
- 6 compress bandages 2" x 2" pads sterilized and individually wrapped in waterproof packages.
- 6 compress bandages 4" x 4" pads sterilized and individually wrapped in waterproof packages.
- 1 package approved eye dressing.
- White vaseline.

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- 2 each of 2", 3" and 4" roller bandages (sterilized).
- 12 3" x 3" sterile gauze pads (individually packaged).
- 18" x 36" sterile gauze.
- 1 pair scissors, 1 pair tweezers, medicine droppers, assorted safety pins and paper drinking cups.
- 1 bottle rubbing alcohol and 1 package absorbent cotton.
- 6 finger cots.
- 1 set arm and leg splints.
- Proper antidotes for poisons to which workers may be exposed.
- A chart clearly showing pressure and tourniquet points shall be fastened on inside of cover or door of materials container.
- 1 stretcher and 2 all wool blankets (properly protected and marked).
- 1 container, dust proof, to be used solely for storage of first aid materials.
- 1 cot, complete with springs, mattress, blankets and 2 pillows (if both men and women are employed in the plant or establishment, privacy shall be provided).
- 2 hot water bottles.
- 1 emergency first aid kit, 24 unit size.
- Some means of sterilizing tweezers shall be provided for.

(2) The foregoing minimum safety educational and first aid program, of necessity, is briefly covered, and calls for less than average safety work. It is not anticipated that there will be conflict with other existing programs or requirements. It is expected that these minimum requirements will become the basis on which a more complete program, suited to the size and the needs of the individual establishment, will be set up.

(3) Where any firm or majority group of employees of any firm finds that these educational standards cannot be adhered to in the operation involved, an application for adoption of a different plan of safety organization (on the form furnished by the department) may be filed with the division of safety, department of labor and industries. After full investigation of the operation of the firm, and consultation with the management and employees, the department may, if it is found that these educational standards cannot be complied with, approve the plan proposed or another type of plan recommended by the department (at its option) provided it conforms to the following provisions:

- (a) The plan provides full management-employee participation.
 - (b) The plan is based on sound principles of accident prevention.
 - (c) The result will not be less than that provided in these educational standards.
 - (d) Any plan approved may be canceled on 30 days' notice by the division of safety after consultation with the management and employees.
- (4) No safety program will run itself. To be successful, the wholehearted interest of the employees' group and management must not only be behind the program, but the fact must also be readily apparent to all.

[Rule 5, filed 3/23/60, effective 8/15/57.]

WAC 296-50-080 General regulations. (1) Smoking is positively prohibited on the plant site except in buildings designated.

(2) No matches or lighters shall be permitted in the plant area except in locations designated by management.

(3) A search of the employees for matches shall be made frequently, and at no time shall the interval between searches exceed one month.

(4) Special clothing and shoes free of metal fasteners shall be worn by all employees regularly working in buildings where explosives are handled. Powder shoes shall not be resoled. Any pockets provided should be constructed of cloth mesh.

(5) Neither the shoes or the special clothing as set forth in (4) above shall be worn off the premises but shall be left in the change room.

(6) New employee shall not handle explosives or operate any equipment in connection with the manufacture of explosives until he has received thorough instructions in accordance with established practices.

(7) Employees shall not engage in practical jokes or horseplay.

(8) All tools and brooms must be kept in their proper place when not in use.

(9) Gloves must be changed frequently.

(10) Oily rags, waste and refuse must be kept in special covered containers and contents removed to the waste quite frequently.

(11) All fire equipment such as extinguishers, hose, etc., shall be kept in good condition and inspected quarterly.

(12) All employees shall be instructed in the use of fire extinguishers and other fire apparatus.

(13) Great care shall be exercised in the handling and transportation of all explosives and acids.

(14) Any material known to be contaminated shall not be sent to the powder line.

(15) All major equipment used in connection with the manufacture of explosives shall be grounded and grounding inspected at regular intervals to be determined by management.

(16) Dope cans or buggies shall be kept covered or inverted at all times except when being filled or emptied.

(17) Breathing of fumes of oxides of nitrogen is to be avoided. Should an employee inhale a sufficient amount to cause irritation, the employee should cease work immediately and report to first aid station.

(18) Instruction shall be posted in the first-aid station pertaining to the treatment of acid burns and nitric oxide vapors.

(19) Goggles shall be worn by employees grinding sulphur, and respirators shall be stand-by equipment in case of bad atmospheric conditions.

(20) All buildings used in the manufacture of explosives shall be kept clean at all times. Daily, weekly and other regular cleanup schedules shall be established.

(21) No explosives in excess of the normal house limit shall be allowed to remain in operating buildings over night.

(22) Suitable maintenance and lubricating schedules shall be set up for each piece of powder machinery.

(23) All electric switches operating equipment shall be turned off during lunch period and at termination of shift.

(24) Equipment in buildings where explosives are manufactured shall not be worked on unless switch is locked in open position, except for minor adjustments.

(25) Shield shall be provided around all acid valves.

(26) Respirators shall be washed daily and cartridges changed when once used.

(27) All safety doors and exits in the houses handling explosives shall be kept clear at all times. Two alternate exits such as chutes or outside stairways shall be provided for each floor.

(28) Rubber mats or suitable shoe cleaning devices shall be provided and used when entering and before leaving the building.

(29) Do not make any repairs to equipment or to buildings until they have been thoroughly cleaned.

(30) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on.

(31) Extreme care shall be used by all employees in connection with the use of or repairing of acid equipment.

(32) Any unusual conditions occurring should be reported to supervision immediately.

(33) Goggles and rubber gloves should be worn when working on acid cars.

(34) Brooms should be washed frequently.

(35) Employees in powder operations shall not respond to fire alarms to fight fire in clothing contaminated with powder or nitro-cotton.

(36) Operations in all buildings when explosives are being manufactured shall be closed down when there is an electric storm in the vicinity; all light and power switches shall be pulled, and employees are to go to change house until storm is over, except N.G. line must be secured.

(37) Whenever the state explosive inspector enters the plant to inspect the powder line, arrangements shall be made previously by the inspector in setting the date and time of inspection. While the inspection is in progress, the powder line shall not operate.

(38) In order to guard against inadvertent trespasses, all explosive manufacturing plants must be enclosed on all sides by a substantial fence of at least four barbed wires with warning signs (white background - red letters) attached at 100 ft. intervals, reading as follows: EXPLOSIVES—DANGER—KEEP OUT.

If natural barriers such as rivers, lakes, high cliffs, etc., form a boundary line, no fencing shall be required.

[Rules A-1 through A-38, filed 3/23/60, effective 8/15/57.]

WAC 296-50-090 Dope house. (1) Clean and inspect dope screens and brushes twice each shift. Leave screens out overnight. Oil machinery once per shift.

(2) Where electro magnets are used and when ammeter shows less than 3 amperes through magnets, trouble must be corrected before continuing operation.

(3) Keep spare screen on hand at all times for replacing screens with holes, or breaks. Remove defective screen from house immediately after it is replaced.

(4) All materials for delivery to the mixing house shall be thoroughly screened. Dope which falls on the floor under

the screen should be swept up and hand screened into the mixing to which it belongs.

(5) Do not send hot dopes to mixing houses. Notify foreman or supervisor if unusual temperatures exist.

(6) Never slide sulfur over floor or down chutes or drop into an empty bin. (Sulfur is subject to static electricity and friction fires and must be handled carefully.) Keep bins full at all times.

(7) Keep dope cans or buggies covered or inverted at all times except when filling or emptying. Examine buggies' interior before filling.

(8) Collect all foreign objects from screen or magnet and send to powder line foreman. Report immediately any unusual material.

(9) Keep house clean and as free of dust as possible at all times.

(10) The following tools are permitted in this building:

- Wooden or rubber mallets
- Bronze bars on thong
- Metal-clad thermometer on thong
- Aluminum scoops or
- Shovels of aluminum or wood
- Brooms and counter brushes
- Spare dope screen
- Small scales
- Wooden hoes

(11) Daily clean-up. Remove screen, clean (wash if necessary) and inspect. Leave screen out overnight. Clean scales, radiators and all interior with compressed air and brush. Brush dirt from exterior of screen and dope cans or buggies. Sweep floors and send all sweepings to waste shed when the accumulation justifies.

(12) Weekly clean-up. In addition to daily clean-up, blow and brush down ceiling, walls and equipment and clean platforms outside the house. Sweep motor room.

(13) Semiannual clean-up. Remove dopes and wash down house.

(14) Powder uniforms and shoes in accordance with WAC 296-50-080(4) must be worn by employees in this house. Goggles and respirators shall be provided for use where needed, particularly when blowing or brushing down a house.

(15) Never work on equipment without pulling switches and locking the starting equipment, except for minor repairs. Pull all electric switches at the end of operating day.

(16) Inspect screens twice each shift or oftener, reporting any holes or breaks immediately to supervisor. Remove defective screen from house for repairs immediately.

(17) Where electro magnets are used, make certain that magnet lights are on during operation of screens. Remove tramp iron from magnets twice per shift and deliver accumulation to the line foreman at regular intervals.

(18) Check grounding frequently. The safety of the powder lines is dependent on receiving supplies free of foreign materials. Do not send any material to the lines unless every reasonable precaution has been taken to eliminate contamination.

(19) Before starting repairs on equipment, such as bins, dryers and screens, adequate precautions should be taken to

prevent contamination with foreign substances. Check house and equipment for loose parts after repairs are made.

(20) Keep house clean.

(21) Keep tools, brooms, implements, etc. (when not in use) in the boards, racks or paper bags provided for them.

(22) Keep materials neatly and safely piled and protected to prevent entrance of any foreign material.

(23) See that all fire-fighting equipment is maintained in adequate condition for use at all times.

(24) Keep all bearings well lubricated and free from dust accumulation.

(25) All material prepared for delivery to the powder lines must be screened through six mesh stainless steel screen.

(26) Oily waste and rags must be placed in covered cans provided for that purpose. Clean rags and waste shall be kept in separate covered cans.

(27) Keep oily waste cans outside of buildings.

(28) No welding or open lights to be used at any time in this house without it being washed down prior, and written permission by the management is required.

[Rules B-1 through B-28, filed 3/23/60, effective 8/15/57.]

WAC 296-50-100 Dynamite mixing house. (1) Man limit - 3 employees, except supervision and truckers, provided, however, that 5 men may be used in tray-bagging operations where open tray is used for bagging and the operation is entirely manual.

(2) Oil machines and inspect carefully before starting to see that all equipment is in proper operating condition and that no foreign material is in bowls. See that bonding is secure. Run bowls empty for a short interval.

(3) If machine is not operating satisfactorily, shut down and notify foreman.

(4) Inspect screens used over bowls carefully before starting operation and before each mixing.

(5) If powder does not appear normal or there is any indication that it will not work satisfactorily for cartridgeing machines, notify foreman.

(6) Clean accumulation of dopes from equipment over bowl and edge of bowl after each dope is dumped.

(7) Sweep floor after each mixing.

(8) Do not mix and hold more powder in the house than is necessary for smooth operation. Mixed powder must not be held in mixer, except under unusual circumstances.

(9) Do not clean bowl or wheels while mixer is in motion.

(10) Examine buggies interior before adding any powder.

(11) It is advisable to use a respirator while shoveling out powder or working over the bowl.

(12) Not more than one N.G. buggy shall be permitted in this house at a time.

(13) The following equipment is allowed in this building while machine is in operation:

- Wooden shovels
- Wooden hoe and wooden scraper
- Floor broom
- Whisk brooms on tongs

Aluminum dust pan
 Wall thermometer in a case
 Oil can
 Nitro-cotton scale
 Fibre hand scoop
 Permissible flash light
 Plastic bottles
 Rubber mallet
 Wooden box for rags and cloth

(14) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on. Before resuming operation, all tools and pieces of equipment shall be accounted for to be certain they do not become a hazard to the operation.

(15) Daily clean-up. Remove all powder and nitrocotton from building and wipe inside of mixer and wheels. Wipe outside of N.G. buggy before returning to neutralizing house. Brush off powder buggies and trucks, and sweep floor thoroughly, sending sweepings to waste shed. Sweep platforms, track and motor rooms.

If mixer is operated more than one shift, the floor shall be thoroughly clean at end of earlier shift, and house left in orderly condition. Motors shall be stopped. Incoming operator shall inspect bowls and equipment before starting motors.

(16) The weekly clean-up shall be established in accordance with safe practices and such clean-up shall be agreed upon by management and the state safety inspector.

(17) Management is held responsible for the strict observance of all the above rules.

(18) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules C-1 through C-18, filed 3/23/60, effective 8/15/57.]

WAC 296-50-110 Dynamite pack machine house. (1) Man limit - 3 employees, except supervision and truckers, provided that in cases where bag-packing and long length, large diameter cartridges are packed, 4 men shall be the limit.

(2) Before starting machine for the day or after repairs or changes, inspect it thoroughly for foreign material and see that all moving parts are oiled. Inspect inside of hopper, install stirrers and examine tamps. Operate machine empty for a short interval. It is very important that machine be accurately lined up and correctly timed.

(3) If machine is not operating satisfactorily, shut down and notify foreman. If any part of equipment is missing or tools unaccounted for, the machine must be shut down, the foreman called and all powder in the house screened, if the part is not located.

(4) Do not replace a broken shear-pin in drive shaft and restart machine until, (a) the foreman has been notified, (b) the powder has been cleaned from the hopper and sent to the waste opening house for screening and (c) you have assured yourself that machine is in satisfactory operating condition.

(5) Do not tighten tamps while machine is in motion.

(6) Keep floor clean. Remove powder from under front of machine as often as a hazard would indicate. Floor sweepings should be screened and sent to the waste house.

(7) Keep covers on buggies except when shoveling powder out, or filling with cartridge powder.

[Title 296 WAC—p. 1090]

(8) Check drive to stirrers to see that there is no slippage. If it is slipping, shut down machine and notify foreman at once. Keep stirrer bearing well oiled. Applies to Starrett type of machine.

(9) No spare parts are to be kept in house, fan or motor rooms or in waste shed. Keep in parts house.

(10) The following miscellaneous equipment is allowed in house while machine is in operation:

Wooden or aluminum hoes
 Wooden shovels
 Wooden or aluminum floor scrapers
 Floor brooms
 Oil cans
 Scale (stick count) chart
 Aluminum dust pans on thong
 Whisk brooms on thong
 Wall thermometer
 Wooden tamp on thong

(11) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on. Before resuming operation, all tools and pieces of equipment shall be accounted for to be certain they do not become a hazard to the operation.

(12) Clean-up for machine change or repairs. All powder must be cleaned from the hopper. Clean loose powder from machine and floor and remove all powder, including waste, from the house. When changing stirrers, tamps and nipple plate, it is necessary to clean the hopper thoroughly in addition to doing the above.

For major repairs to house or machine, make clean-up as specified below for weekly clean-up.

No powder shall be delivered to building until machine operator advises that machine is ready for operation.

(13) Remove all waste and cartridge powder from buildings before starting machine clean-up. Clean powder hoppers and stirrers. Clean off all parts of machine and radiators. Remove all dry clean powder recovered to the waste house for screening. Sweep floor thoroughly and send dirty sweepings to waste shed. Leave stirrers out for operators to install on the following operating day. Sweep outside platforms and track. If the house is operated two shifts, at the end of the first shift all powder is put into hopper and worked down to the allowable limit and the floor swept. All waste and sweepings shall be removed.

(14) The weekly clean-up shall be established in accordance with safe practices and such clean-up shall be agreed upon by management and the state safety inspector.

(15) Management is responsible for the enforcement of all of the above rules.

(16) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules D-1 through D-16, filed 3/23/60, effective 8/15/57.]

WAC 296-50-120 Gelatin mixing house. (1) Man limit - 3 employees, except supervision and truckers.

(2) Lubricate all machinery thoroughly and inspect bowls and stirrers carefully before starting up on each shift, to insure that all equipment is in good operating condition and the bowls are free of foreign material. Where figure eight

type of mixer is used, house operator should check clearance of mixer paddles each morning before starting by passing the hand under and around end of paddles to determine if there is satisfactory clearance at these points. Run empty bowls for a short interval and lower and raise paddles.

(3) Dope screens above mixers. These screens shall be inspected daily and before each mixing.

(4) Shut down and notify foreman if machine is not working properly.

(5) Where figure eight mixer is used, stirrers must be locked. Lock wheels on both sides in the "up" position while digging out or dumping powder, and lock wheels on both sides in the "down" position before starting to mix. Removable covers must be in place over the mixing bowls while mixing is in operation.

(6) Floor around bowl shall be swept after each mixing and sweepings stored in a closed container and sent to the waste shed.

(7) Mixing house buggies shall be inspected for foreign material before filling from mixer.

(8) Wooden shovels or scraper should be used to remove powder from stirrers on figure eight mixer.

(9) Mixing bowl temperatures shall not exceed 130°F.

(10) Not more than one N.G. buggy shall be permitted in this house at a time. The buggy shall be removed from the house after emptying.

(11) Do not add any material; use brush or whisk broom on any object within the immediate vicinity of a figure eight mixer while it is in operation; do not take sample from bowl while it is in operation.

(12) Floors to be kept clean. Walls and equipment to be maintained reasonably free of dust.

(13) The following miscellaneous equipment is permitted in this building while machine is in operation:

- Wooden or aluminum hoes
- Wooden shovels
- Wooden or aluminum floor scrapers
- Floor brooms
- Oil cans
- Scale (stick count) chart
- Aluminum dust pans on thong
- Whisk brooms on thong
- Wall thermometer
- Wooden tamp on thong

(14) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on. Before resuming operation, all tools and pieces of equipment shall be accounted for to be certain they do not become a hazard to the operation.

(15) Daily clean-up. Clean thoroughly with solvent the inside of bowl and stirrers. Brush off powder buggies and trucks. Wipe outside of N.G. buggy before returning to store house. Brush down outside of bowls. Sweep floors, platforms, track and motor rooms. Send all sweepings to waste shed. It is recommended that goggles be used in clean-up operations.

If mixer is operated more than one shift, the floor shall be swept thoroughly at end of earlier shift and house left in orderly condition. Motors shall be stopped and electric

switches disconnected. Incoming operator shall inspect bowls and equipment before starting motors.

(16) The weekly clean-up shall be established in accordance with safe practices and such clean-up shall be agreed upon by management and the state safety inspector.

(17) The management is held responsible for the strict observance of all of the above rules.

[Rules E-1 through E-17, filed 3/23/60, effective 8/15/57.]

WAC 296-50-130 Gelatin cartridge machine house.

(1) Man limit - 3 employees, except supervision and truckers.

(2) Before starting machine for the day or after repairs or changes, inspect carefully to see that machine is well oiled and bowl is free of foreign material. For Starrett Stuffer type of machine, check rigidity of worms. Operate machinery empty for a short interval.

(3) If machine is not operating satisfactorily, shut down and notify foreman. Do not attempt to run powder which is too stiff.

(4) If any part of equipment is missing or tool unaccounted for, the machine must be shut down and the foreman called. Do not start it again until missing material is found or inspection of machine and powder has shown it safe to resume operations.

(5) When feeding powder into bowl, care should be exercised in keeping the hands well out of the bowl and away from worm to avoid injury.

(6) Clean tables and floor frequently, storing waste in closed containers for removal to waste shed.

(7) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on. If removed string nipple plate nuts on a thong or aluminum wire and immerse in engine oil until plate is again assembled.

(8) Keep no spare parts in house, fan or motor houses or waste shed. Keep only in parts house.

(9) No tools are permitted in this building while the machine is running. The following miscellaneous equipment is allowed in house while machine is in operation:

- Wooden shovel
- Scale
- Cartridge chart
- Aluminum dust pan on thong
- Floor brooms
- Whisk brooms and counter brushes on thong
- Oil can
- Floor scraper
- Wall thermometer
- Brass screwdriver on counter-weight
- Hand scraper

(10) On Starrett Stuffer machine make certain that auger is secured in threaded coupling before starting machine. Always check to see that machine is operating in proper direction so that auger will not screw out.

(11) Where Starrett Stuffer machine is used, make sure that auger, when out of place, has ample clearance between liner and check clearance between nipple plate by turning machine by hand after nipple plate is assembled.

(12) On Starrett Stuffer, always use a gasket which has been freshly lubricated with oil between nipple plate and bowl. Oil resistant synthetic rubber is preferable.

(13) All tools shall be handled carefully and oil desensitizer used liberally on the parts being worked on. Before resuming operation, all tools and pieces of equipment shall be accounted for to be certain they do not become a hazard to the operation.

(14) Daily clean-up. Remove all punched and unpunched powder from the house and cut off power to machine motor before starting the machine clean-up. Remove and clean the nipple plate and horizontal auger. Wipe inside and outside of bowl, vertical worms and inside of lower worm housing as well as possible with rags and solvent. Leave nipple off until start of next shift. Clean crimper and leave crimper head in oil overnight. Clean floor and table carefully and wipe with solvent if necessary. Send sweepings to waste shed.

(15) The weekly clean-up shall be established in accordance with safe practices and such clean-up shall be agreed upon by management and the state safety inspector.

(16) The management is responsible for the enforcement of the above rules.

(17) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules F-1 through F-17, filed 3/23/60, effective 8/15/57.]

WAC 296-50-140 Handpack house. (1) Man limit - 3 employees, except supervision and truckers.

(2) Keep powder in buggies covered as much as possible.

(3) Keep floor and benches clean. Store sweepings in covered container and send to waste shed frequently.

(4) Spare equipment shall be stored in spare parts house. No parts shall be stored in waste shed, fan or motor rooms.

(5) The following miscellaneous equipment is allowed in this building:

- Wooden shovels
- Wooden or aluminum hoes
- Wooden tamps
- Whisk brooms on thong
- Wooden or aluminum floor scrapers
- Scale (stick count) chart
- Aluminum hand scoops
- Floor brooms

(6) At end of day, remove powder from building, clean equipment and sweep floors, platforms and track thoroughly.

(7) The management is responsible for the enforcement of the above rules.

(8) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules G-1 through G-8, filed 3/23/60, effective 8/15/57.]

WAC 296-50-150 Waste opening house. (1) Man limit - 3 employees, except supervision and truckers.

(2) Hardwood wedges and rubber mallets shall be used to open wooden cases.

(3) Open cartridges with short knife or wooden spatula attached to long rawhide thong or opening boards.

[Title 296 WAC—p. 1092]

(4) Inspect screens before use and often during the day. Clean and deliver to repairman immediately any screen found to be defective.

(5) Screen all dynamite grades, except semi-gel, by brushing through the screen. Semi-gel may be opened and rolled with an all wood rolling pin on a table to facilitate inspection for foreign material, semi-gel may also be screened. Gelatin grades shall be unrolled and inspected.

(6) Under normal conditions full size cartridges or large pieces of powder should not be sent to the burning ground but should be cut or broken into small pieces before delivery to waste shed.

(7) The following miscellaneous equipment is allowed in this building during opening operations:

- Solid knives on thongs (or a cutting bench)
- Wooden shovels
- Wooden spatulas on thongs
- Powder screens
- Wooden floor scraper
- Scale
- Floor brooms
- Whisk brooms on thong and aluminum scoop
- Counter brush on thong
- Brass picks on thong
- Wall thermometer

(8) House shall be kept orderly and be cleaned thoroughly at end of shift.

(9) The management is held responsible for the strict observance of the above rules.

(10) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules H-1 through H-10, filed 3/23/60, effective 8/15/57.]

WAC 296-50-160 Box packing house. (1) Man limit - 6 employees, except supervision and truckers.

(2) Paraffin temperature in the dip pot must not exceed 220 degrees F.

(3) Machines in this house shall be kept clean and the bearings oiled.

(4) No explosives in excess of the normal house limit shall be allowed to remain in building overnight.

(5) Do not handle cases roughly.

(6) Inspect cases carefully and remove all protruding nails.

(7) Keep floor swept and loose nails cleaned up.

(8) The following tools and miscellaneous equipment are permitted in this house:

- 1 Pair pliers
- 1 Screwdriver
- 1 Crescent or end wrench for nailing
- 1 Box scraper
- 1 Wire cutter
- 1 Butcher knife
- Scales
- Paraffin transfer tube
- 1 Floor scraper, aluminum
- 1 Metal-clad thermometer on thong
- 1 Oil can
- 1 Set stencils with brush and pot
- 2 Test weights - 25 lbs. and 50 lbs.

- Box lining forms
- 2 Floor brooms
- 2 Aluminum dust pans
- Or other necessary items

(9) Daily clean-up. Clean nailing machine, roller conveyor, scales and radiators each evening with appropriate tools. Scrape and sweep floor. Shut off steam in paraffin heater kettle. Remove and clean dip tank screen. Remove sludge from the dip tank, mix with sawdust and transfer to waste shed. (At plants where paraffin is pumped to dip tank, leave tank empty overnight and noon.) Sweep platforms, track and magazine cars. Clean powder buggies and replace paper in bottom. If house is operated more than one shift, the floors shall be thoroughly cleaned at end of each shift.

(10) The management is responsible for the strict observance of all the above rules.

[Rules I-1 through I-10, filed 3/23/60, effective 8/15/57.]

WAC 296-50-170 Powder repair shop. (1) This building is classed as an explosive building and general rules for powder apply here. Approved shoes and uniforms are required.

(2) No powder shall be brought into this building at any time.

(3) All parts shall be thoroughly cleaned of powder.

(4) Extreme care shall be taken in making repairs to any equipment having been in contact with dynamite or N.G. Careful inspection shall be made of all wooden parts before starting repairs. If they appear to be saturated with N.G., they shall be discarded and taken to the burning ground.

(5) Use engine oil liberally on tools being used and parts being repaired.

(6) Never make any repairs to a danger building or adjacent equipment while such is in operation and until you are familiar with the special rules applying to that operation.

(7) All tools, metallic parts and spare parts shall be checked into and out of explosive building before and after making repairs. Inspect thoroughly all repaired equipment before removal from this shop to operating building and spare parts storage.

(8) Keep benches clean and orderly and sweep floor often enough to keep clean.

(9) The responsibility for the observance of the above rules rests with the management.

[Rules J-1 through J-9, filed 3/23/60, effective 8/15/57.]

WAC 296-50-180 Batch nitrator. (1) Every nitrator shall be provided with an auxiliary power unit capable of safely disposing of N.G. in process in the event of a power failure.

(2) Employees shall be limited to three excluding supervision.

(3) The nitrator temperature must never exceed 50°F. The charge should not be dropped at a temperature lower than 32°F. (34°F. in winter) as received in the separator except for regular N.G. (100% glycerin), which should not drop below 40°F. to prevent freezing.

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(4) Nitrator operator shall give his undivided attention to a charge being nitrated and when drawing charge from nitrator to separator.

(5) Nitrator charge, N.G., or waste acid shall never be sent to the next operation until proper notification has been received that the store-house is ready to receive the charge.

(6) Open, wash, and inspect nitrator interior every 3 months.

[Rules K-1 through K-6, filed 3/23/60, effective 8/15/57.]

WAC 296-50-190 Separator and prewash operation.

(1) No prewash or soda water shall be heated above 140°F.

(2) N.G. gutter to neutralizers must be sponged at the end of shift.

(3) All sponges must be kept in weak soda water.

(4) Rubber gloves must be worn when washing gutter and equipment.

(5) Gutters should be painted as often as necessary to maintain them in good condition.

(6) When painting tank interiors, a life belt and a gas mask (or air line respirator) shall be worn. Two attendants must be present while a man is in tank.

(7) Daily clean-up. Clean house and all equipment at end of day and oil lead work when necessary. Remove, wash and leave out overnight the glycerin distributor. Check glycerin screen. Open drain on waste acid blow case and leave open overnight. Examine all tanks and catch boxes for slums and clean if any are present.

(8) Weekly clean-up. Clean and inspect all equipment, water drains, ditch, etc. Paint catch boxes and gutters if needed. Clean glycerin heater house.

(9) Periodic clean-up. Test air and steam accumulators (monthly). Empty and clean large drowners. Clean glycerin scale tanks. At least biennially examine interior of all acid blow cases.

(10) The management is held responsible for the enforcement of all these rules.

[Rules K-7 through K-16, filed 3/23/60, effective 8/15/57.]

WAC 296-50-200 N.G. neutralizing house and store house. (1) Man limit - 2 employees, except supervision.

(2) Start ventilator fan and wait a few minutes before entering house.

(3) Inspect all rubber hoses on tanks and buggies daily for any signs of leakage. Replace all hose where any sign of deterioration exists.

(4) Carrying of N.G. in buckets shall be avoided as much as possible.

(5) In case of N.G. spill, sponge up N.G. into a bucket and put in catch box, wipe thoroughly with sponge and soda ash solution and clean thoroughly with N.G. Remove. Report spills to management at once.

(6) N.G. sponges must be kept in weak soda solution when not in use, and wiping rags must be kept in closed container.

(7) Sweep up or mop floor and keep house clean and tidy at all times.

(8) Wash N.G. buggies at end of day. Always leave fresh or weak soda water in N.G. buggy tanks overnight.

[Title 296 WAC—p. 1093]

(9) At the end of each week the catch boxes and all equipment not containing N.G. in storage must be emptied of water and thoroughly scrubbed out and refilled with fresh water.

(10) The following is the only miscellaneous equipment allowed in this building except when it is being cleaned for repairs:

- Rubber buckets
- Sample carrier
- Hose
- Plastic or rubber covered scale
- Weights and balance
- Clock in box
- Lead pan for sample bottles
- Blue litmus paper
- 2 brooms
- Tank markers
- Brom phenol blue solution
- Thermometers
- Hydrometers
- Rubber covered flashlight on thong for wrist
- Rubber dipper
- 2 dust pans

[Rules L-1 through L-10, filed 3/23/60, effective 8/15/57.]

WAC 296-50-210 Acid operations. (1) The greatest care must be observed in the handling and transportation of acids. Avoid doing things which will cause splashing.

(2) Wash acid or ammonia burns with great quantities of water over a long period of time, then report to hospital.

(3) Every employee working with acids should know the location of and how to operate the safety showers. Test them every shift and do not permit obstructions in front of them. If shower is not nearby, have bucket of water at hand for use in case of acid burns when making repairs or when operation is being carried on.

(4) Use water from drinking fountain to wash acid out of eye or use the eye cup and solution provided for this purpose. Report any accident immediately to foreman, supervisor or hospital.

(5) Nitrous fumes: Breathing of nitrous fumes is to be avoided and any man who has inhaled sufficient to cause even slight irritation should cease work immediately and report to the foreman and proceed to the plant hospital at once. He should not exert himself after exposure to the fumes because complete rest is the best first-aid treatment to prevent serious complications. Men exposed to red fumes, even though they do not produce coughing, must follow the above rule. When it is absolutely necessary to enter an area laden with these fumes, a gas mask must be worn.

(6) Know the location and use of the gas masks for acid and ammonia fumes and use them when fumes are strong. Return any mask that has been used to laboratory for inspection and repairs.

(7) Glasses shall be worn by all employees in acid area at all times except when performing duties requiring goggles. Approved type acid goggles must be worn whenever acid or ammonia is outside, or may get out of, its normal pipe line or tank. This includes taking samples, working on valves, gas-

kets or pumps, measuring tanks, or carrying on any work where acid or ammonia might reasonably be expected to come in contact with the eyes.

(8) Under especially hazardous conditions, a rubber suit and helmet must be worn.

(9) Employees should wear proper clothing and "safety" shoes. Hats with brims must be worn around operations for protection against drips from overhead lines and equipment. Rubber gloves should be worn when sampling acid and handling equipment contaminated with acid and anhydrous ammonia.

(10) All ladders other than step-ladders or special ladders must be equipped with spiked feet or other approved friction feet. When used on concrete or smooth floors, plants must be placed under the spiked feet and the ladder must be securely fastened to prevent slipping. If this cannot be done, another man must hold the ladder.

(11) Repair work on acid equipment must not be started unless water is at hand. Whenever possible, acid equipment should be washed off thoroughly with fresh water before repairs are started.

(12) Before opening a line for repairs, be certain that the line is drained, all valves are closed and locked, and motors or pumps which deliver acid through the lines are locked out. Remove blanks, valve tags and motor locks when work is completed.

(13) When braking flanges in a pipe line, or removing a flange from a vessel, make sure there is no pressure on the line or vessel. Do not take all bolts out. At least two nuts must remain on two bolts in a loosened condition until the joint is broken and possible pressure released. Stand away from the flange when actually breaking the line so that if acid spurts out it will not come in contact with you.

(14) Observe the following rules before entering any acid tank: (a) Disconnect and blank off all connections, (b) wash and neutralize interior, (c) obtain permission to enter from foreman or supervisor who has inspected the tank and seen that all precautions and preparations have been made, (d) be equipped with protective clothing, goggles, gas masks, if necessary, and safety harness with line attached. Two men shall be in attendance outside tank to render assistance, if required.

(15) Always wear a gas mask when entering a brick-line tank which has been used for acid.

(16) Acid samples must be conveyed in suitable carriers and rubber gloves must be worn while taking samples.

(17) It is recommended that safety shields be in place around bonnets of valves, pipe flanges and over pumps at all times. Tighten bolts on valves and pumps frequently, and repack when necessary.

(18) Report to your foreman or supervisor at once any unsafe condition or any apparatus which is leaking acid or seems likely to become leaky. Block off entire area whenever there is an acid leak.

(19) Do not use a carbon tetrachloride fire extinguisher where it may come in contact with acid. Carbon tetrachloride and acid react to form phosgene, a poisonous gas.

[Rules M-1 through M-19, filed 3/23/60, effective 8/15/57.]

WAC 296-50-220 Spare parts houses. (1) No powder is to be brought into this building at any time.

(2) All powder is to be cleaned from spare parts before delivering to storage.

(3) Floors, benches, and racks shall be kept clean and in order.

(4) The following rules govern the cleaning of powder machine equipment for storage:

Parts are to be cleaned of all powder as they are removed from the machine unless special cleaning facilities are provided elsewhere.

[Rules N-1 through N-4, filed 3/23/60, effective 8/15/57.]

WAC 296-50-230 Nitrocotton screening and drying houses. (1) Matches, torches, or other flame-producing devices are strictly prohibited in nitrocotton areas. Only non-sparking tools are permitted.

(2) The walls and floor of nitrocotton dryer building and screening building when in regular use should be washed or brushed down each week.

Hoops and nuts on nitrocotton barrels or containers must be wet with water prior to removing them and prior to placing them back on the containers, also the socket wrench used for this purpose must be wet with water.

(3) Extreme cleanliness must be maintained in all nitrocotton operations. Waste or dirty nitrocotton should never be mixed with other refuse or waste material.

(4) Dry nitrocotton is extremely hazardous and after cotton has been dried, extraordinary precautions must be observed in handling.

(5) Do not store nitrocotton in open containers.

(6) Employees whose clothing may contain or be covered with nitrocotton must not answer fire alarms, assist in fighting fires or leave plant until clothing has been changed.

(7) Under no condition is frozen nitrocotton to be opened and handled. It must be thawed before removing from drums and screening.

(8) Steel drums shall be opened outside, or at least in a place removed from the screening operation.

(9) The nitrocotton shall be taken from the drums by means of wooden tools or a fibre scoop, or brass cotton fork.

(10) All wet nitrocotton shall be screened before delivery to the drying and mixing houses.

(11) Dry nitrocotton containing less than 5% moisture shall never be screened.

(12) The drums, when emptied, must be thoroughly cleaned of all nitrocotton, both inside and out.

(13) Partially filled drums of unused nitrocotton shall be removed from screen room and carefully closed to prevent evaporation of moisture, taking the precaution of wetting clamp and drum before closing.

(14) Screened nitrocotton shall be placed in covered fibre cans, or aluminum barrels, or paper bags.

(15) The amount of nitrocotton in the screening house shall be held to a minimum and never exceed the posted limit.

(16) The screening house must be clean at all times.

(17) The following miscellaneous equipment is stored outside, in a cabinet, for opening drums before taking them into the building:

- 2 Brass socket wrenches on thong
- 1 Brass end wrench on thong
- 1 Wooden wedge
- 1 Rubber mallet

(18) Only screened nitrocotton shall be placed on the dryer.

(19) Wooden boxes, fibre cans and aluminum barrels are the only containers that may be taken into the dryer.

(20) Do not allow air temperature to exceed 135°F.

(21) Operators and visitors are not permitted to wear rubber soled shoes or overshoes in dry house.

(22) Care should be used in discharging dryer to keep friction to a minimum.

(23) Check ground connections from supporting screen under cloth.

(24) The miscellaneous equipment permitted in this house is a wooden hoe, a wooden shovel, and broom.

(25) Clean-up. The floors shall be kept clean at all times. The walls, ceilings, floors, and air ducts from the blower shall be washed at frequent intervals to prevent an accumulation.

(26) The management is held responsible for the observance of the above rules.

(27) See that all fire-fighting equipment is maintained in adequate condition for use at any time.

[Rules O-1 through O-27, filed 3/23/60, effective 8/15/57.]

Chapter 296-52 WAC

SAFETY STANDARDS FOR THE POSSESSION AND HANDLING OF EXPLOSIVES

WAC

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- 296-52-445 Licenses and inspections.
- 296-52-449 Storage magazine license fees.

PART C—MAGAZINE CONSTRUCTION

- 296-52-453 Construction of magazines.

PART D—EXPLOSIVES STORAGE

- 296-52-457 Storage of caps with other explosives prohibited.
- 296-52-461 Storage of explosives.
- 296-52-465 Storage of ammonium nitrate.
- 296-52-469 Storage of blasting agents and supplies.
- 296-52-477 Quantity and distance table for separation between magazines.
- 296-52-481 Recommended separation distances of ammonium nitrate and blasting agents from explosives or blasting agents.
- 296-52-485 Quantity and distance tables for manufacturing buildings.
- 296-52-487 Low explosives.

	PART E—EXPLOSIVES TRANSPORTATION	296-52-060	More stringent ordinances prevail. [Order 70-4, § 296-52-060, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-489	Transportation.		
	PART F—USE OF EXPLOSIVES	296-52-080	Temporary permit for existing storage facilities. [Order 70-4, § 296-52-080, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-493	Use of explosives and blasting agents.		
296-52-497	Blasting agents.		
296-52-501	Water gel (slurry) explosives and blasting agents.		
	PART G—MISCELLANEOUS	296-52-090	Construction of magazines. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-090, filed 12/11/84; 82-08-026 (Order 82-10), § 296-52-090, filed 3/30/82; 81-07-048 (Order 81-4), § 296-52-090, filed 3/17/81; Order 75-41, § 296-52-090, filed 12/19/75; Order 70-4, § 296-52-090, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-505	Coal mining code unaffected.		
296-52-509	Small arms ammunition, primers, propellants and black powder.		
296-52-510	Explosives at piers, railway stations, and cars or vessels not otherwise specified in this standard.		
	PART H—APPENDICES	296-52-095	Storage of explosives. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-095, filed 12/11/84; 81-07-048 (Order 81-4), § 296-52-095, filed 3/17/81; Order 75-41, § 296-52-095, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-550	Appendix I—IME two-compartment transportation units (mandatory).		
296-52-552	Appendix II—Radio frequency warning signs (mandatory).		
296-52-555	Appendix III—ATF regulations.		
	DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER	296-52-100	Quantity and distance tables for storage. [Order 75-41, § 296-52-100, filed 12/19/75; Order 70-4, § 296-52-100, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-010	Introduction. [Statutory Authority: Chapters 42.30 and 43.22 RCW, RCW 49.17.040, 49.17.050 and 49.17.240. 78-07-052 (Order 78-10), § 296-52-010, filed 6/28/78; Order 70-4, § 296-52-010, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-110	Limit on storage quantity. [Order 70-4, § 296-52-110, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-012	Incorporation of standards of national organizations and federal agencies. [Order 75-41, § 296-52-012, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-120	Quantity and distance tables for factory buildings. [Order 70-4, § 296-52-120, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-020	Purpose. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-020, filed 12/24/81; Order 70-4, § 296-52-020, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-140	Quantity and distance table for separation between magazines. [Order 75-41, § 296-52-140, filed 12/19/75; Order 70-4, § 296-52-140, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-025	Variance and procedure. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-025, filed 12/24/81; Order 75-41, § 296-52-025, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-150	Storage of blasting caps with other explosives prohibited. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-150, filed 12/24/81; Order 70-4, § 296-52-150, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-027	Equipment approval by nonstate agency or organization. [Order 75-41, § 296-52-027, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-160	License for manufacturing. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-160, filed 12/11/84; Order 70-4, § 296-52-160, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-030	Definitions. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-030, filed 12/11/84; 81-07-048 (Order 81-4), § 296-52-030, filed 3/17/81; Order 75-41, § 296-52-030, filed 12/19/75; Order 70-4, § 296-52-030, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-165	Blasting agents. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-165, filed 12/24/81; Order 76-6, § 296-52-165, filed 3/1/76; Order 75-41, § 296-52-165, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-040	User's (blaster's) license. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-040, filed 12/11/84; 82-02-003 (Order 81-32), § 296-52-040, filed 12/24/81; Order 70-4, § 296-52-040, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-167	Water gel (slurry) explosives and blasting agents. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-167, filed 12/24/81; Order 75-41, § 296-52-167, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-043	Use of explosives and blasting agents. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-043, filed 12/11/84; 82-08-026 (Order 82-10), § 296-52-043, filed 3/30/82; 81-07-048 (Order 81-4), § 296-52-043, filed 3/17/81; Order 76-6, § 296-52-043, filed 3/1/76; Order 75-41, § 296-52-043, filed 12/19/75.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-170	Storage magazine license. [Order 70-4, § 296-52-170, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
		296-52-180	Storage magazine license fees. [Order 70-4, § 296-52-180, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-52-050	Transportation. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-050, filed 12/24/81; 81-07-048 (Order 81-4), § 296-52-050, filed 3/17/81; Order 75-41, § 296-52-050, filed 12/19/75; Order 70-4, § 296-52-050, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-52-190	Dealer's license. [Order 76-6, § 296-52-190, filed 3/1/76; Order 70-4, § 296-52-190, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
		296-52-200	Annual inspection. [Order 70-4, § 296-52-200, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-220 Purchaser's license. [Order 70-4, § 296-52-220, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-230 Unlawful access to explosives. [Order 70-4, § 296-52-230, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-260 Coal mining code unaffected. [Order 70-4, § 296-52-260, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-270 Shipments out-of-state. [Order 70-4, § 296-52-270, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-330 Explosives containers to be marked—Penalty. [Order 70-4, § 296-52-330, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-350 Small arms ammunition, primers, and propellants—Transportation regulations. [Order 70-4, § 296-52-350, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-360 Small arms ammunition, primers, and propellants—Separation from flammable materials. [Order 70-4, § 296-52-360, filed 4/29/70.] Repealed by 86-10-4 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-370 Smokeless propellants and black powder, transportation, storage and display requirements. [Order 76-6, § 296-52-370, filed 3/1/76; Order 70-4, § 296-52-370, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-380 Small arms ammunition primers, transportation, storage, and display requirements. [Order 76-6, § 296-52-380, filed 3/1/76; Order 70-4, § 296-52-380, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-390 Storage of ammonium nitrate. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-390, filed 12/24/81; Order 76-6, § 296-52-390, filed 3/1/76; Order 75-41, § 296-52-390, filed 12/19/75; Order 70-4, § 296-52-390, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-400 Enforcement. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-52-400, filed 12/11/84; Order 70-4, § 296-52-400, filed 4/29/70.] Repealed by 86-10-044 (Order 86-24), filed 5/6/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-473 Quantity and distance tables for storage. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-473, filed 5/6/86.] Repealed by 90-03-029 (Order 89-20), filed 1/11/90, effective 2/26/90. Statutory Authority: Chapter 49.17 RCW.

296-52-9001 Appendix Figure 1—Application for user's (blaster's) license. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9001, filed 12/24/81; Order 75-41, Appendix Figure I (codified as WAC 296-52-9001), filed 12/19/75; Order 70-4, Appendix Figure 1, filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9002 Appendix Figure 2—Request for inspection. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9002, filed 12/24/81; Order 70-4, Appendix Figure 2 (codified as WAC 296-52-9002), filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9003 Appendix Figure 3—Application for license to manufacture explosives. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9003, filed 12/24/81; Order 70-4, Appendix Figure 3 (codified as WAC 296-52-9003), filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9004 Appendix Figure 4—Application for license to operate a storage magazine for explosives. [Order 75-41, Appen-

dix Figure 4 (codified as WAC 296-52-9004), filed 12/19/75; Order 70-4, Appendix Figure 4, filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9005 Appendix Figure 5—Application for dealer's license. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9005, filed 12/24/81; Order 70-4, Appendix Figure 5 (codified as WAC 296-52-9005), filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9006 Appendix Figure 6—Application for license to purchase explosives. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9006, filed 12/24/81; Order 75-41, Appendix Figure 6 (codified as WAC 296-52-9006), filed 12/19/75; Order 70-4, Appendix Figure 6, filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-52-9007 Appendix Figure 7—Dealer's record. [Statutory Authority: RCW 49.17.040 and 49.17.050. 82-02-003 (Order 81-32), § 296-52-9007, filed 12/24/81; Order 70-4, Appendix Figure 7 (codified as WAC 296-52-9007), filed 4/29/70.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

PART A—GENERAL

WAC 296-52-401 Scope and application. (1) This chapter is adopted pursuant to the State Explosives Act, RCW 70.74.020, in accordance with chapter 34.05 RCW, the Administrative Procedure Act, and chapter 49.17 RCW, the Washington Industrial Safety and Health Act.

(2) This chapter shall be identified as chapter 296-52 WAC, "safety standards for possession, handling and use of explosives" and hereafter be called the "explosive code."

(3) This chapter shall apply to:

(a) All aspects of manufacture, possession, storage, selling, purchase, transportation, and the use of explosives or blasting agents as defined in this chapter.

(b) Any person, partnership, company, corporation, or other entity, including governmental agencies, except:

(i) Storage, handling, and use of (noncommercial) military explosives while under the control of the United States Government and/or United States Military authorities.

(ii) Those instances and actions identified by RCW 70.74.191, "Exemptions."

(4) Fireworks regulations.

(a) "Common fireworks" classified as Class C explosives (International Designation 1.4) by the U.S. Department of Transportation shall be exempt from all requirements of this chapter. Common fireworks are subject to the requirements of chapter 70.77 RCW, State fireworks law, and chapter 212-17 WAC, fireworks regulations administered by the state department of community trade and economic development, fire protection services division.

(b) Fireworks classified as Class A or Class B explosives, (International Designation 1.1, 1.2 or 1.3) shall be subject to the storage (only) requirements of this chapter and shall be stored in magazines licensed by the department of labor and industries when unattended.

Note: Fire protection services division administers requirements of the Uniform Fire Code and Uniform Building Code for Class C common fireworks storage.

(5) The manufacture of explosives or pyrotechnics, as defined in this chapter, shall comply with the requirements of chapter 296-67 WAC, Safety standards for process safety management of highly hazardous chemicals.

(6) The enforcing authority of this chapter, the department of labor and industries, recognizes the obligation of other law enforcement agencies to enforce specific aspects or sections of chapter 70.74 RCW, the State Explosives Act, under local ordinance and with joint and shared authority as granted by RCW 70.74.201. The department of labor and industries shall cooperate with all other law enforcement agencies in carrying out the intent of the explosive code and the State Explosives Act.

(7) In all activities governed by the State Explosives Act, chapter 70.74 RCW, the director shall administer this chapter with the full resources of the department of labor and industries. Where materials classified by this chapter as explosives or blasting agents may be found or where the director has reasonable cause to expect they exist, administration of this chapter shall include the right of entry for inspection purposes into any location, facility, or equipment at any such times as the director or his designated representative deems appropriate and to issue penalty sanctions for all instances found not to be in compliance with the requirements of this chapter.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-401, filed 3/6/95, effective 4/20/95; 92-17-022 (Order 92-06), § 296-52-401, filed 8/10/92, effective 9/10/92; 88-23-054 (Order 88-25), § 296-52-401, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-401, filed 5/6/86.]

WAC 296-52-405 Incorporation of standards of national organizations and federal agencies. (1) Whenever a provision of this chapter incorporates by reference a national code or portion thereof which has been adopted by and is currently administered by another state agency, compliance with those provisions adopted and administered by such other state agency, if from a more recent edition of such national code, will be deemed to be prima facie evidence of compliance with the provisions of this chapter.

(2) Whenever a provision of this chapter incorporates therein provisions of the Code of Federal Regulations (CFR) or any other regulations adopted by an agency of the federal government, that provision of this chapter shall be construed to mean that compliance with such regulations shall be prima facie evidence of compliance with the provisions of this chapter.

(3) Whenever a provision of this chapter incorporates therein provisions of the Code of Federal Regulations, the provisions so incorporated shall be those in effect on the date of effectiveness of this chapter, unless the content of the incorporating section specifies otherwise.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-405, filed 5/6/86.]

WAC 296-52-409 Variance and procedure. Realizing that conditions may exist in operations under which certain state standards will not have practical application, the director of the department of labor and industries or his authorized representative may, pursuant to this section, RCW 49.17.080 and/or 49.17.090 and appropriate administrative rules of this

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state and the department of labor and industries and upon receipt of application and after adequate investigation by the department, permit a variation from these requirements when other means of providing an equivalent measure of protection are afforded. Such variation granted shall be limited to the particular case or cases covered in the application for variance and may be revoked for cause. The permit for variance shall be conspicuously posted on the premises and shall remain posted during the time it is in effect. All requests for variances from safety and health standards included in this or any other chapter of Title 296 WAC, shall be made in writing to the director of the department of labor and industries at Olympia, Washington, or his/her duly authorized representative, the assistant director, division of consultation and compliance, department of labor and industries, Olympia, Washington. Variance application forms may be obtained from the department upon request.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-409, filed 3/6/95, effective 4/20/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-409, filed 5/6/86.]

WAC 296-52-413 Equipment approval by nonstate agency or organization. Whenever a provision of this chapter states that only that equipment or those processes approved by an agency or organization other than the department of labor and industries, such as the Underwriters Laboratories, Mine Safety and Health Administration or the National Institute for Occupational Safety and Health, shall be construed to mean that approval of such equipment or process by the designated agency or group shall be prima facie evidence of compliance with the provision of this chapter.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-413, filed 3/6/95, effective 4/20/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-413, filed 5/6/86.]

WAC 296-52-417 Definitions. Definitions as used in this chapter, unless a different meaning is plainly required by the context:

"American Table of Distances" means American Table of Distances for Storage of Explosives as revised and approved by the Institute of the Makers of Explosives.

"Approved storage facility" means a facility for the storage of explosive materials conforming to the requirements of this part and covered by a license or permit issued under authority of the department of labor and industries. (See WAC 296-52-441.)

"Attend" means the physical presence of an authorized person within the field of vision of explosives. The said attendant shall be awake, alert and not engaged in activities which may divert attention so that in case of an emergency the attendant can get to the explosives quickly and without interference, except for brief periods of necessary absence, during which absence simple theft of explosives is not ordinarily possible.

"Authorized, " "approved" or "approval" means authorized, approved, or approval by the department of labor and industries or other approving agency or individual as specified by the provisions of this chapter.

"Authorized person" means a person approved or assigned by the employer, owner, or licensee to perform a

specific type of duty or duties or to be at a specific location or locations at the jobsite.

"Barricaded" means the effective screening of a building containing explosives from a magazine or other building, railway, or highway by a natural or an artificial barrier. A straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine or other building or to a point twelve feet above the center of a railway or highway shall pass through such barrier.

"Blast area" means the area of a blast within the influence of flying rock missiles, gases, and concussion.

"Blast pattern" means the plan of the drill holes laid out on a bench; an expression of the burden distance and the spacing distance and their relationship to each other.

"Blast site" means the area where explosive material is handled during loading, including the perimeter of blast holes and 50 feet in all directions from loaded holes or holes to be loaded. In underground mines 15 feet of solid rib or pillar can be substituted for the 50 foot distance.

"Blaster" means that qualified person in charge of and responsible for the loading and firing of a blast.

"Blaster in charge" shall mean a licensed blaster who is fully qualified in the blasting process to be used including all aspects of storage, handling and use as recommended by the manufacturer and as required by this chapter. He/she shall be adequately trained and experienced as to be capable of recognizing hazardous conditions throughout the blast site and has the authority to take prompt corrective action.

"Blasting agent" means any material or mixture consisting of a fuel and oxidizer, intended for blasting, not otherwise classified as an explosive, and in which none of the ingredients are classified as an explosive, provided that the finished product, as mixed and packaged for use or shipment, cannot be detonated when unconfined by means of a No. 8 test blasting cap.

"Blockholing" means the breaking of boulders by firing a charge of explosives that has been loaded in a drill hole.

"Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to personnel or property, and who has authorization to take prompt corrective action to eliminate them.

"Conveyance" means any unit for transporting explosives or blasting agents, including but not limited to trucks, trailers, rail cars, barges, and vessels.

"Day box" means a box which is not approved as a magazine for unattended storage of explosives. Such box may be used for storage of explosives during working hours on a job site, provided that it shall always be guarded against theft, particularly in inhabited areas, and shall be attended or locked and secured against outright lifting, as the risk demands. Caps shall be safely separated from other explosives. Such day boxes shall be marked with the word "explosives" and be constructed in accordance with WAC 296-52-453(7).

"Dealer" means any person who purchases explosives or blasting agents for the sole purpose of resale, and not for use or consumption.

"Department" means the department of labor and industries.

"Detonating cord" means a round, flexible cord containing a center core of high explosive and used to initiate other explosives.

"Detonator" means any device containing any initiating or primary explosive that is used for initiating detonation. The term includes, but is not limited to, electric blasting caps of instantaneous and delay types, blasting caps for use with safety fuses, detonating cord delay connectors, and nonelectric instantaneous and delay blasting caps which use detonating cord, shock tube, or any other replacement for electric leg wires.

"Director" means the director of the department of labor and industries, or the designated representative.

"Efficient artificial barricade" means an artificial mound or properly revetted wall of earth of a minimum thickness of not less than three feet or such other artificial barricade as approved by the department of labor and industries.

"Electric blasting cap" means a blasting detonator designed for and capable of detonation by means of an electric current.

"Electric blasting circuitry" means:

- Bus wire. An expendable wire, used in parallel or series, in parallel circuits, to which are connected the leg wires of electric blasting caps.
- Connecting wire. An insulated expendable wire used between electric blasting caps and the leading wires or between the bus wire and the leading wires.
- Leading wire. An insulated wire used between the electric power source and the electric blasting cap circuit.
- Permanent blasting wire. A permanently mounted insulated wire used between the electric power source and the electric blasting cap circuit.

"Electric delay blasting caps" means caps designed to detonate at a predetermined period of time after energy is applied to the ignition system.

"Emulsion" means an explosive material containing substantial amounts of oxidizer dissolved in water droplets, surrounded by an immiscible fuel, or droplets of an immiscible fuel surrounded by water containing substantial amounts of oxidizer.

"Explosive" or "explosives" whenever used in this chapter means any chemical compound or mechanical mixture that is commonly used or intended for the purpose of producing an explosion, that contains any oxidizing and combustible units, or other ingredients, in such proportions, quantities or packing, that an ignition by fire, by friction, by concussion, by percussion, or by detonation of any part of the compound or mixture may cause such a sudden generation of highly heated gases that the resultant gaseous pressures are capable of producing destructive effects on contiguous objects or of destroying life or limb. In addition, the term "explosives" shall include all material which is classified as Class A, Class B, and Class C explosives by the federal Department of Transportation. For the purposes of this chapter small arms ammunition, small arms ammunition primers, smokeless powder not exceeding fifty pounds, and black powder not exceeding five pounds shall not be defined as explosives unless possessed or used for a purpose inconsistent with small arms use or other lawful purpose.

Note 1: As excerpted from RCW 70.74.010(4), classification of explosives shall include but not be limited to the following:

- (a) Class A explosives: (Possessing detonating hazard) dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder exceeding five pounds, blasting caps in quantities of 1001 or more, and detonating primers.
- (b) Class B explosives: (Possessing flammable hazard) propellant explosives, including smokeless propellants exceeding fifty pounds.
- (c) Class C explosives: (Including certain types of manufactured articles which contain Class A or Class B explosives, or both, as components but in restricted quantities) blasting caps in quantities of 1000 or less.

Note 2: Under the authority of RCW 70.74.020(3), the department of labor and industries will accept federal (U.S. Department of Transportation and/or Bureau of Alcohol, Tobacco and Firearms) international identification marking on explosives and/or explosives containers or packaging in lieu of Washington state designated marking as defined in RCW 70.74.010 (Class A, B or C) and required by RCW 70.74.300. See Appendix III, WAC 296-52-555.

"Explosive-actuated power devices" means any tool or special mechanized device which is actuated by explosives, but not to include propellant-actuated power devices.

"Explosives manufacturing building" means any building or other structure (excepting magazines) containing explosives, in which the manufacture of explosives, or any processing involving explosives, is carried on, and any building where explosives are used as a component part or ingredient in the manufacture of any article or device.

"Explosives manufacturing plant" means all lands, with the buildings situated thereon, used in connection with the manufacturing or processing of explosives or in which any process involving explosives is carried on, or the storage of explosives thereat, as well as any premises where explosives are used as a component part or ingredient in the manufacture of any article or device.

"Factory building" means the same as "manufacturing building."

"Forbidden or not acceptable explosives" means explosives which are forbidden or not acceptable for transportation by common carriers by rail freight, rail express, highway, or water in accordance with the regulations of the federal Department of Transportation.

"Fuel" means a substance which may react with oxygen to produce combustion.

"Fuse (safety)" means a flexible cord containing an internal burning medium by which fire or flame is conveyed at a continuous and uniform rate from the point of ignition to the point of use, usually a fuse detonator.

"Fuse cap (fuse detonator)" means a detonator which is initiated by a safety fuse; also referred to as an ordinary blasting cap.

"Fuse lighters" means special devices for the purpose of igniting safety fuse.

"Handler" means any person/individual who handles explosives for purposes of transporting, moving, or assisting a licensed user (blaster) in loading, firing, blasting, or disposing of explosives and blasting agents. This does not include employees of a licensed manufacturer engaged in manufacturing process, drivers of common carriers or contract haulers.

"Handloader" means any person who engages in the non-commercial assembling of small arms ammunition for per-

sonal use, specifically the operation of installing new primers, powder, and projectiles into cartridge cases.

"Handloader components" means small arms ammunition, small arms ammunition primers, smokeless powder not exceeding fifty pounds, and black powder as used in muzzle loading firearms not exceeding five pounds.

"Highway" shall mean and include any public street, public alley, or public road.

"Improvised device" means a device which is fabricated with explosives or destructive, lethal, noxious, pyrotechnic, or incendiary chemicals and which is designed to disfigure, destroy, distract, or harass.

"Inhabited building" means only a building regularly occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other building where people are accustomed to assemble, other than any building or structure occupied in connection with the manufacture, transportation, storage, or use of explosives.

"Low explosives" means explosives materials which can be caused to deflagrate when confined, (for example, black powder, safety fuses, igniters, igniter cords, fuse lighters, and "special fireworks" defined as Class B explosives by U.S. Department of Transportation regulations in 49 CFR Part 173, except for bulk salutes).

"Magazine" means any building, structure or container, other than an explosive manufacturing building, approved for the storage of explosive materials.

"Manufacturer" means any person engaged in the business of manufacturing explosive materials for purposes of sale, distribution, or use, provided that the term manufacturing shall not include inserting a detonator into a cast booster or a stick of high explosive product to make a primer for loading into a blasthole. The term manufacturer also shall not include nor be applicable to the act of on-blast site mixing, either by hand or by mechanical apparatus, binary components, ammonium nitrate and fuel oil and/or emulsion products to create explosives for immediate down-blasthole delivery. This defined exclusion is limited to materials and components which are not classified by U.S. DOT as explosives until after they are mixed.

"Misfire" means the complete or partial failure of an explosive charge to explode as planned.

"Motor vehicle" means any self-propelled automobile, truck, tractor, semitrailer or full trailer, or other conveyance used for the transportation of freight.

"Mudcap" means covering the required number of cartridges that have been laid on top of a boulder with a three or four inch layer of mud (free from rocks or other material which might constitute a missile hazard). Mudcapping is also commonly known as "bulldozing" and "dobyng."

"Natural barricade" means any natural hill, mound, wall, or barrier composed of earth or rock or other solid material of a minimum thickness of not less than three feet. With site specific department approval, an acceptable natural barricade may be a stand of mature timber of sufficient density that the surrounding exposures which require protection cannot be seen from the magazine when the trees are bare of leaves.

"Nonelectric delay blasting cap" means a blasting cap with an integral delay element in conjunction with and capa-

ble of being detonated by a detonation impulse or signal from miniaturized detonating cord or shock tube.

"Oxidizer" means a substance that yields oxygen readily to stimulate the combustion of organic matter or other fuel.

"Permanent magazines" means magazines that are permanently fastened to a foundation and that are left unattended. The capacity of said permanent magazines shall not exceed the limits stated in RCW 70.74.040. Permanent magazines shall be approved and licensed.

"Person" means any individual, firm, copartnership, corporation, company, association, joint stock association, and including any trustee, receiver, assignee, or personal representative thereof.

"Person responsible," for an explosives magazine, means the legal person who actually operates the magazine and who is responsible for the proper storage, protection and removal of the explosives. The responsible person may be the owner or the lessee or the authorized operator of the magazine.

"Portable magazines" also called "field" magazines means magazines that are designed to be unattended and that are not permanently fastened to a foundation. Said magazines shall be so constructed or secured that they can not be readily lifted and carried away by unauthorized persons. The capacity of said portable magazines shall be limited to the amount of explosives required for efficient operation. Portable magazines shall be approved and licensed.

"Possess" means the physical possession of explosives in one's hand, vehicle, magazine or building.

"Primary blasting" means the blasting operation by which the original rock formation is dislodged from its natural location.

"Primer" means a unit, package, cartridge, or container of explosives into which a detonator or detonating cord is inserted or attached to initiate other explosives or blasting agents.

"Propellant-actuated power device" means any tool or special mechanized device or gas generator system which is actuated by a propellant or which releases and directs work through a propellant charge.

"Public conveyance" means any railroad car, streetcar, ferry, cab, bus, airplane, or other vehicle which is carrying passengers for hire.

"Public utility transmission system" means power transmission lines over 10 kV, telephone cables, or microwave transmission systems, or buried or exposed pipelines carrying water, natural gas, petroleum, or crude oil, or refined products and chemicals, whose services are regulated by the utilities and transportation commission, municipal, or other publicly owned systems.

"Purchaser" means any person who buys, accepts, or receives any explosives or blasting agents.

"Pyrotechnics" means any combustible or explosive compositions or manufactured articles designed and prepared for the purpose of producing audible or visible effects which are commonly referred to as fireworks.

"Qualified person" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve

problems relating to the subject matter, the work, or the project.

"Railroad" means any steam, electric, or other railroad which carries passengers for hire.

"Railroad freight car" means cars that are built for and loaded with explosives and operated in accordance with DOT rules.

"Safety fuse" means a flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing blasting caps.

"Secondary blasting" means the reduction of oversize material by the use of explosives to the dimension required for handling, including muddcapping and blockholing.

"Semiconductive hose" means a hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels, yet not so high as to prevent drainage of static electric charges to ground; hose of not more than 2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.

"Shall" means that the rule establishes a minimum standard which is mandatory.

"Shock tube" means a small diameter plastic tube for initiating detonators. It contains a limited amount of reactive material so that the energy that is transmitted through the tube by means of a detonation wave is guided through and confined within the walls of the tube.

"Should" means recommended.

"Small arms ammunition" means any shotgun, rifle, pistol, or revolver cartridge, and cartridges for propellant-actuated power devices and industrial guns. Military-type ammunition containing explosive bursting charges, incendiary, tracer, spotting, or pyrotechnic projectiles is excluded from this definition.

"Small arms ammunition primers" means small percussion-sensitive explosive charges encased in a cap or capsule and used to ignite propellant powder and shall include percussion caps as used in muzzle loaders.

"Smokeless propellants" means solid chemicals or solid chemical mixtures in excess of fifty pounds which function by rapid combustion.

"Special industrial explosive devices" means explosive-actuated power devices and propellant-actuated power devices.

"Special industrial explosives materials" means shaped materials and sheet forms and various other extrusions, pellets, and packages of high explosives, which include dynamite, trinitrotoluene (TNT), pentaerythritol tetranitrate (PETN), hexahydro-1, 3, 5-trinitro-s-triazine (RDX), and other similar compounds used for high-energy-rate forming, expanding, and shaping in metal fabrication, and for dismemberment and quick reduction of scrap metal.

"Springing" means the creation of a pocket in the bottom of a drill hole by the use of a moderate quantity of explosives in order that larger quantities or explosives may be inserted therein.

"Sprung holes" means to spring or chamber the bottom of the drilled hole to allow room for additional explosives as a bottom load.

"Stemming" means a suitable inert incombustible material or device used to confine or separate explosives in a drill hole, or to cover explosives in mudcapping.

"Trailer" means semitrailers or full trailers as defined by DOT, that are built for and loaded with explosives and operated in accordance with DOT rules.

"User" means any natural person, manufacturer, or blaster who acquires, purchases, or uses explosives as an ultimate consumer or who supervises such use.

"Water gels or slurry explosives" comprise a wide variety of materials used for blasting. They all contain substantial proportions of water and high proportions of ammonium nitrate, some of which is in solution in the water. Two broad classes of water gels are:

- Those which are sensitized by a material classed as an explosive, such as TNT or smokeless powder,
- Those which contain no ingredient classified as an explosive; these are sensitized with metals such as aluminum or with other fuels. Water gels may be premixed at an explosives plant or mixed at the site immediately before delivery into the bore hole.

"DOT specification" are regulations of the Department of Transportation published in 49 CFR Chapter I.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-417, filed 3/6/95, effective 4/20/95; 91-03-044 (Order 90-18), § 296-52-417, filed 1/10/91, effective 2/12/91; 90-03-029 (Order 89-20), § 296-52-417, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-417, filed 5/6/86.]

PART B—EXPLOSIVES LICENSING

WAC 296-52-419 Basic legal obligations. (1) It is unlawful for any person to manufacture, purchase, sell, offer for sale, use, possess, transport, or store any explosive improvised device, or components that are intended to be assembled into an explosive or improvised device without having a validly issued license from the department of labor and industries which license has not been revoked or suspended. Violation of this section is a Class C felony.

(2) Upon notice from the department of labor and industries or any law enforcement agency having jurisdiction, a person manufacturing, purchasing, selling, offering for sale, using, possessing, transporting, or storing any explosives, improvised device, or components of explosives or improvised devices without a license shall immediately surrender those explosives, improvised devices, or components to the department or to the respective law enforcement agency.

(3) At any time that the director of labor and industries requests the surrender of explosives, improvised devices, or components of explosives or improvised devices from any person pursuant to subsection (2) of this section, the director may in addition request the attorney general to make application to the superior court of the county in which the unlawful practice exists for a temporary restraining order or such other relief as appears to be appropriate under the circumstances.

(4) Miscellaneous provisions - general hazard. No person shall store, handle, or transport explosives or blasting agents when such storage, handling, and transportation of explosives or blasting agents constitutes an undue hazard to life.

(5) No person, except the director of labor and industries or the director's authorized agent, the owner, the owner's agent, or a person authorized to enter by the owner or owner's agent, or a law enforcement officer acting within his or her official capacity, may enter any explosives manufacturing building, magazine or car, vehicle or other common carrier containing explosives in this state. Violation of this section is a gross misdemeanor punishable under chapter 9A.20 RCW.

(6) Unless otherwise allowed to do so under this chapter, a person who exhibits a device designed, assembled, fabricated, or manufactured, to convey the appearance of an explosive or improvised device, and who intends to, and does, intimidate or harass a person, is guilty of a Class C felony.

(7) Discharge of firearms or igniting flame near explosives.

(a) No person shall discharge any firearms at or against any magazine or explosives manufacturing buildings or ignite any flame or flame-producing device nearer than fifty feet from said magazine or explosives manufacturing building.

(b) No person shall discharge a firearm at a magazine or at explosive material.

(8) Every person who maliciously places any explosive or improvised device in, upon, under, against, or near any building, car, vessel, railroad track, airplane, public utility transmission system, or structure, in such a manner or under such circumstances as to destroy or injure it if exploded, shall be punished as follows:

(a) If the circumstances or surroundings are such that the safety of any person might be endangered by the explosion, by imprisonment in a state correctional facility for not more than twenty years.

(b) In every other case by imprisonment in a state correctional facility for not more than five years.

(9) It shall be unlawful for any person to abandon explosives or improvised devices. Violation of this section is a gross misdemeanor punishable under chapter 9A.20 RCW.

(10) If any provision of this act or its application to any person or circumstance is held invalid, the remainder of the act or the application of the provisions to other persons or circumstances is not affected.

(11) This chapter shall not preclude local jurisdictions such as city or county government, or other government authorities such as the Washington utilities and transportation commission or Washington state patrol from adopting and administering local ordinances or Washington Administrative Code regulations relating to explosives. Said rules and regulations however shall not diminish or replace any regulation of this chapter which will be administered by the director of labor and industries in all applications where explosives are stored, kept or had, without regard for employer-employee relationship.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-419, filed 3/6/95, effective 4/20/95; 90-03-029 (Order 89-20), § 296-52-419, filed 1/11/90, effective 2/26/90; 88-23-054 (Order 88-25), § 296-52-419, filed 11/14/88.]

WAC 296-52-421 Licenses—Information verification. (1) Any information request by the department, in order

to verify statements in an application or in order to facilitate a department inquiry, shall be supplied prior to the issuance or renewal of a license.

(2) The director of labor and industries shall require, as a condition precedent to the original issuance or renewal of any explosive license, fingerprinting and criminal history record information checks of every applicant.

(a) In the case of a corporation, fingerprinting and criminal history record information checks shall be required for the management officials directly responsible for the operations where the explosives are used if such persons have not previously had their fingerprints recorded with the department of labor and industries.

(b) In the case of a partnership, fingerprinting and criminal history record information checks shall be required of all general partners.

(c) Such fingerprints as are required by the department of labor and industries shall be submitted on forms provided by the department to the identification section of the Washington state patrol and to the identification division of the Federal Bureau of Investigation in order that these agencies may search their records for prior convictions of the individuals fingerprinted.

(d) The Washington state patrol shall provide to the director of labor and industries such criminal record information as the director may request.

(e) The applicant shall give full cooperation to the department of labor and industries and shall assist the department of labor and industries in all aspects of fingerprinting and criminal history record information check.

(f) The applicant may be required to pay a fee not to exceed twenty dollars to the agency that performs the fingerprinting and criminal history process.

(3) The director of labor and industries shall not issue a license to manufacture, purchase, store, use, or deal with explosives to:

(a) Any persons under twenty-one years of age;

(b) Any person whose license is suspended or whose license has been revoked, except as provided in WAC 296-52-423;

(c) Any person who has been convicted in this state or elsewhere of a violent offense as defined in RCW 9.94A.030, perjury, false swearing, or bomb threats or a crime involving a schedule I or II controlled substance, or any other drug or alcohol related offenses, unless such other drug or alcohol related offense does not reflect a drug or alcohol dependency.

Exception: The director of labor and industries may issue a license if the person suffering a drug or alcohol related dependency is participating in or has completed an alcohol or drug recovery program acceptable to the department of labor and industries and has established control of their alcohol or drug dependency. The director of labor and industries shall require the applicant to provide proof of such participation and control.

(d) Any person who has previously been adjudged to be mentally ill or insane, or to be incompetent due to any mental disability or disease and who has not at the time of application been restored to competency.

(e) The department shall not issue or reissue an explosives license to any individual who is physically handicapped or diseased to an extent that he or she cannot safely pursue or continue all normal aspects of an explosives occupation. Dis-

qualifying physical imparities may include but are not limited to examples such as blindness, deafness, or subject to epileptic or diabetic seizures or coma.

(f) A license holder of any unexpired license(s) shall surrender such license(s) to the department upon request for identified cause. Such surrender is subject to appeal to refute the contention of cause with verification of physical ability by a qualified physician.

Note: See also WAC 296-52-425 and 296-52-433.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-421, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-421, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-421, filed 5/6/86.]

WAC 296-52-423 Revoking or suspending licenses.

(1) The department of labor and industries shall revoke and not renew the license of any person holding a manufacturer, dealer, purchaser, user, or storage license upon conviction of any of the following offenses, which conviction has become final:

(a) A violent offense as defined in RCW 9.94A.030;

(b) A crime involving perjury or false swearing, including the making of a false affidavit or statement under oath to the department of labor and industries in an application or report made pursuant to this title;

(c) A crime involving bomb threats;

(d) A crime involving a schedule I or II controlled substance, or any other drug or alcohol related offense, unless such other drug or alcohol related offense does not reflect a drug or alcohol dependency.

Conditional exception: The department of labor and industries may issue a conditional renewal of the license to any convicted person suffering a drug or alcohol dependency who is participating in an alcoholism or drug recovery program acceptable to the department of labor and industries and has established control of their alcohol or drug dependency. The department of labor and industries shall require the applicant to provide proof of such participation and control.

(e) A crime relating to possession, use, transfer, or sale of explosives under this chapter or any other chapter of the Revised Code of Washington.

(2) The department of labor and industries shall revoke the license of any person adjudged to be mentally ill or insane, or to be incompetent due to any mental disability or disease. The director shall not renew the license until the person has been restored to competency.

(3) The department of labor and industries is authorized to suspend, for a period of time not to exceed six months, the license of any person who has violated this chapter or the rules promulgated pursuant to this chapter.

(4) The department of labor and industries may revoke the license of any person who has repeatedly violated this chapter or the rules promulgated pursuant to this chapter, or who has twice had his or her license suspended under this chapter.

(5) Upon receipt of notification by the department of labor and industries of revocation or suspension, a licensee must surrender immediately to the department any or all such licenses revoked or suspended. License fees will not be refunded for any licenses which are revoked for cause.

[Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-423, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-423, filed 11/14/88.]

WAC 296-52-425 Dealer's license. (RCW 70.74.130 and 70.74.230, apply.)

(1) The application for a dealer's license to buy explosives for the sole purpose of resale shall be made to Department of Labor and Industries, Olympia.

(2) Original license applications and/or application for renewal shall be completed on forms available from the department and shall comply with all requirements of WAC 296-52-421. The license fee shall be thirty-seven dollars and shall increase to fifty dollars two years after the effective date of this section.

(3) The license shall be renewed annually, no later than the expiration date.

(4) When an order for explosives is placed in person, by telephone, or in writing by a purchaser, the seller shall request proper authorization and identification from the purchaser and shall record the purchaser's license number.

(5) A dealer shall not distribute explosive materials to a company or individual on the order of a person who does not appear on the up to date list of representatives or agents and if the person does appear on the list, the dealer shall verify the identity of such person.

Exception: The above regulation(s) shall not apply to licensed common carrier companies when said common carrier is not purchasing the explosives but is merely transferring the materials from the seller to the purchaser and the transfer practices comply with current state and federal DOT regulations.

(6) Dealers records.

(a) A dealer's record of all explosives purchased and sold as defined in RCW 70.74.010, shall be kept on file and a copy transmitted not later than the tenth of every month to the department.

(b) The purchaser's name and license number shall be stated on dealer's record, and the name of the person authorized by the purchaser to physically receive the explosives.

(c) The dealer shall ascertain the identity of the individual who receives the explosives from a picture-type identification card, such as a driver's license. The recipient shall sign a receipt, documenting the explosives received and said receipt shall be retained by the dealer for not less than one year from the date of purchase.

(7) Any package, cask, or can containing any explosive, nitroglycerin, dynamite, or powder that is put up for sale, or is delivered to any warehouseman, dock, depot, or common carrier shall be properly labeled thereon to indicate its explosive classification.

(8) If the explosives are delivered by the dealer or dealer's authorized agent to an explosives magazine, the license number of said magazine and the legal signature of the recipient, properly authorized and identified, shall be obtained.

(9) No person shall sell, display, or expose for sale any explosive, improvised device or blasting agent on any highway, street, sidewalk, public way, or public place.

[Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-425, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-425, filed

11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-425, filed 5/6/86.]

WAC 296-52-429 License for manufacturing. RCW 70.74.110 and 70.74.144, apply.

(1) No person, partnership, firm, company or corporation shall manufacture explosives or blasting agents or use any process involving explosives as a component part in the manufacture of any device, article or product without first obtaining a manufacturer's license from the department of labor and industries.

(2) The application for license for manufacturing explosives and/or blasting agents shall be made to Department of Labor and Industries, Division of Consultation and Compliance, Olympia. The license fee for either an original license or a renewal shall be thirty-seven dollars and shall increase to fifty dollars two years after the effective date of this section.

(3) The application for original license or renewal shall be completed on forms available from the department and shall provide the following information:

(a) Location of place of manufacture or processing;

(b) Kind of explosives manufactured, processed, or used;

(c) The distance that such explosives manufacturing building is located or intended to be located from the other factory buildings, magazines, inhabited buildings, railroads, highways, and public utility transmission systems;

(d) The name and address of the applicant;

(e) The reason for desiring to manufacture explosives;

(f) The applicant's citizenship, if the applicant is an individual;

(g) If the applicant is a partnership, the names and addresses of the partners and their citizenship;

(h) If the applicant is an association or corporation, the names and addresses of the officers and directors thereof, and their citizenship; and

(i) Such other pertinent information as the director of labor and industries shall require to effectuate the purpose of this chapter.

(4) Each application for license shall be accompanied by a site plan of the proposed or existing manufacturing facilities. The plan shall show:

(a) The distance each manufacturing building is located from other buildings on the premises where people are employed, from other occupied buildings on adjoining property, from buildings where customers are served, from public highways and utility transmission systems.

(b) The site plan shall demonstrate compliance with all applicable requirements of chapter 70.74 RCW, the State Explosives Act as it exists at the time of this adoption or is hereafter amended; with applicable requirements of chapter 296-50 WAC, Safety standards—Manufacture of explosives; with the separation/location requirements of this chapter.

(c) The site plan shall identify and describe all natural or artificial barricades which are utilized to influence minimum permissible separation distances.

(d) The site plan shall identify the nature of and kind of work carried on in each building.

(e) The site plan shall specify the maximum amount and kind of explosives or blasting agents which will be permitted in each building or magazine at any one time.

(5) The application for license shall comply with all requirements of WAC 296-52-421.

(6) Upon receipt of a completed application meeting all requirements of this section, the department will schedule an inspection of the premises at the earliest time possible.

(7) The department will issue a license to the applicant(s) provided that:

(a) The required inspection confirms that the site plan is accurate and the facilities comply with applicable regulations of the department;

(b) The applicant(s) or operating superintendent and employees are sufficiently trained and experienced in the manufacture of explosives.

(8) A license to manufacture explosives and/or blasting agents shall be valid for not more than one year from the date of issue unless suspended or revoked by the department.

(9) A copy of the site plan and manufacturer's license shall be posted in the main office of each manufacturing plant.

(a) The site plan shall be maintained to reflect current status of manufacturing facilities, occupancy changes, etc.

(b) The department shall be notified when significant change occurs in the site plan. If the change is of such nature or magnitude as to make compliance with all requirements of this chapter questionable, the license holder shall consult with the department before changing the operations.

(10) Specific applicable requirements for the manufacture of explosives and blasting agents are codified and distributed in chapter 296-50 WAC, Safety standards—Manufacture of explosives.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-429, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-429, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-429, filed 5/6/86.]

WAC 296-52-433 Purchaser's license. RCW 70.74.135 and 70.74.137, apply.

(1) No person, firm, partnership, or corporation and including public agencies, shall be permitted to purchase explosives or blasting agents without a valid license as issued by the department of labor and industries.

(2) Applicants desiring to purchase explosives or blasting agents, except hand loader components as defined in this chapter, shall make application for license to the department of labor and industries. Application forms may be obtained at all department district offices, and from explosives dealers.

(3) Applicants shall comply with all requirements of WAC 296-52-421 and shall have a current user (blaster) license issued by the department. The purchaser's license fee shall be ten dollars and shall increase to fifteen dollars two years after the effective date of this section.

(4) Applicants shall be required to furnish at least the following information:

- (a) The location where explosives are to be used;
- (b) The kind and amount of explosives to be used;
- (c) The name and address of the applicant;
- (d) The reason for desiring to use explosives;

(e) The citizenship of the applicant, if the applicant is an individual;

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(f) If the applicant is a partnership, the names and addresses of the partners and their citizenship;

(g) If the applicant is an association or corporation, the names and addresses of the officers and directors thereof and their citizenship;

(h) Documented proof of ownership of a licensed storage magazine or a signed authorization to use another person's licensed magazine; or the purchaser shall sign a statement certifying that the explosives will not be stored.

(i) Such other pertinent information as the director of the department of labor and industries shall require to effectuate the purposes of this chapter.

(5) The department will grant a purchaser's license after all legal requirements have been fulfilled.

(6) The license is valid for one year from date of issuance.

(7) Purchaser shall, prior to ordering explosive materials, furnish the dealer a current list of the representatives or agents authorized to order explosive materials on their behalf showing the name, address, drivers license number or valid identification and date and place of birth. A copy of the list shall be submitted with the purchaser's application. The dealer and the department lists shall be updated as changes occur.

(8) The individual who physically receives the purchased explosives shall prove to the satisfaction of the dealer that he, personally, is the purchaser, or the person authorized by the purchaser to receive said purchased explosives. Such authorization procedure shall be approved by the department. Said receiver of explosives shall identify himself properly and shall sign the dealer's record with his legal signature.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-433, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-433, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-433, filed 5/6/86.]

WAC 296-52-437 User's (blaster's) license. RCW 70.74.020 and 70.74.142, apply.

(1) No person, firm, partnership, or corporation shall use, blast, or dispose of explosives and/or blasting agents unless in possession of a valid user's (blaster's) license issued by the department of labor and industries.

(2) The application for a user's (blaster's) license to use, blast or dispose explosives and blasting agents shall be made to Department of Labor and Industries, Division of Consultation and Compliance, Olympia.

(a) Application forms may be obtained at all department district offices, and from explosives dealers.

(b) The license is valid for one year from date of issuance. The license fee shall be ten dollars and shall increase to fifteen dollars two years after the effective date of this section.

(c) Applicants shall comply with all requirements of WAC 296-52-421.

(d) User (blaster) may be required to verify name of licensed purchaser, which will be confirmed and approved by the department.

(3) In addition to the submission of the application form, all new applicants, all applicants requesting change in classification of their license, and all applicants who have not

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renewed their user (blaster) license within sixty days of expiration will be required to submit a resume of successful blasting experience, properly witnessed, and to pass a written examination prepared and administered by the department.

(4) User (blaster) qualifications:

(a) A user (blaster) shall be able to understand and give written and oral orders.

(b) A user (blaster) shall be in good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs. This rule does not apply to persons taking prescription drugs and/or narcotics as directed by a physician providing such use shall not endanger the worker or others.

(c) A user (blaster) shall be qualified by reason of training, knowledge, and experience, in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of state and local laws and regulations which pertain to explosives.

(d) User (blaster) shall be required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required.

(e) The user (blaster) shall be knowledgeable and competent in the use of each type of blasting method used.

(5) The department will issue a user's license card which shall state the limitations imposed on the licensee and shall be presented by the user to authorized persons, upon request, together with valid personal identification.

(6) A "hand loader" as defined in this chapter, does not require a user's license.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-437, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-437, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-437, filed 5/6/86.]

WAC 296-52-441 Storage magazine license requirements. RCW 70.74.120, applies.

(1) All explosives or blasting agents as defined in this chapter shall be kept or stored in magazines licensed by the department and which comply with the construction, location, and security requirements established by this chapter.

(2) Any person engaged in keeping or storing explosives or blasting agents shall make application to the department for an operating license for each storage magazine before engaging in the activity of keeping or storing explosives or blasting agents. Applications shall be made to the Department of Labor and Industries, Division of Consultation and Compliance, Olympia, WA 98504.

(3) License applicants shall meet the requirements of WAC 296-52-421.

(4) License applicants or the officers, agents, or employees of the applicant shall demonstrate sufficient experience in the handling of explosives, including the storage requirements for the different types of explosives or blasting agents to be stored.

(5) Each application shall include the following information:

(a) The name and address of the applicant;

(b) The reason for desiring to store or possess explosives;

(c) The citizenship of the applicant if the applicant is an individual;

(d) If the applicant is a partnership, the names and addresses of the partners and their citizenship;

(e) If the applicant is an association or corporation, the names and addresses of the officers and directors thereof and their citizenship;

(f) The location of the magazine, if then existing, or in case of a new magazine, the proposed location of such magazine;

(g) The kind of explosives that are kept or stored or possessed or intended to be kept or stored or possessed and the maximum quantity that is intended to be kept or stored or possessed thereat;

(h) The distance that such magazine is located or intended to be located from other magazines, inhabited buildings, explosives manufacturing buildings, railroads, highways, and public utility transmission systems;

(i) And such other pertinent information as the director of the department of labor and industries shall require to effectuate the purpose of this chapter.

(6) A license number shall be permanently affixed on the inside and outside of each storage magazine. This license number will stay with each magazine during its life.

(7) If the magazine is used or leased by a person other than the owner, such other person shall then be responsible for the safe operation of the magazine, and for obtaining of the license.

When the responsibility for a magazine is transferred from one person to another, the transferor shall immediately notify the department, stating the magazine license number. The transferee shall execute a new application and pay the fee for one year, based on WAC 296-52-449.

(8) When a magazine is moved, altered or destroyed, the responsible person shall notify the department stating the magazine license number. When a magazine is altered, the alterations made shall be stated.

The moving of a magazine on a job site within a reasonable distance from its original location stated on the application is permitted without notifying the department; provided, that the new location complies with the Explosives Act and Explosives Code, and that the magazine can be quickly located for an inspection.

(9) Licenses will be issued pursuant to the procedures identified in WAC 296-52-445. The license fees are published in WAC 296-52-449.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-441, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-441, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-441, filed 5/6/86.]

WAC 296-52-445 Licenses and inspections. RCW 70.74.150, applies.

(1) Upon receipt of a completed application for license, the department will schedule the necessary inspection or examination at the earliest available and mutually agreeable date.

(2) Explosives manufacturing plants and all Class 2, 3, 4, or 5 magazines shall be inspected before being placed in operation or service and at annual intervals thereafter. New licenses or renewal licenses shall be issued for a period not to

exceed one year. Class 1 magazines may be inspected and licensed for a period not to exceed two years.

(3) Each explosives license shall identify the operating limits for that license.

(4) Each license shall be valid until the specified expiration date or until suspended or revoked by the department.

(5) Any change in the conditions around a manufacturing plant or magazine shall be promptly identified to the department if such change could influence compliance with all requirements of this chapter. Such change(s) could include but are not limited to examples such as: Construction of occupied buildings, public utilities transmission systems, roads or railroads nearer said manufacturing plant or magazine.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-52-445, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-445, filed 5/6/86.]

WAC 296-52-449 Storage magazine license fees. RCW 70.74.140, applies.

The annual license fee for operating each magazine has been established by the department and shall be as shown in the following table:

Maximum weight (pounds) of explosives permitted in each magazine	Maximum number of blasting caps permitted in each magazine	Annual fee (dollars) for each magazine
200	133,000	20.00
1,000	667,000	35.00
5,000	3,335,000	50.00
10,000	6,670,000	60.00
50,000	33,350,000	75.00
Max. 300,000	Max. 200,000,000	100.00

Any permanent magazine licensed for two years shall pay twice the license fee shown.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-449, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-449, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-449, filed 5/6/86.]

PART C—MAGAZINE CONSTRUCTION

WAC 296-52-453 Construction of magazines. (1) Construction of all explosive storage magazines must comply with Washington state and Bureau of Alcohol, Tobacco, and Firearms regulations.

(2) Construction of permanent storage facilities.

(a) General. A Class 1 storage facility shall be a permanent structure; a building, an igloo or army-type structure, a tunnel, or a dugout. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated.

(b) Buildings. All building type storage facilities shall be constructed of masonry, wood, metal, or a combination of these materials and shall have no openings except for entrances and ventilation. Ground around such storage facilities shall slope away for drainage.

(c) Masonry wall construction. Masonry wall construction shall consist of brick, concrete, tile, cement block, or cinder block and shall be not less than 6 inches in thickness. Hollow masonry units used in construction shall have all hollow

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spaces filled with well tamped coarse dry sand or weak concrete (a mixture of one part cement and eight parts of sand with enough water to dampen the mixture while tamping in place). Interior wall shall be covered with a nonsparking material.

(d) Fabricated metal wall construction. Metal wall construction shall consist of sectional sheets of steel or aluminum not less than number 14 gauge, securely fastened to a metal framework. Such metal wall construction shall be either lined inside with brick, solid cement blocks, hardwood not less than 4 inches in thickness or material of equivalent strength, or shall have at least a 6 inch sand fill between interior and exterior walls. Interior walls shall be constructed of or covered with a nonsparking material.

(e) Wood frame wall construction. The exterior of outer wood walls shall be covered with iron or aluminum not less than number 26 gauge. An inner wall of nonsparking materials shall be constructed so as to provide a space of not less than 6 inches between the outer and inner walls, which space shall be filled with coarse dry sand or weak concrete.

(f) Floors. Floors shall be constructed of a nonsparking material and shall be strong enough to bear the weight of the maximum quantity to be stored.

(g) Foundations. Foundations shall be constructed of brick, concrete, cement block, stone, or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the buildings shall be enclosed with metal.

(h) Roof.

(i) Except for buildings with fabricated metal roofs, the outer roof shall be covered with no less than number 26-gauge iron or aluminum fastened to a 7/8-inch sheathing.

(ii) Where it is possible for a bullet to be fired directly through the roof and into the storage facility at such an angle that the bullet would strike a point below the top of inner walls, storage facilities shall be protected by one of the following methods:

(A) A sand tray shall be located at the tops of inner walls covering the entire ceiling area, except that necessary for ventilation, lined with a layer of building paper, and filled with not less than 4 inches of coarse dry sand.

(B) A fabricated metal roof shall be constructed of 3/16-inch plate steel lined with 4 inches of hardwood or material of equivalent strength (for each additional 1/16-inch of plate steel, the hardwood or material of equivalent strength lining may be decreased one inch).

(i) Doors. All doors shall be constructed of 1/4-inch plate steel and lined with 2 inches of hardwood or material of equivalent strength. Hinges and hasps shall be attached to the doors by welding, riveting or bolting (nuts on inside of door). They shall be installed in such a manner that the hinges and hasps cannot be removed when the doors are closed and locked.

(j) Locks. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on

the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(k) Ventilation. Except at doorways, a 2-inch air space shall be left around ceilings and the perimeter of floors. Foundation ventilators shall be not less than 4 by 6 inches. Vents in the foundation, roof, or gables shall be screened and offset.

(l) Exposed metal. No sparking metal construction shall be exposed below the top of walls in the interior of storage facilities, and all nails therein shall be blind-nailed, counter-sunk or nonsparking.

(m) Igloos, army-type structures, tunnels and dugouts. Storage facilities shall be constructed of reinforced concrete, masonry, metal or a combination of these materials. They shall have an earthmound covering of not less than 24 inches on the top, sides and rear unless the magazine meets the requirements of (h)(ii) of this subsection. Interior walls and floors shall be covered with a nonsparking material. Storage facilities of this type shall also be constructed in conformity with the requirements of subsection (1)(a), (b), (f), (i), (j), (k) and (l) of this section.

(3) Construction of portable (field) storage facilities.

(a) General. A Class 2 storage facility shall be a box, a trailer, a semitrailer or other mobile facility. It shall be bullet-resistant, fire-resistant, weather-resistant, theft-resistant, and well ventilated. Portable magazines shall be at least one cubic yard in size. The floor shall be supported to prevent direct contact with the ground. The ground around magazines shall slope away for drainage or other adequate drainage provided. When unattended, vehicular magazines shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department.

(b) Construction. The exterior and doors shall be constructed of not less than 1/4-inch steel and lined with at least two inches of hardwood. Magazines with top openings shall have lids with water-resistant seals or shall overlap the sides by at least one inch when in a closed position.

(c) Hinges and hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(e) Ventilation. Except at doorways, a 2-inch air space shall be left around ceilings and the perimeter of floors. Foundation ventilators shall be not less than 4 by 6 inches.

Vents in the foundation, roof, or gables shall be screened and offset.

(f) Exposed metal. No sparking metal construction shall be exposed below the top of walls in the interior of storage facilities and all nails therein shall be blind-nailed, counter-sunk, or nonsparking.

Note: The following alternatives may be used. (All steel and wood dimensions indicated are actual thicknesses. To meet the concrete block and brick dimensions indicated, the manufacturer's represented thicknesses may be used.)

(i) Exterior of 5/8-inch steel, lined with an interior of any type of nonsparking material.

(ii) Exterior of 1/2-inch steel, lined with an interior of not less than 3/8-inch plywood.

(iii) Exterior of 3/8-inch steel, lined with an interior of two inches of hardwood.

(iv) Exterior of 3/8-inch steel, lined with an interior of three inches of softwood or 2-1/4-inches of plywood.

(v) Exterior of 1/4-inch steel, lined with an interior of five inches of softwood or 5-1/4-inches of plywood.

(vi) Exterior of 3/16-inch steel, lined with an interior of four inches of hardwood.

(vii) Exterior of 3/16-inch steel, lined with an interior of seven inches of softwood or 6-3/4-inches of plywood.

(viii) Exterior of 3/16-inch steel, lined with an intermediate layer of three inches of hardwood and an interior lining of 3/4-inch plywood.

(ix) Exterior of 1/8-inch steel, lined with an interior of five inches of hardwood.

(x) Exterior of 1/8-inch steel, lined with an interior of nine inches of softwood.

(xi) Exterior of 1/8-inch steel, lined with an intermediate layer of four inches of hardwood and an interior lining of 3/4-inch plywood.

(xii) Exterior of any type of fire-resistant material which is structurally sound, lined with an intermediate layer of four inches solid concrete block or four inches solid brick or four inches of solid concrete, and an interior lining of 1/2-inch plywood placed securely against the masonry lining.

(xiii) Standard eight-inch concrete block with voids filled with well-tamped sand/cement mixture.

(xiv) Standard eight-inch solid brick.

(xv) Exterior of any type of fire-resistant material which is structurally sound, lined with an intermediate six-inch space filled with well-tamped dry sand or well-tamped sand/cement mixture.

(xvi) Exterior of 1/8-inch steel, lined with a first intermediate layer of 3/4-inch plywood, a second intermediate layer of 3-5/8-inches well-tamped dry sand or sand/cement mixture and an interior lining of 3/4-inch plywood.

(xvii) Exterior of any type of fire-resistant material, lined with a first intermediate layer of 3/4-inch plywood, a second intermediate layer of 3-5/8-inch well-tamped dry sand or sand/cement mixture, a third intermediate layer of 3/4-inch plywood, and a fourth intermediate layer of two inches of hardwood or 14-gauge steel and an interior lining of 3/4-inch plywood.

(xviii) Eight-inch thick solid concrete.

(4) Construction of detonator (blasting cap) indoor storage facilities.

Note: BATF regulations § 55.208(b) permits an indoor (federal) type 2 magazine to contain up to 50 pounds of high explosives or up to 5,000 caps (detonators) provided that no magazine for explosives storage may be located in a residence or dwelling (as defined). The department of labor and industries calculates 1,000 standard No.8 caps (detonators) as the equivalency of 1-1/2 pounds high explosives. This chapter permits a (state) type 3 indoor storage magazine for up to 1,000 No. 8 caps to be located within access controlled buildings such as warehouses, shops, and maintenance buildings, but specifically excluding any residence or dwelling, provided that the building shall comply with all applicable Washington Administrative Code and NFPA requirements and the magazine shall be constructed in compliance with this section.

(a) General. Class 3 storage facility for detonators (blasting caps) in quantities of 1,000 or less shall be fire-resistant and theft-resistant. They need not be bullet-resistant and weather-resistant if the locked uninhabited building in which they are stored provide protection from the weather and from bullet penetration.

(b) Construction. Sides, bottoms and covers shall be constructed of not less than number 12-gauge metal and lined with a nonsparking material.

(c) Hinges and hasps shall be attached so they cannot be removed from the outside.

(d) Locks. One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes.

(i) A magazine for indoor cap storage is not required to be at least 1 cubic yard in size provided that it is otherwise constructed in compliance with the requirements of this section.

(ii) Class 3 magazines, when located indoors, shall be painted red and appropriately labeled for ready identification in case of fire.

(5) Construction of blasting agent, low explosive or electric blasting cap storage facilities.

(a) General. A Class 4 storage facility may be a building, an igloo, or army-type structure, a tunnel, a dugout, a box, a trailer, or a semitrailer or other mobile facility. They shall be fire-resistant, weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage. When unattended, vehicular storage facilities shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department.

Note: As a result of tests with electric blasting caps, it has been determined that these blasting caps are not subject to sympathetic detonation. Therefore, a Class 4 storage facility meets the necessary requirements for storage of electric blasting caps.

(b) Construction. These magazines shall be constructed of masonry, metal-covered wood, fabricated metal, or a combination of these materials. Foundations are to be constructed of brick, concrete, cement block, stone, or metal or wood posts. If piers or posts are used, in lieu of a continuous foundation, the space under the building shall be enclosed with fire-resistant material. The walls and floors are to be constructed of, or covered with, a nonsparking material or lattice work. The doors shall be metal or solid wood covered with metal.

(c) Hinges and hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps and staples. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(6) Construction of blasting agent storage facilities.

(a) General. A Class 5 storage facility may be a building, igloo or army-type structure, tunnel, dugout, bin, box, trailer, or a semitrailer or other mobile facility. They shall be weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage. When unattended, vehicular storage facilities shall have wheels removed or otherwise effectively immobilized by kingpin locking devices or other methods approved by the department.

(b) Construction. The doors shall be constructed of solid wood or metal.

(c) Hinges and hasps. Hinges and hasps shall be attached to doors by welding, riveting, or bolting (nuts on inside of door). Hinges and hasps shall be installed so that they cannot be removed when the doors are closed and locked.

(d) Locks. Each door shall be equipped with two mortise locks; or with two padlocks fastened in separate hasps and staples; or with a combination of mortise lock and a padlock, or with a mortise lock that requires two keys to open; or a three-point lock. Padlocks shall have at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter. Padlocks shall be protected with not less than 1/4-inch steel hoods constructed so as to prevent sawing or lever action on the locks, hasps, and staples.

Note: Trailers, semitrailers, and similar vehicular magazines may, for each door, be locked with one steel padlock (which need not be protected by a steel hood) having at least 3/8-inch diameter, if the door hinges and lock hasp are securely fastened to the magazine and to the door frame. These requirements do not apply to magazine doors that are adequately secured on the inside by means of a bolt, lock, or bar that cannot be actuated from the outside.

(7) Construction of day box storage facilities for explosives.

(a) General. A temporary storage facility shall be a day box. It must be fire-resistant, weather-resistant and theft-resistant. The ground around such storage facilities shall slope away for drainage.

(b) Construction. A day box shall be constructed of not less than number 12-gauge (.1046 inches) steel, lined with at least either 1/2-inch plywood or 1/2-inch Masonite-type hardboard. Doors shall overlap sides by at least one inch.

(c) Hinges and hasps. Hinges and hasps are to be attached by welding, riveting or bolting (nuts on inside).

(d) Locks. One steel padlock (which need not be protected by a steel hood) having at least five tumblers and a case-hardened shackle of at least 3/8-inch diameter is sufficient for locking purposes.

(e) Unattended storage. No explosive materials shall be left in a day box if unattended. The explosive materials contained therein shall be removed to licensed storage facilities for unattended storage.

(8) Construction of day box storage facilities for detonators (blasting caps).

(a) General. Temporary storage facilities for blasting caps in quantities of 1,000 or less.

(b) Construction. Sides, bottoms and covers shall be constructed of number 12-gauge metal and lined with a nonsparking material.

(c) Hinges and hasps shall be attached thereto by welding.

(d) Locks. A single five-tumbler proof lock shall be sufficient for locking purposes.

(e) No explosive materials shall be left in such facilities if unattended. The explosive materials contained therein shall be removed to licensed storage facilities for unattended storage.

(9) Magazine heating systems requirements, NFPA Code No. 495, "Manufacture, Transportation, Storage and Use of Explosive Materials, 1992," and the following will apply:

(a) Magazines requiring heat shall be heated by either hot water radiant heating within the magazine building; or air directed into the magazine building over either hot water or low pressure steam (15 psig) coils located outside the magazine building.

(b) The magazine heating systems shall meet the following requirements:

(i) The radiant heating coils within the building shall be installed in such a manner that the explosive materials or their containers cannot contact the coils and air is free to circulate between the coils and the explosive materials or their containers.

(ii) The heating ducts shall be installed in such a manner that the hot air discharge from the duct is not directed against the explosive materials or their containers.

(iii) The heating device used in connection with a magazine shall have controls which prevent the ambient building temperature from exceeding 130°F.

(iv) The electric fan or pump used in the heating system for a magazine shall be mounted outside and separate from the wall of the magazine and shall be grounded.

(v) The electric fan motor and the controls for electrical heating devices used in heating water or steam shall have overloads and disconnects, which comply with the National Electrical Code, (National Fire Protection Association, NFPA No. 70-1992). All electrical switch gear shall be located a minimum distance of 25 feet from the magazine.

(vi) The heating source for water or steam shall be separated from the magazine by a distance of not less than 25 feet when electrical and 50 feet when fuel-fired. The area between the heating unit and the magazine shall be cleared of all combustible materials.

(vii) The storage of explosive materials and their containers in the magazine shall allow uniform air circulation so temperature uniformity can be maintained throughout the explosive materials.

(10) Lighting.

(a) Battery-activated safety lights or battery-activated safety lanterns may be used in explosives storage magazines.

(b) Electric lighting used in any explosives storage magazine shall meet the standards prescribed by the "National Electrical Code," (National Fire Protection Association, NFPA 70-1992), for the conditions present in the magazine at any time. All electrical switches shall be located outside of the magazine and also meet the standards prescribed by the National Electrical Code.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-453, filed 3/6/95, effective 4/20/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-453, filed 5/6/86.]

PART D—EXPLOSIVES STORAGE

WAC 296-52-457 Storage of caps with other explosives prohibited. No blasting caps, or other detonating or fulminating caps, or detonators, or flame-producing devices shall be kept or stored in any magazine in which other explosives are kept or stored.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-457, filed 5/6/86.]

WAC 296-52-461 Storage of explosives. (1) General.

(a) All Class A, Class B, Class C explosives, and special industrial explosives, and any newly developed and unclassified explosives, shall be kept in magazines which meet the requirements as defined in chapter 70.74 RCW and chapter 296-52 WAC, unless they are in the process of manufacture, being physically handled in the operating process, being used or being transported to a place of storage or use. No explosives and no detonators (blasting caps) in quantities of 1,001 or more shall be stored in any building or structure except a Class 1, permanent, magazine that has been approved and licensed.

Note 1: Separate storage of components capable of detonation when mixed. Any two components which, when mixed, become capable of detonation by a number 6 cap must be stored in separate locked containers or in a licensed, approved magazine.

Note 2: Electromagnetic radiation. Blasting operations or storage of electrical detonators shall be prohibited in vicinity of operating radio frequency (RF) transmitter stations except where the clearances, as referenced in WAC 296-52-493(g), can be observed.

Note 3: Blasting caps, electric blasting caps, detonating primers and primed cartridges shall not be stored in the same magazine with other explosives.

(b) Subsection (1) of this section does not apply to:

(i) Stocks of small arms ammunition, propellant-actuated power cartridges, small arms ammunition primers in quantities of less than 750,000, smokeless propellants in quantities of less than 150 pounds or black powder, as used in muzzle loading firearms, in quantities of less than 25 pounds;

(ii) Explosive-actuated power devices when in quantities less than 50 pounds net weight of explosives;

(iii) Fuse lighters and fuse igniters;

(iv) Safety fuses other than cordeau detonant fuses.

(2) Quantity restrictions. Explosive materials in excess of 300,000 pounds or blasting caps in excess of 20,000,000 shall not be stored in one storage magazine.

(3) Inventory and responsibility.

(a) Magazines shall be in the charge of a qualified person at all times who shall be at least twenty-one years of age, and who shall be held responsible for the enforcement of all safety precautions.

(b) All explosives shall be accounted for at all times. Explosives not being used shall be kept in a locked magazine, unavailable to persons not authorized to handle them. The employer shall maintain an inventory and use record of all explosives.

(c) Any person or company storing explosive material shall inspect their magazine at least every seven days. This inspection need not be an inventory, but must be sufficient to determine whether there has been unauthorized entry or attempted entry into the magazines or unauthorized removal of the contents of the magazines.

(i) The person conducting weekly inspection must be familiar with the magazine being inspected and the contents.

(ii) The inspecting person shall date and sign the inspection log, inventory sheet or other record upon completion of each inspection.

(iii) The proof of weekly inspection shall be maintained for not less than one year.

(d) A person who knows of a theft or loss of explosives for which that person is responsible under this chapter shall

report the theft or loss to the local law enforcement agency within twenty-four hours of discovery of the theft or loss. The local law enforcement agency shall immediately report the theft or loss to the department of labor and industries.

It is recommended that any person who knows of an attempted unauthorized entry should report same to the local law enforcement agency.

(4) Surrounding area.

(a) Firearms (except firearms carried by qualified guards and qualified law enforcement officers) shall not be permitted inside of or within 50 feet of magazines.

(b) The area surrounding magazines is to be kept clear of rubbish, brush, dry grass, or trees (except of live trees more than 10 feet tall), for not less than 25 feet in all directions.

(c) Volatile materials are to be kept a distance of not less than 50 feet from outdoor magazines. Living foliage which is used to stabilize earthen covering of a magazine need not be removed.

(d) Smoking, matches, open flames, and spark-producing devices are not permitted:

(i) In any magazine;

(ii) Within 50 feet of any outdoor magazine; or

(iii) Within any room containing an indoor magazine.

(5) Signs. The premises on which a magazine is located shall be conspicuously marked with signs as illustrated below. Such signs shall warn any person approaching the magazine of the presence of explosives, but shall be so located that a bullet passing directly through the face of the sign will not strike the magazine.

**DANGER: EXPLOSIVES
STORAGE AREA. KEEP
OUT. NO SHOOTING.
DO NOT FIGHT
EXPLOSIVE FIRES.
PHONE: _____**

Letters: 3" high X 2" wide

Reflectorized finish
White background with
Red letters

Note: The phone number should be that of the individual or company responsible for the contents of the magazine.

Approved U.S. Department of Transportation placards must remain on Class 5 trailers, containing blasting agents while unattended.

(6) Temporary storage at a site for blasting operations shall be located away from neighboring inhabited buildings, railways, highways, and other magazines. A distance of at least one hundred and fifty feet shall be maintained between magazines and the work in progress when the quantity of explosives kept therein is in excess of 25 pounds, and at least 50 feet when the quantity of explosives is 25 pounds or less.

(7) Explosives recovered from blasting misfires shall be placed separately in an approved magazine until competent personnel have determined from the manufacturer the method of disposal. Suspected defective caps recovered from blasting misfires shall not be reused. Such explosives and

caps shall then be disposed of in the manner recommended by the manufacturer.

(8) Storage within magazines.

(a) Explosives which are not conspicuously age date marked by the manufacturer shall be marked with the manufacturing date before being stored in the magazine.

Note: Unidentified explosives confiscated by law enforcement may be marked with the confiscation date if the manufacturer's date is unknown.

(b) Explosive materials within a magazine shall not be placed directly against interior walls, and must not be stored so as to interfere with ventilation. To prevent contact of stored explosive materials with the interior walls, a nonsparking lattice work or other nonsparking material may be used.

(c) Packages of explosives shall be laid flat with the top side up and shall be piled in a stable manner.

Exception: Nitroglycerin based dynamite in long-term storage may be inverted (turned top down) at intervals recommended by the product manufacturer.

(d) Corresponding grades and brands shall be stored together in such a manner that brands and grade marks show. All stocks shall be stored so as to be easily counted and checked.

(e) Black powder when stored in magazines with other explosives shall be stored separately. Black powder stored in kegs shall be stored on ends, bungs down, or on side, seams down.

(f) When any kind of explosive is removed from a magazine for use, the oldest explosive of that particular kind shall always be taken first.

(g) Except with respect to fiberboard or other nonmetal containers, containers of explosives shall not be unpacked or repacked in a magazine nor within 50 feet of a magazine or in close proximity to other explosives.

(h) Tools used for opening packages of explosives shall be constructed of nonsparking materials, except that nonsparking metallic slitters may be used for opening fiberboard boxes. A wood wedge and a fiber, rubber, or wood mallet shall be used for opening or closing wood packages of explosives. Opened packages of explosives shall be securely closed before being returned to a magazine.

(i) Magazines shall not be used for the storage of any metal tools nor any commodity except explosives, blasting agents and blasting supplies.

(j) Magazine floors shall be regularly swept, kept clean, dry, free of grit, paper, empty used packages, and rubbish. Brooms and other cleaning utensils shall not have any spark-producing metal parts. Sweepings from floors of magazines shall be properly disposed of. Magazine floors stained with nitroglycerin shall be cleaned according to instructions by the manufacturer.

(k) When any explosive has deteriorated to an extent that it is in an unstable or dangerous condition, or if nitroglycerin leaks from any explosives, then the person in possession of such explosive shall immediately proceed to destroy such explosive in accordance with the instructions of the manufacturer. Only experienced persons shall be allowed to do the work of destroying explosives.

(l) Magazine repairs.

(i) All explosives shall be removed from the magazine and the floor shall be cleaned before commencing repairs inside a magazine.

(ii) When making outside repairs on a magazine and the work could cause sparks or fire, all explosives shall be removed from the magazine before commencing repair activities.

(iii) Explosives removed from a magazine under repair shall be placed in another magazine or placed a safe distance from the magazine under repair and shall be properly attended until returned to the magazine.

(9) Underground storage.

(a) Explosives and related materials shall be stored in approved facilities required under the provisions of chapter 296-52 WAC.

(b) No explosives or blasting agents shall be permanently stored in any underground operation until the opera-

tion has been developed to the point where at least two modes of exit have been developed.

(c) Permanent underground storage magazines shall be at least 300 feet from any shaft, adit, or active underground working area.

(d) Permanent underground magazines containing detonators shall not be located closer than 50 feet to any magazine containing other explosives or blasting agents.

(e) Upon the approach of an electrical storm, unless a greater hazard would be created thereby, explosives at the adit or the top of any shaft leading to where persons are working shall be moved away from such location a distance equal to that required for inhabited buildings, as listed in Table H-20.

(10) All explosive manufacturing buildings and magazines in which explosives or blasting agents, except small arms ammunition and smokeless powder are had, kept, or stored, must be located at distances from inhabited buildings, railroads and highways in conformity with the following quantity and distance tables, and these tables shall be the basis on which applications for license for storage shall be made and license for storage issued, as provided in RCW 70.74.110 and 70.74.120. Blasting and electric blasting caps in strength through number 8 shall be rated as one and one-half pounds of explosives per one thousand caps. Blasting and electric blasting caps of strength higher than number 8 shall be computed on the combined weight of explosives.

(11) When two or more storage magazines are located on the same property, each magazine must comply with the minimum distances specified from inhabited buildings, railways, and highways, and in addition, they should be separated from each other by not less than the distances shown for "separation of magazines", except that the quantity of explosives contained in cap magazines shall govern in regard to the spacing of said cap magazines from magazines containing other explosives. If any two or more magazines are separated from each other by less than the specified "separation of magazines" distances, then such two or more magazines, as a group, must be considered as one magazine, and the total quantity of explosives stored in such group must be treated as if stored in a single magazine located on the site of any magazine of the group, and must comply with the minimum of distances specified from other magazines, inhabited buildings, railways and highways.

Illustration, Table H-20

Table of Distances for Storage of Explosives

Quantity of Explosive (In Pounds)		Distances (in Feet)					
		Inhabited Buildings		Public Highways Class A to D_		Passenger Railways and Public Highways: With Traffic Volume of More Than 3,000 Vehicles Per Day	
Over	Not Over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
2	5	70	140	30	60	51	102
5	10	90	180	35	70	64	128
10	20	110	220	45	90	81	162
20	30	125	250	50	100	93	186
30	40	140	280	55	110	103	206
40	50	150	300	60	120	110	220
50	75	170	340	70	140	127	254
75	100	190	380	75	150	139	278
100	125	200	400	80	160	150	300
125	150	215	430	85	170	159	318
150	200	235	470	95	190	175	350
200	250	255	510	105	210	189	378
250	300	270	540	110	220	201	402
300	400	295	599	120	240	221	442
400	500	320	640	130	260	238	476
500	600	340	680	135	270	253	506
600	700	355	710	145	290	266	532
700	800	375	750	150	300	278	556
800	900	390	780	155	310	289	578
900	1,000	400	800	160	320	300	600
1,000	1,200	425	850	165	330	318	636
1,200	1,400	450	900	170	340	336	672
1,400	1,600	470	940	175	350	351	702
1,600	1,800	490	980	180	360	366	732
1,800	2,000	505	1,010	185	370	378	756
2,000	2,500	545	1,090	190	380	408	816
2,500	3,000	580	1,160	195	390	432	864
3,000	4,000	635	1,270	210	420	474	948
4,000	5,000	685	1,370	225	450	513	1,026
5,000	6,000	730	1,460	235	470	546	1,092
6,000	7,000	770	1,540	245	490	573	1,146
7,000	8,000	800	1,600	250	500	600	1,200
8,000	9,000	835	1,670	255	510	624	1,248
9,000	10,000	865	1,730	260	520	645	1,290
10,000	12,000	875	1,750	270	540	687	1,374
12,000	14,000	885	1,770	275	550	723	1,446
14,000	16,000	900	1,800	280	560	756	1,512
16,000	18,000	940	1,880	285	570	786	1,572
18,000	20,000	975	1,950	290	580	813	1,626
20,000	25,000	1,055	2,000	315	630	876	1,752
25,000	30,000	1,130	2,000	340	680	933	1,866
30,000	35,000	1,205	2,000	360	720	931	1,962
35,000	40,000	1,275	2,000	380	760	1,026	2,000
40,000	45,000	1,340	2,000	400	800	1,068	2,000
45,000	50,000	1,400	2,000	420	840	1,104	2,000
50,000	55,000	1,460	2,000	440	880	1,140	2,000
55,000	60,000	1,515	2,000	455	910	1,173	2,000
60,000	65,000	1,565	2,000	470	940	1,206	2,000
65,000	70,000	1,610	2,000	485	970	1,236	2,000
70,000	75,000	1,655	2,000	500	1,000	1,263	2,000
75,000	80,000	1,695	2,000	510	1,020	1,293	2,000
80,000	85,000	1,730	2,000	520	1,040	1,317	2,000
85,000	90,000	1,760	2,000	530	1,060	1,344	2,000
90,000	95,000	1,790	2,000	540	1,080	1,368	2,000
95,000	100,000	1,815	2,000	545	1,090	1,392	2,000
100,000	110,000	1,835	2,000	550	1,100	1,437	2,000
110,000	120,000	1,855	2,000	555	1,110	1,479	2,000
120,000	130,000	1,875	2,000	560	1,120	1,521	2,000
130,000	140,000	1,890	2,000	565	1,130	1,557	2,000
140,000	150,000	1,900	2,000	570	1,140	1,593	2,000
150,000	160,000	1,935	2,000	580	1,160	1,629	2,000
160,000	170,000	1,965	2,000	590	1,180	1,662	2,000
170,000	180,000	1,990	2,000	600	1,200	1,695	2,000
180,000	190,000	2,010	2,010	605	1,210	1,725	2,000
190,000	200,000	2,030	2,030	610	1,220	1,755	2,000
200,000	210,000	2,055	2,055	620	1,240	1,782	2,000

Quantity of Explosive (In Pounds)		Distances (in Feet)					
		Inhabited Buildings		Public Highways Class A to D ₂		Passenger Railways and Public Highways: With Traffic Volume of More Than 3,000 Vehicles Per Day	
Over	Not Over	Barricaded	Unbarricaded	Barricaded	Unbarricaded	Barricaded	Unbarricaded
210,000	230,000	2,100	2,100	635	1,270	1,836	2,000
230,000	250,000	2,155	2,155	650	1,300	1,890	2,000
250,000	275,000	2,215	2,215	670	1,340	1,950	2,000
275,000	300,000	2,275	2,275	690	1,380	2,000	2,000

*** Note 1: Terms used in Table H-20 are found in WAC 296-52-417.

Note 2: Source of Table data is BATF (6/90) §55.218.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-461, filed 3/6/95, effective 4/20/95; 92-17-022 (Order 92-06), § 296-52-461, filed 8/10/92, effective 9/10/92; 90-03-029 (Order 89-20), § 296-52-461, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-461, filed 5/6/86.]

WAC 296-52-465 Storage of ammonium nitrate. (1) Scope and definitions.

(a) Except as provided in (d) of this subsection applies to the storage of ammonium nitrate in the form of crystals, flakes, grains, or prills including fertilizer grade, dynamite grade, nitrous oxide grade, technical grade, and other mixtures containing 60 percent or more ammonium nitrate by weight but does not apply to blasting agents.

(b) This section does not apply to the transportation of ammonium nitrate while such transportation is being conducted under U.S. DOT jurisdiction and in compliance with DOT regulations (see 49 CFR Part 173).

(c) This section does not apply to storage under the jurisdiction of and in compliance with the regulations of the United States Coast Guard (see 46 CFR Parts 146-149).

(d) This section shall not apply to storage of ammonium nitrate and ammonium nitrate mixtures which are more sensitive than allowed by the "Definition and Test Procedures for Ammonium Nitrate Fertilizers" from the FERTILIZER INSTITUTE. Storage of ammonium nitrate which is above the sensitivity criteria shall comply with WAC 296-52-469, Storage of Blasting Agents and Supplies.

(e) Nothing in this section shall apply to the production of ammonium nitrate or to the storage of ammonium nitrate on the premises of the producing plant, provided that no distinct undue hazard to employees or the public is created.

(f) The definition and test procedures for ammonium nitrate fertilizer are those found in the bulletin, "Definition and test procedures for ammonium nitrate fertilizer," available from the Fertilizer Institute, 501 2nd St. N.E., Washington, D.C. 20006. This definition limits the contents of organic materials, metals, sulfur, etc., in a product that may be classified ammonium nitrate fertilizer.

(g) The standards for ammonium nitrate (nitrous oxide grade) are those found in the "specifications, properties, and recommendations for packaging, transportation, storage, and use of ammonium nitrate," available from the Compressed Gas Association, Inc., 1235 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4100.

(2) General provisions.

(a) This subsection applies to all persons storing, having, or keeping ammonium nitrate, and to the owner or lessee of any building, premises, or structure in which ammonium

nitrate is stored in quantities of 1,000 pounds (454 kg) or more.

(b) Approval of large quantity storage shall be subject to due consideration of the fire and explosion hazards, including exposure to toxic vapors from burning or decomposing ammonium nitrate.

(c) Storage buildings shall not have basements unless the basements are open on at least one side. Storage buildings shall not be over one story in height.

(d) Storage buildings shall have adequate ventilation or be of a construction that will be self-ventilating in the event of fire.

(e) The wall on the exposed side of a storage building within 50 feet (15.2 m) of a combustible building, forest, piles of combustible materials and similar exposure hazards shall be of fire-resistive construction. (See NFPA Std. 220, Type 1 Construction.) In lieu of the fire-resistive wall, other suitable means of exposure protection such as a free standing wall may be used. The roof coverings shall be Class C or better, as defined in Roof Coverings, NFPA 203M-1970.

(f) All flooring in storage and handling areas, shall be of noncombustible material or protected against impregnation by ammonium nitrate and shall be without open drains, traps, tunnels, pits, or pockets into which any molten ammonium nitrate could flow and be confined in the event of fire.

(g) The continued use of an existing storage building or structure not in strict conformity with this section may be approved in cases where such continued use will not constitute a hazard to life or adjoining property.

(h) Buildings and structures shall be dry and free from water seepage through the roof, walls, and floors.

(3) Storage of ammonium nitrate in bags, drums, or other containers.

(a) Bags and containers used for ammonium nitrate must comply with specifications and standards required for use in interstate commerce (see 49 CFR Chapter I).

(b) Containers used on the premises in the actual manufacturing or processing need not comply with provisions of (a) of this subsection.

(c) Containers of ammonium nitrate shall not be accepted for storage when the temperature of the ammonium nitrate exceeds 130°F (54.4°C).

(d) Bags of ammonium nitrate shall not be stored within 30 inches (76 cm) of the storage building walls and partitions.

(e) The height of piles shall not exceed 20 feet (6.1 m). The width of piles shall not exceed 20 feet (6.1 m) and the length 50 feet (15.2 m) except that where the building is of noncombustible construction or is protected by automatic sprinklers the length of piles shall not be limited. In no case shall the ammonium nitrate be stacked closer than 36 inches (0.9 m) below the roof or supporting and spreader beams overhead.

(f) Aisles shall be provided to separate piles by a clear space of not less than 3 feet (0.9 m) in width. At least one service or main aisle in the storage area shall be not less than 4 feet (1.2 m) in width.

(4) Storage of bulk ammonium nitrate.

(a) Warehouses shall have adequate ventilation or be capable of adequate ventilation in case of fire.

(b) Unless constructed of noncombustible material or unless adequate facilities for fighting a roof fire are available, bulk storage structures shall not exceed a height of 40 feet (12.2 m).

(c) Bins shall be clean and free of materials which may contaminate ammonium nitrate.

(d) Due to the corrosive and reactive properties of ammonium nitrate, and to avoid contamination, galvanized iron, copper, lead, and zinc shall not be used in a bin construction unless suitably protected. Aluminum bins and wooden bins protected against impregnation by ammonium nitrate are permissible. The partitions dividing the ammonium nitrate storage from other products which would contaminate the ammonium nitrate shall be of tight construction.

(e) The ammonium nitrate storage bins or piles shall be clearly identified by signs reading "ammonium nitrate" with letters at least 2 inches (5 cm) high.

(f) Piles or bins shall be so sized and arranged that all material in the pile is moved out periodically in order to minimize possible caking of the stored ammonium nitrate.

(g) Height or depth of piles shall be limited by the pressure-setting tendency of the product. However, in no case shall the ammonium nitrate be piled higher at any point than 36 inches (0.9 m) below the roof or supporting and spreader beams overhead.

(h) Ammonium nitrate shall not be accepted for storage when the temperature of the product exceeds 130°F (54.4°C).

(i) Dynamite, other explosives, and blasting agents shall not be used to break up or loosen caked ammonium nitrate.

(5) Contaminants.

(a) Ammonium nitrate shall be in a separate building or shall be separated by approved type firewalls of not less than 1 hour fire-resistance rating from storage or organic chemicals, acids, or other corrosive materials, materials that may require blasting during processing or handling, compressed flammable gases, flammable and combustible materials or other contaminating substances, including but not limited to animal fats, baled cotton, baled rags, baled scrap paper, bleaching powder, burlap or cotton bags, caustic soda, coal, coke, charcoal, cork, camphor, excelsior, fibers of any kind, fish oils, fish meal, foam rubber, hay, lubricating oil, linseed oil, or other oxidizable or drying oils, naphthalene, oakum, oiled clothing, oiled paper, oiled textiles, paint, straw, sawdust, wood shavings, or vegetable oils. Walls referred to in this subsection need extend only to the underside of the roof.

(b) In lieu of separation walls, ammonium nitrate may be separated from the materials referred to in (a) of this subsection by a space of at least 30 feet (9.1 m).

(c) Flammable liquids such as gasoline, kerosene, solvents, and light fuel oils shall not be stored on the premises except when such storage conforms to WAC 296-24-330, and when walls and sills or curbs are provided in accordance with (a) or (b) of this subsection.

(d) LP-Gas shall not be stored on the premises except when such storage conforms to WAC 296-24-475.

(e) Sulfur and finely divided metals shall not be stored in the same building with ammonium nitrate except when such storage conforms to chapter 296-52 WAC and NFPA Std. 495, Explosive Materials Code.

(f) Explosives and blasting agents shall not be stored in the same building with ammonium nitrate except on the premises of makers, distributors, and user-compounders of explosives or blasting agents.

(g) Where explosives or blasting agents are stored in separate buildings, other than on the premises of makers, distributors, and user-compounders of explosives or blasting agents, they shall be separated from the ammonium nitrate by the distances and/or barricades specified in Table H-22 of WAC 296-52-481, but by not less than 50 feet (15.2 m).

(h) Storage and/or operations on the premises of makers, distributors, and user-compounders of explosives or blasting agents shall be in conformity with chapter 296-52 WAC.

(6) General precautions.

(a) Electrical installations shall conform to the requirements of chapter 296-24 WAC, Part L, for ordinary locations. They shall be designed to minimize damage from corrosion.

(b) In areas where lightning storms are prevalent, lightning protection shall be provided. (See the Lightning Protection Code, NFPA 78-1992.)

(c) Provisions shall be made to prevent unauthorized personnel from entering the ammonium nitrate storage area.

(7) Fire protection.

(a) Not more than 2,500 (2270 metric) tons of bagged ammonium nitrate shall be stored in a building or structure not equipped with an automatic sprinkler system. Sprinkler systems shall be of the approved type and installed in accordance with WAC 296-24-607.

(b) Suitable fire control devices such as small hose or portable fire extinguishers shall be provided throughout the warehouse and in the loading and unloading areas. Suitable fire control devices shall comply with the requirements of WAC 296-24-592 and 296-24-602.

(c) Water supplies and fire hydrants shall be available in accordance with recognized good practices.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-465, filed 3/6/95, effective 4/20/95; 91-03-044 (Order 90-18), § 296-52-465, filed 1/10/91, effective 2/12/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-465, filed 5/6/86.]

WAC 296-52-469 Storage of blasting agents and supplies. (1) Blasting agents or ammonium nitrate, when stored in conjunction with explosives, shall be stored in the manner set forth in WAC 296-52-453 (2)(a) for explosives. The mass of blasting agents and one-half the mass of ammonium nitrate shall be included when computing the total quality of explosives for determining distance requirements.

(2) Blasting agents, when stored entirely separate from explosives, may be stored in the manner set forth in WAC 296-52-453 (5) and (6) or in one-story warehouses (without basements) which shall be:

(a) Noncombustible or fire resistive;

(b) Constructed so as to eliminate open floor drains and piping into which molten materials could flow and be confined in case of fire;

(c) Weather resistant;

(d) Well ventilated; and

(e) Equipped with a strong door kept securely locked except when open for business.

(3) Semitrailer or full-trailer vans used for highway or on-site transportation of the blasting agents are satisfactory for temporarily storing these materials, provided they are located in accordance with Table H-21 with respect to inhabited buildings, passenger railways, and public highways and according to Table H-22 with respect to one another. Trailers shall be provided with substantial means for locking, and the trailer doors shall be kept locked, except during the time of placement and removal of stocks of blasting agents.

(4) Warehouses used for the storage of blasting agents shall be located in accordance with the provisions of Table H-21 with respect to inhabited buildings, passenger railways, and public highways, and according to Table H-22 with respect to one another.

(5) If both blasting agents and ammonium nitrate are handled or stored within the distance limitations prescribed in Table H-21, one-half the mass of the ammonium nitrate shall be added to the mass of the blasting agent when computing the total quality of explosives for determining the proper distance.

(6) Smoking, matches, open flames, spark producing devices, and firearms are prohibited inside of or within 50 feet (15.2 m) of any warehouse used for the storage of blasting agents. Combustible materials shall not be stored within 50 feet (15.2 m) of warehouses used for the storage of blasting agents.

(7) The interior of warehouses used for the storage of blasting agents shall be kept clean and free from debris and empty containers. Spilled materials shall be cleaned up promptly and safely removed. Combustible materials, flammable liquids, corrosive acids, chlorates, or nitrates shall not be stored in any warehouse used for blasting agents unless separated therefrom by a fire resistive separation of not less than one hour resistance. The provisions of this subsection shall not prohibit the storage of blasting agents together with nonexplosive blasting supplies.

(8) Piles of ammonium nitrate and warehouses containing ammonium nitrate shall be adequately separated from readily combustible fuels.

(9) Caked oxidizers, either in bags or in bulk, shall not be loosened by blasting.

(10) Every warehouse used for the storage of blasting agents shall be under the supervision of a competent person who shall be not less than twenty-one years of age.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-469, filed 3/6/95, effective 4/20/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-469, filed 5/6/86.]

WAC 296-52-477 Quantity and distance table for separation between magazines. Magazines containing blasting caps and electric blasting caps shall be separated from other magazines containing like contents, or from mag-

azines containing explosives by distances in the following table.

TABLE H-21
QUANTITY AND DISTANCE TABLE FOR SEPARATION BETWEEN
MAGAZINES CONTAINING EXPLOSIVES

Pounds Over	Pounds Not Over	Separation Distance in Feet Between Magazines	
		Not Barricaded	Barricaded
2	5	12	6
5	10	16	8
10	20	20	10
20	30	22	11
30	40	24	12
40	50	28	14
50	75	30	15
75	100	32	16
100	125	36	18
125	150	38	19
150	200	42	21
200	250	46	23
250	300	48	24
300	400	54	27
400	500	58	29
500	600	62	31
600	700	64	32
700	800	66	33
800	900	70	35
900	1,000	72	36
1,000	1,200	78	39
1,200	1,400	82	41
1,400	1,600	86	43
1,600	1,800	88	44
1,800	2,000	90	45
2,000	2,500	98	49
2,500	3,000	104	52
3,000	4,000	116	58
4,000	5,000	122	61
5,000	6,000	130	65
6,000	7,000	136	68
7,000	8,000	144	72
8,000	9,000	150	75
9,000	10,000	156	78
10,000	12,000	164	82
12,000	14,000	174	87
14,000	16,000	180	90
16,000	18,000	188	94
18,000	20,000	196	98
20,000	25,000	210	105
25,000	30,000	224	112
30,000	35,000	238	119
35,000	40,000	248	124
40,000	45,000	258	129
45,000	50,000	270	135
50,000	55,000	280	140
55,000	60,000	290	145
60,000	65,000	300	150
65,000	70,000	310	155
70,000	75,000	320	160
75,000	80,000	330	165
80,000	85,000	340	170
85,000	90,000	350	175
90,000	95,000	360	180
95,000	100,000	370	185
100,000	110,000	380	195
110,000	120,000	410	205
120,000	130,000	430	215
130,000	140,000	450	225
140,000	150,000	470	235
150,000	160,000	490	245
160,000	170,000	510	255
170,000	180,000	530	265

TABLE H-21
QUANTITY AND DISTANCE TABLE FOR SEPARATION BETWEEN
MAGAZINES CONTAINING EXPLOSIVES

Pounds Over	Pounds Not Over	Separation Distance in Feet Between Magazines	
		Not Barricaded	Barricaded
180,000	190,000	550	275
190,000	200,000	570	285
200,000	210,000	590	295
210,000	230,000	630	315
230,000	250,000	670	335
250,000	275,000	720	360
275,000	300,000	770	385

- Note 1. The term "natural barricade" is defined in WAC 296-52-417.
- Note 2. Efficient artificial barricade is defined in WAC 296-52-417.
- Note 3. "Barricaded" means that a building containing explosives is effectually screened from a magazine, building, railway, or highway, either by a natural barricade, or by an artificial barricade of such height that a straight line from the top of any sidewall of the building containing explosives to the eave line of any magazine, or building, or to a point 12 feet above the center of a railway or highway, will pass through such intervening natural or artificial barricade.
- Note 4. This table applies only to the manufacture and permanent storage of commercial explosives. It is not applicable to transportation of explosives, or any handling or temporary storage necessary or incident thereto. It is not intended to apply to bombs, projectiles, or other heavily encased explosives.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-477, filed 3/6/95, effective 4/20/95; 90-03-029 (Order 89-20), § 296-52-477, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-477, filed 5/6/86.]

WAC 296-52-481 Recommended separation distances of ammonium nitrate and blasting agents from explosives or blasting agents.

TABLE H-22
TABLE OF RECOMMENDED SEPARATION DISTANCES OF AMMONIUM NITRATE AND BLASTING AGENTS FROM EXPLOSIVES OR BLASTING AGENTS¹⁶

Donor weight		Minimum separation distance of receptor when barricaded ² (ft.)		Minimum thickness of artificial barricades ⁵ (in.)
Pounds over	Pounds not over	Ammonium nitrate ³	Blasting agent ⁴	
	100	3	11	12
100	300	4	14	12
300	600	5	18	12
600	1,000	6	22	12
1,000	1,600	7	25	12
1,600	2,000	8	29	12
2,000	3,000	9	32	15
3,000	4,000	10	36	15
4,000	6,000	11	40	15
6,000	8,000	12	43	20
8,000	10,000	13	47	20
10,000	12,000	14	50	20
12,000	16,000	15	54	25
16,000	20,000	16	58	25
20,000	25,000	18	65	25

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25,000	30,000	19	68	30
30,000	35,000	20	72	30
35,000	40,000	21	76	30
40,000	45,000	22	79	35
45,000	50,000	23	83	35
50,000	55,000	24	86	35
55,000	60,000	25	90	35
60,000	70,000	26	94	40
70,000	80,000	28	101	40
80,000	90,000	30	108	40
90,000	100,000	32	115	40
100,000	120,000	34	122	50
120,000	140,000	37	133	50
140,000	160,000	40	144	50
160,000	180,000	44	158	50
180,000	200,000	48	173	50
200,000	220,000	52	187	60
220,000	250,000	56	202	60
250,000	275,000	60	216	60
275,000	300,000	64	230	60

Notes to table of recommended separation distances of ammonium nitrate and blasting agents from explosives or blasting agents:

- Note 1. These distances apply to the separation of stores only. Table H-20 shall be used in determining separation distances from inhabited buildings, passenger railways, and public highways.
- Note 2. When the ammonium nitrate and/or blasting agent is not barricaded, the distances shown in the table shall be multiplied by six. These distances allow for the possibility of high velocity metal fragments from mixers, hoppers, truck bodies, sheet metal structures, metal containers, and the like which may enclose the "donor." Where storage is in bullet-resistant magazines recommended for explosives or where the storage is protected by a bullet-resistant wall, distances, and barricade thicknesses in excess of those prescribed in Table H-20 are not required.
- Note 3. The distances in the table apply to ammonium nitrate that passes the insensitivity test prescribed in the definition of ammonium nitrate fertilizer promulgated by the Fertilizer Institute*; and ammonium nitrate failing to pass said test shall be stored at separation distances determined by competent persons. (*Definition and Test Procedures for Ammonium Nitrate Fertilizer, The Fertilizer Institute, formerly the National Plant Food Institute, November 1964.)
- Note 4. These distances apply to nitro-carbo-nitrates and blasting agents which pass the insensitivity test prescribed in the United States Department of Transportation (DOT) regulations.
- Note 5. Acceptable barricades include either natural or artificial barricades as defined in WAC 296-52-417.
- Note 6. When the ammonium nitrate must be counted in determining the distances to be maintained from inhabited buildings, passenger railways and public highways, it may be counted at one-half its actual weight because its blast effect is lower.
- Note 7. Guide to use of table of recommended separation distances of ammonium nitrate and blasting agents from explosives or blasting agents.
- (a) Sketch location of all potential donor and acceptor materials together with the maximum mass of material to be allowed in that vicinity. (Potential donors are high explosives, blasting agents, and combination of masses of detonating materials. Potential acceptors are high explosives, blasting agents, and ammonium nitrate.)
 - (b) Consider separately each donor mass in combination with each acceptor mass. If the masses are closer than table allowance (distances measured between nearest edges), the combination of masses becomes a new potential donor of weight equal to the total mass. When individual masses are considered as donors, distances to potential acceptors shall be measured between edges. When combined masses within propagating distance of each other are considered as a donor, the appropriate distance to

the edge of potential acceptors shall be computed as a weighted distance from the combined masses:

(i) Calculation of weighted distance from combined masses:

- Let M_2, M_3, \dots, M_n be donor masses to be combined.
- M_1 is a potential acceptor mass.
- D_{12} is distance from M_1 to M_2 (edge to edge).
- D_{13} is distance from M_1 to M_3 (edge to edge), etc.

To find weighted distance [$D_{1(2,3,\dots,n)}$] from combined masses to M_1 , add the products of the individual masses and distances and divide the total by the sum of the masses thus:

$$D_{1(2,3,\dots,n)} = \frac{M_2 \times D_{12} + M_3 \times D_{13} + \dots + M_n \times D_{1n}}{M_2 + M_3 + \dots + M_n}$$

Propagation is possible if either an individual donor mass is less than the tabulated distance from an acceptor or a combined mass is less than the weighted distance from an acceptor.

- (c) In determining the distances separating highways, railroads, and inhabited buildings from potential explosions (as prescribed in Table H-20), the sum of all masses which may propagate (i.e., lie at distances less than prescribed in the Table) from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only 50 percent of its weight shall be used because of its reduced blast effects. In applying Table H-21 to distances from highways, railroads, and inhabited buildings, distances are measured from the nearest edge of potentially explodable material.
- (d) When all or part of a potential acceptor comprises Explosives Class A as defined in DOT regulations, storage in bullet-resistant magazines is required. Safe distances to stores in bullet-resistant magazines may be obtained from the intermagazine distances prescribed in Table H-21.
- (e) Barricades must not have line-of-sight openings between potential donors and acceptors which permit blast or missiles to move directly between masses.
- (f) Good housekeeping practices shall be maintained around any bin containing ammonium nitrate or blasting agent. This includes keeping weeds and other combustible materials cleared within 25 feet of such bin. Accumulation of spilled product on the ground shall be prevented.

[Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-481, filed 3/6/95, effective 4/20/95; 90-03-029 (Order 89-20), § 296-52-481, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-10-044 (Order 86-24), § 296-52-481, filed 5/6/86.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 296-52-485 Quantity and distance tables for manufacturing buildings. All explosives manufacturing buildings shall be located one from the other and from other buildings on explosives manufacturing plants in which persons are regularly employed, and all magazines shall be located from factory buildings and buildings on explosives plants in which persons are regularly employed, in conformity with the intraexplosives plant quantity and distance table below.

TABLE H-23

EXPLOSIVES		
Pounds Over	Pounds Not Over	Distance Feet
.....	10	Separate Building or Within Substantial Dividing Walls
10	25	
25	50	

TABLE H-23

EXPLOSIVES			Distance Feet
Pounds Over	Pounds Not Over	Separate Building or Within Substantial Dividing Walls	
50	100	80	
100	200	100	
200	300	120	
300	400	130	
400	500	140	
500	750	160	
750	1,000	180	
1,000	1,500	210	
1,500	2,000	230	
2,000	3,000	260	
3,000	4,000	280	
4,000	5,000	300	
5,000	6,000	320	
6,000	7,000	340	
7,000	8,000	360	
8,000	9,000	380	
9,000	10,000	400	
10,000	12,500	420	
12,500	15,000	450	
15,000	17,500	470	
17,500	20,000	490	
20,000	25,000	530	
25,000	30,000	560	
30,000	35,000	590	
35,000	40,000	620	
40,000	45,000	640	
45,000	50,000	660	
50,000	55,000	680	
55,000	60,000	700	
60,000	65,000	720	
65,000	70,000	740	
70,000	75,000	770	
75,000	80,000	780	
80,000	85,000	790	
85,000	90,000	800	
90,000	95,000	820	
95,000	100,000	830	
100,000	125,000	900	
125,000	150,000	950	
150,000	175,000	1,000	
175,000	200,000	1,050	
200,000	225,000	1,100	
225,000	250,000	1,150	
250,000	275,000	1,200	
275,000	300,000	1,250	

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-10-044 (Order 86-24), § 296-52-485, filed 5/6/86.]

WAC 296-52-487 Low explosives. (1) Magazines which are restricted to the storage of only Class C (low explosives) as defined in this chapter, or classified as low explosives by the Bureau of Alcohol, Tobacco and Firearms, may be located in accordance with Table H-24.

(2) Detonators shall not be stored with any other low explosives.

TABLE H-24
TABLE OF DISTANCES FOR STORAGE OF LOW
EXPLOSIVES

Pounds		From inhabited building distance	From public railroad and highway	From above ground magazine
Over	Not Over	(feet)	distance (feet)	(feet)
0	1,000	75	75	50
1,000	5,000	115	115	75
5,000	10,000	150	150	100
10,000	20,000	190	190	125
20,000	30,000	215	215	145
30,000	40,000	235	235	155
40,000	50,000	250	250	165
50,000	60,000	260	260	175
60,000	70,000	270	270	185
70,000	80,000	280	280	190
80,000	90,000	295	295	195
90,000	100,000	300	300	200
100,000	200,000	375	375	250
200,000	300,000	450	450	300

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-487, filed 3/6/95, effective 4/20/95; 88-23-054 (Order 88-25), § 296-52-487, filed 11/14/88.]

PART E—EXPLOSIVES TRANSPORTATION

WAC 296-52-489 Transportation. (1) Regulations governing the transportation of explosives on public highways are adopted by the United States Department of Transportation (see 49 CFR Parts 100 through 199) and the Washington utilities and transportation commission and administered by the Washington state patrol.

(2) The regulations of this section shall be applicable in and on job sites and off-highway roads. The department of labor and industries shall administer these regulations in locations such as but not limited to: Construction or mining access roads and blast sites; off-highway forest roads including both publicly and privately owned logging roads, haul roads or general access roads.

Note: Examples of publicly owned off-highway roads where these regulations are applicable shall include, but are not limited to: U.S. Forest Service roads, Bureau of Land Management roads, state department of natural resources roads, but specifically not including the state or interstate highway system.

(a) No person shall be allowed to smoke, carry matches or any other flame-producing device, except guards or commissioned law enforcement officers, to carry any firearms or loaded cartridges while in or near a motor vehicle transporting explosives; or drive, load, or unload such vehicle in a careless or reckless manner.

(b) Explosives shall not be carried on any vehicle while vehicle is being used to transport workers other than driver and two persons.

(c) Explosives shall be transferred from a disabled vehicle to another, only when proper and qualified supervision is provided. Local fire and police departments shall be promptly notified in congested areas. In remote areas they shall be notified if appropriate.

(1999 Ed.)

(d) Other materials or supplies shall not be placed on or in the cargo space of a conveyance containing explosives, detonating cord or detonators, except carrying safety fuse, and properly secured, nonsparking equipment used expressly in the handling of such explosives will be permissible.

(3) Transportation vehicles.

(a) All vehicles used for transporting explosives shall be strong enough to carry the load without difficulty and be in good mechanical condition. The cargo compartment(s) shall have a tight floor and must not have any exposed spark producing metal on the inside which could come into contact with explosives cargo.

(b) Explosives vehicles used on any roadway which is open to public travel shall comply with WAC 296-52-550, Appendix II.

(c) Open top explosives transportation vehicles may only be used on the jobsite or on roads which are not open to public travel (while laden with explosives). In open top vehicles or trailers, explosives may only be transported in the original DOT approved shipping container(s)/box(es) or a daybox or portable magazine which complies with the requirements of this chapter. In all instances the explosive container(s), box(es), daybox or portable magazine shall be secured to the bed of the vehicle or trailer.

(i) If an explosives transportation vehicle or trailer does not have a fully enclosed cargo area with nonsparking interior, the cargo bed and all explosive cargo shall be covered with a flameproof and moisture-proof tarpaulin or other effective protection against moisture and sparks. Whenever tarpaulins are used for covering explosives, both the tarpaulin and the explosives container shall be secured to the body of the truck bed by means of rope, wire, or other equally efficient tie downs.

(ii) Packages of explosives shall not be loaded above the sides on open-sided vehicles.

(4) Vehicles shall be placarded and displayed as specified by the United States Department of Transportation, CFR 49-1981, Parts 100 through 199. Placards shall remain on the vehicle until all explosives have been removed from the vehicle.

(5)(a) Each motor vehicle used for transporting explosives shall be equipped with a minimum of two extinguishers, each having a rating of at least 2A 10BC. The driver shall be trained in the use of the extinguishers on the vehicle.

(i) Only extinguishers listed or approved by a nationally recognized testing laboratory shall be deemed suitable for use on explosives-carrying vehicles. Refer to WAC 296-24-58501(19) for definition of listed, and federal regulation 29 CFR 1910.7 for nationally recognized testing laboratory.

(ii) Extinguishers shall be filled and ready for immediate use and readily available. Extinguishers shall be examined periodically by a competent person.

(b) A motor vehicle used for transporting explosives shall be given the following inspection to determine that it is in proper condition for safe transportation of explosives:

(i) Fire extinguishers shall be filled and in working order.

(ii) All electrical wiring shall be completely protected and securely fastened to prevent short-circuiting.

(iii) Chassis, motor, pan, and underside of body shall be reasonably clean and free of excess oil and grease.

(iv) Fuel tank and feedline shall be secure and have no leaks.

(v) Brakes, lights, horn, windshield wipers, and steering apparatus shall function properly.

(vi) Tires shall be checked for proper inflation and defects.

(vii) The vehicle shall be in proper condition in every other respect and acceptable for handling explosives.

(c) Motor vehicles or conveyances carrying explosives, blasting agents, or blasting supplies, shall not be taken inside a garage or shop for repairs or servicing.

(6) Operation of transportation vehicles.

(a) Vehicles transporting explosives shall only be driven by and be in the charge of a licensed driver who is not less than twenty-one years of age, physically fit, careful, capable, reliable, able to read and write the English language, and not addicted to the use, or under the influence of intoxicants, narcotics, or other dangerous drugs. This rule does not apply to persons taking prescription drugs and/or narcotics as directed by a physician providing such use shall not endanger the worker or others. They shall be familiar with the traffic regulations, state laws, and the provisions of this section.

(i) Explosives may only be transported by a licensed manufacturer, blaster, purchaser or seller, or the designated agent or representative thereof, or a contract carrier for hire who complies with all requirements for transportation of hazardous materials.

(ii) The person in control of the explosive laden vehicle shall be made aware of the nature of the cargo and pertinent safety precautions relating to the particular explosive(s) being transported.

(b) Parking. A motor vehicle which contains Class A or Class B explosives must not be parked under any of the following circumstances:

(i) On or within 5 feet of the traveled portion of a public street or highway;

(ii) On private property (including premises of a fueling or eating facility) without the knowledge and consent of the person who is in charge of the property and who is aware of the nature of the hazardous materials the vehicle contains; or

(iii) Within 300 feet of a bridge, tunnel, dwelling, building, or place where people work, congregate, or assemble, except for brief periods when the necessities of operation require the vehicle to be parked and make it impracticable to park the vehicle in any other place.

(c) Every motor vehicle transporting any quantity of Class A or Class B explosives shall, at all times, be attended by a driver or other attendant of the motor carrier. This attendant shall have been made aware of the class of the explosive material in the vehicle and of its inherent dangers, and shall have been instructed in the measures and procedures to be followed in order to protect the public from those dangers. The attendant shall have been made familiar with the vehicle to which assigned, and shall be trained, supplied with the necessary means, and authorized to move the vehicle when required.

(i) For the purpose of this subdivision, a motor vehicle shall be deemed "attended" only when the driver or other attendant is physically on or in the vehicle, or has the vehicle within the driver or attendants field of vision and can reach it

quickly and without any kind of interference; "attended" also means that the driver or attendant is awake, alert, and not engaged in other duties or activities which may divert their attention from the vehicle.

(ii) An explosive laden vehicle may be left unattended for a period not to exceed 48 hours provided that:

(A) The vehicle is parked in a designated parking lot which complies with NFPA Std. 498 and with the appropriate clearance table of this chapter for the type and quantity of explosives carried;

(B) The designated parking lot is correctly bermed and walled or fenced and gated to prevent unauthorized entry;

(C) The designated lot is inspected and approved by the department of labor and industries and is provided with a full-time security patrol at all times when explosives are present;

(D) Trucks used for explosives delivery which contain only blasting agents (International Class 1.5 D) and no high explosives need not be attended provided the vehicle is locked to prevent movement of the vehicle, the cargo compartments are locked to prevent theft, the vehicle is parked according to all applicable storage distance requirements, and the vehicle is located in a secured area which restricts entry to the area by unauthorized personnel.

(d) No spark-producing metal, spark-producing tools, oils, matches, firearms, electric storage batteries, flammable substances, acids, oxidizing materials, or corrosive compounds shall be carried in the body of any motor truck and/or vehicle transporting explosives, unless the loading of such dangerous articles and the explosives comply with U.S. Department of Transportation regulations.

(e) Vehicles transporting explosives shall avoid congested areas and heavy traffic.

(f) Delivery and issue of explosives shall only be made by and to authorized persons and into authorized magazines or authorized temporary storage or handling area.

(7) Transporting blasting caps and explosives in the same vehicle.

(a) Fuse type blasting caps, blasting caps with safety fuse and/or blasting caps with metal clad mild detonating fuse shall not be transported in the same vehicle or trailer with other explosives.

(b) Blasting caps rated by U.S. DOT as nonmass detonating may be transported in the same vehicle or trailer with other explosives when:

(i) The caps are carried in DOT approved shipping containers;

(ii) The truck or trailer complies with Appendix 1, WAC 296-52-550.

(8) When primers are made up at a central primer house for use in high speed tunneling, the following shall apply:

(a) Only enough primers shall be made up for each round of blasting.

(b) The primers shall be placed in separate containers or bins, categorized by degree of delay in such a manner so as to prevent them from physical impact.

(c) Explosives carried in the same magazine shall be separated by 1/4-inch steel, covered on each side by four inches of hardwood planking, or equivalent.

(d) Hoist operators shall be notified before explosives or blasting agents are transported in a shaft conveyance.

(e) Explosives and blasting agents shall be hoisted, lowered, or conveyed in a powder car. No other materials, supplies, or equipment shall be transported in the same conveyance at the same time.

(f) Only a state approved powder car or conveyance shall be used underground.

(g) All explosives or blasting agents in transit underground shall be taken to the place of use or storage without delay.

(h) The quantity of explosives or blasting agents taken to an underground loading area shall not exceed the amount estimated to be necessary for the blast.

(i) The number of primers for one round will be removed from the state approved car or vehicle at the face or heading after the drilling has been completed and the holes readied for loading. After loading the charge, the powder car or vehicle will be withdrawn from the tunnel.

(j) Wires on electric caps shall be kept shunted until wired to the bus wires.

(k) The powder car or conveyance shall be inspected daily for lights, brakes and external damage to electrical circuitry. The electrical system shall be checked weekly to detect any failures that may constitute an electrical hazard and a written certification record of such inspection shall be kept on file for the duration of the job. The certification record shall contain the date of inspection, the serial number or other positive identification of the unit being inspected and the signature of the person performing the inspection.

(l) The installation of auxiliary lights on truck beds, which are powered by the truck's electrical system, shall be prohibited.

(m) No one, except the operator, the helper, and/or the powderperson, shall be permitted to ride on a conveyance transporting explosives and blasting agents.

(n) No person shall ride in any shaft conveyance transporting explosives and blasting agents.

(o) No explosives or blasting agents shall be transported on a crew-haul trip.

(p) The car or conveyance containing explosives or blasting agents shall be pulled, not pushed, whenever possible.

(q) The powder car or conveyance especially built for the purpose of transporting explosives or blasting agents shall bear a reflectorized sign on each side with the word "explosives" in letters not less than 4 inches in height; upon a background of sharply contrasting color.

(r) Compartments for transporting detonators and explosives in the same car or conveyance shall be physically separated by a distance of 24 inches or by a solid partition at least 6 inches thick.

(s) Detonators and other explosives shall not be transported at the same time in any shaft conveyance.

(t) Explosives and/or blasting agents, not in original containers, shall be placed in a suitable container when transported manually.

(u) No explosives or blasting agents shall be transported on any locomotive. At least two car lengths shall separate the locomotive from the powder car.

(9) When explosives are carried to the blasting site from the main storage magazines by the blaster or helper:

(a) Special insulated containers or original DOT shipping containers shall be used for this purpose, either boxes or bags, one container for explosives and one for detonators.

(b) Detonators or explosives shall never be carried in pockets of clothing.

[Statutory Authority: RCW 49.17.040, 98-19-056, § 296-52-489, filed 9/15/98, effective 11/8/98. Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-489, filed 3/6/95, effective 4/20/95; 92-17-022 (Order 92-06), § 296-52-489, filed 8/10/92, effective 9/10/92; 91-03-044 (Order 90-18), § 296-52-489, filed 1/10/91, effective 2/12/91; 88-23-054 (Order 88-25), § 296-52-489, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-10-044 (Order 86-24), § 296-52-489, filed 5/6/86.]

PART F—USE OF EXPLOSIVES

WAC 296-52-493 Use of explosives and blasting agents. (1) General provisions.

(a) While explosives are being handled or used, smoking, matches, or any other source of fire or flame shall not be allowed within 100 feet of the blast site. No person shall be allowed to handle explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs. This rule does not apply to persons taking prescription drugs and/or narcotics as directed by a physician providing such use shall not endanger the worker or others.

(b) Original containers or day box magazines shall be used for taking detonators and other explosives from storage magazines to the blast site.

(c) When blasting is done in congested areas or in close proximity to a structure, railway, or highway or any other installation that may be damaged, the blast shall be covered before firing with a mat or other suitable protective material that is capable of preventing fragments from being thrown.

(d) Persons authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution, including but not limited to warning signals, flags and barricades or blasting mats to insure the safety of the general public and workers.

(e) Blasting operations shall be conducted during daylight hours whenever possible.

(f) Whenever blasting is being conducted in the vicinity of gas, electric, water, fire alarm, telephone, telegraph, and steam utilities, the user (blaster) shall notify the appropriate representatives of such utilities at least twenty-four hours in advance of blasting, specifying the location and intended time of such blasting. Verbal notice shall be confirmed with written notice. The blaster shall ensure that appropriate measures for safe control have been taken.

(g) Due precaution shall be taken to prevent unintended discharge of blasting caps from extraneous electric current or from transmitted radio frequency (RF) energy. Examples:

Common sources of extraneous electricity include but are not limited to adjacent powerlines, dust storms and lightning storms.

Common sources of hazardous RF transmissions include but are not limited to: (MOBILE) citizen band (CB) or side band radio transmitters, VHF (FM) radio transmitters, UHF cellular telephones and radar transmitters. (FIXED LOCATION TRANSMITTERS) base stations for CB, side band or FM radio communications, UHF cellular telephone transmitters and service extension repeater systems, AM and FM

(commercial) radio broadcast transmitters, TV broadcast transmitters and repeater system transmitters, surface scan and radio navigation beacons.

(h) Low flying aircraft and in particular military aircraft create the most common serious RF exposures. These highly unpredictable mobile transmitters are very powerful and transmit on a broad spectrum of frequencies including radar, laser and all common communications bands. Probably the two most dangerous examples are low flying automatic terrain following guidance systems and airplanes which are equipped to jam all common radar and communications frequencies for a distance of several miles around the airborne transmitters.

(i) Precautions to prevent unintended discharge of electric blasting caps from extraneous electric currents or RF transmission shall include:

(i) Positive identification of voltages in electrical transmission and distribution lines and specific required clearance for each specific system; and

(ii) Complete suspension of all blasting operations and removal of all personnel from the blast site during the approach and progress of heavy dust storms which may create static lightening or conventional thunder and lightening storms; and

(iii) The posting of signs warning against the use of radio frequency transmitters including CBs, mobile phones and two-way radios. The required signs shall be placed in a manner to adequately warn transmitter users, including all routes into the required clearance zone around where electric blasting caps are used.

(A) The required clearance zone for construction and/or demolition operations shall be 1000 feet;

(B) The required clearance zone for general industry operations which are not subject to construction requirements shall be 350 feet.

Note: See Appendix II, WAC 296-52-552 for illustrations and specific posting requirements.

(iv) Ensuring that mobile RF transmitters which are less than 100 feet away from electrical blasting caps are deenergized or disconnected when the caps are not fully contained in the original DOT shipping containers; and

(v) Fixed location RF transmitters represent a higher level of hazard to both storage and/or blasting operations involving electric caps because the transmitters are more powerful and transmit dangerous levels of RF exposure over much greater distances. Storage or blasting operations with electric caps shall only be carried out in full compliance with the appropriate recommended distance tables published in *INSTITUTE OF MAKERS OF EXPLOSIVES (I.M.E.) Publication No. 20, 1988, "SAFETY GUIDE FOR THE PREVENTION OF RADIO FREQUENCY HAZARDS IN THE USE OF COMMERCIAL ELECTRIC DETONATORS (Blasting Caps)"*; and

(vi) When necessary to conduct blasting operations within the required separation distances specified in I.M.E. Pamphlet 20-1988, the storage and use of electric blasting caps shall be prohibited on the site and only detonating cord, safety fuse, shock tube or other approved nonelectric systems may be used.

(j) No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders.

(k) Electric detonators shall be shunted until wired into the blasting circuit.

(l) Explosives shall not be handled near open flames, uncontrolled sparks or energized electric circuits.

(m) Delivery and issue of explosives shall only be made by and to authorized persons and into authorized magazines or approved temporary storage or handling area.

(n) Blaster in charge.

(i) The blast site shall be under the control of a fully qualified and currently licensed "blaster in charge" throughout the course of every blasting operation. That obligation shall commence with a site survey to determine potential safety conflicts with: Public utility transmission systems, dwellings or other occupied buildings, roads or railroads, radio frequency transmitters, preexisting explosives storage magazines.

(ii) Whenever the site survey identifies conditions which conflict with safe blasting operations, the blaster in charge shall prepare a written site blasting plan before beginning blasting operations. The written plan shall identify the methods, materials, procedures and/or engineering calculations which will be used to address each identified conflicting condition.

Note 1. When the site survey identifies that no conflicting conditions exist, a written blasting plan is not required.

Note 2. Written blasting plans may be discarded at the end of a job provided that no blasting incident has occurred which resulted in bodily injury or property damage.

(iii) All on-site transportation, storage, loading and firing of explosives shall be supervised by the blaster in charge. Trainees and inexperienced personnel shall work only under direct supervision of licensed personnel fully qualified in the blasting method in use, including safety procedures and blasting signals in use at that site.

(iv) The site blasting plan shall include designated safe location(s) for personnel during actual blasting and a method for determining when all personnel are accounted for in the designated safe location(s).

Note: It is desirable that all potential means of egress into the blast site should be under observation immediately prior to each blast. The observer(s) should be provided with a means of communication with the blaster in charge.

(o) The employer shall permit only competent and authorized personnel to handle explosives.

(p) No explosive shall be loaded or used underground in the presence of combustible gases or combustible dusts unless approved as permissible by MSHA.

(q) In either electric or nonelectric blasting, the firing line(s) shall not be connected to the blast initiating device until all personnel have been accounted for and removed from the blast danger area or are in a blast shelter or other location which affords adequate protection.

(2) Storage at use sites.

(a) Empty boxes and paper and fiber packing materials which have previously contained high explosives shall not be used again for any purpose, but shall be destroyed by burning

at the blast site or at an approved isolated location out of doors, and no person shall be nearer than 100 feet after the burning has started.

(b) When opening kegs or wooden cases, no sparking metal tools shall be used; wooden wedges and either wood, fiber or rubber mallets shall be used. Nonsparking metallic slitters may be used for opening fiberboard cases.

(c) Should cartridges or packages of explosives show signs of deterioration, the manufacturer or the department shall be notified. Such explosives must be carefully set aside and properly disposed of.

(3) Loading of explosives or blasting agents in blast holes.

(a) Procedures that permit safe and efficient loading shall be established before loading is started.

(b) All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives. Holes shall be checked prior to loading to determine depth and conditions.

(c) Tamping shall be done only with wood rods or with approved plastic tamping poles without exposed metal parts, but nonsparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. The primer shall never be tamped.

(d) No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives and detonators shall be immediately returned to an authorized magazine or day box.

(e) Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges, and if any are found, they shall be refired before work proceeds.

(f) When a charge of explosives has been exploded in a bore hole to enlarge or "spring" it, an interval of at least two hours must be allowed to pass before an additional charge of explosives can be loaded into the hole.

Note: There may be an exception made to this rule provided the sprung hole is thoroughly wet down with water before it is loaded.

(g) No person shall be allowed to deepen drill holes which have contained explosives or blasting agents.

(h) No explosives or blasting agents shall be left unattended at blast sites unless stored in a licensed magazine.

(i) Users (blasters) shall not load, store or use explosives closer than the length of the steel being used for drilling and in no event nearer than fifty feet of drilling operations.

(j) Machines and all tools not used for loading explosives into bore holes shall be removed from the immediate location of holes being loaded with explosives. Equipment shall not be operated within 50 feet of loaded holes except when equipment is needed to add burden, mats or tracking of drills out of the loading area.

(k) Powerlines and portable electric cables for equipment being used shall be kept a safe distance from explosives or blasting agents being loaded into drill holes. Cables in the proximity of the blast area shall be deenergized and locked out by the blaster.

(l) Holes shall not be drilled where there is danger of intersecting a charged or misfired hole.

(m) All blast holes in open work shall be stemmed to the collar or to a point which will confine the charge.

(n) No explosives for underground operations other than those in Fume Class 1, as set forth by the Institute of Makers of Explosives, shall be used; however, explosives complying with the requirements of Fume Class 2 and Fume Class 3 may be used if adequate ventilation has been provided.

(o) Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area. The warning sign lettering shall not be less than 4 inches in height on a contrasting background. All loaded stumps must be marked for identification on logging sites.

(p) A bore hole shall never be sprung when it is adjacent to or near a hole which has been loaded. Flashlight batteries shall not be used as a power source (blasting machine) for springing holes.

(q) No loaded holes shall be left unattended or unprotected.

(r) The user (blaster) shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in a blast and shall keep an accurate running inventory of all explosives and blasting agents stored on the operation.

(s) When loading blasting agents pneumatically over primed boosters, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded.

(4) Initiation of explosive charges - electric blasting.

(a) Blasting cap leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing.

(b) Before adopting any system of electrical firing, the user (blaster) shall conduct a thorough survey for extraneous currents, and all dangerous currents shall be eliminated before any holes are loaded.

(c) In any single blast using electric blasting caps, all caps shall be of the same style or function and be of the same manufacture and compatible with each other.

(d) Electric blasting shall be carried out by using blasting circuits or power circuits in accordance with the electric blasting cap manufacturer's recommendations.

(e) The firing line shall be checked with an approved testing device at the terminals before being connected to the blasting machine or other power source.

(f) The circuit including all caps shall be tested with an approved testing device before being connected to the firing line.

(g) When firing a circuit of electric blasting caps, care shall be exercised to ensure that an adequate quantity of delivered current is available, in accordance with the manufacturer's recommendations.

(h) Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity, and shall not be less than twenty gauge (American wire gauge) solid core insulated wire.

(i) Firing line or lead wires shall be solid single wires of sufficient current-carrying capacity, and shall be not less than fourteen gauge (American wire gauge) solid core insulated wire. Bus wires - depends on the size of the blast, fourteen gauge (American wire gauge) copper is recommended.

(j) The ends of lead wires which are to be connected to a firing device shall be shorted by twisting them together or otherwise shunting them before they are connected to the leg wires or connecting wires, and they shall be kept in the control of the person who is doing the loading until loading is

completed and the leg wires attached. Lead wires shall not be attached to the firing device until the blaster is ready to fire the shot and must be attached by the user (blaster) themselves.

(k) The ends of the leg wires on electric detonators shall be shorted in a similar manner and not separated other than for testing until all holes are loaded and the loader is ready to connect the leg wires to the connecting wires or lead wires.

(l) When firing electrically, the insulation on all firing lines shall be adequate and in good condition.

(m) A power circuit used for firing electric blasting caps shall not be grounded.

(n) In underground operations when firing from a power circuit, a safety switch shall be placed at intervals in the permanent firing line. This switch shall be made so it can be locked only in the "off" position and shall be provided with a short-circuiting arrangement of the firing lines to the cap circuit.

(o) In underground operations there shall be a "lightning" gap of at least 5 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast.

(p) When firing from a power circuit, the firing switch shall be locked in the open or "off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "off" position. Keys to this switch shall be entrusted only to the user (blaster).

(q) Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity.

(r) When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric blasting caps used.

(s) The number of electric blasting caps connected to a blasting machine shall not be in excess of its rated capacity. Furthermore, in primary blasting, a series circuit shall contain no more caps than the limits recommended by the manufacturer of the electric blasting caps in use.

(t) The blaster in charge shall be in charge of the blasting machines, and no other person shall connect the lead wires to the machine.

(u) Users (blasters), when testing circuits to charged holes, shall use only blasting testers especially designed for this purpose.

(v) Whenever the possibility exists that a lead line or blasting wire might be thrown over live overhead powerlines, communication lines, utility services, or other services or structures by the force of an explosion, care shall be taken to see that the total length of wires are kept too short to hit the lines, that the wires are securely anchored to the ground and owners or operators are notified. If those requirements can not be satisfied, a nonelectric system shall be used.

(w) In electrical firing, only the person making lead wire connections shall fire the shot. All connections shall be made from the bore hole back to the source of firing current, and the lead wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.

(x) After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited.

(y) When electric blasting caps have been used, workers shall not return to misfired holes for at least thirty minutes.

(5) Use of safety fuse.

(a) A fuse that is deteriorated or damaged in any way shall not be used.

(b) The hanging of fuse on nails or other projections which will cause a sharp bend to be formed in the fuse is prohibited.

(c) Before capping safety fuse, a short length shall be cut from the end of the supply reel so as to assure a fresh cut end in each blasting cap.

(d) Only a cap crimper of approved design shall be used for attaching blasting caps to safety fuse. Crimpers shall be kept in good repair and accessible for use.

(e) No unused cap or short capped fuse shall be placed in any hole to be blasted; such unused detonators shall be removed from the working place and disposed of or stored in licensed magazine.

(f) No fuse shall be capped, or primers made up, in any magazine or near any possible source of ignition.

(g) Capping of fuse and making of primers shall only be done in a place selected for this purpose and at least one hundred feet distant from any storage magazine.

(h) Fuse must be cut long enough to reach beyond the collar of the bore hole and in no case less than three feet. When shooting choker holes, not less than three feet of fuse shall be used.

(i) At least two persons shall be present when multiple cap and fuse blasting is done by hand lighting methods.

(j) Not more than 12 fuses shall be lighted by each blaster when hand lighting devices are used. However, when two or more safety fuses in a group are lighted as one by means of igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse.

(k) The so-called "drop fuse" method of dropping or pushing a primer or any explosive with a lighted fuse attached is prohibited.

(l) Cap and fuse shall not be used for firing mudcap charges unless charges are separated sufficiently to prevent one charge from dislodging other shots in the blast.

(m) When blasting with safety fuses, consideration shall be given to the length and burning rate of the fuse. Sufficient time, with a margin of safety, shall always be provided for the blaster to reach a place of safety.

(n) The burning rate of the safety fuse in use at any time shall be measured, posted in conspicuous locations, and brought to the attention of all workers concerned with blasting. No fuse shall be used that burns faster than one foot in forty seconds or slower than one foot in fifty-five seconds.

(o) For use in wet places the joint between the cap and fuse shall be waterproofed with a compound prepared for this purpose.

(p) In making up primers only nonsparking skewers shall be used for punching the hole in the cartridge to insert the capped fuse. No blasting cap shall be inserted in the explosives without first making a hole in the cartridge of proper size or using a standard cap crimper.

(q) Only sufficient primers for one day's use shall be made up at one time. They shall be stored in a box type magazine in which no other explosives are stored.

(r) Any loose cartridges of explosives, detonators, primers and capped fuse unused at the end of the shift shall be returned to their respective magazines and locked up.

(s) Safety fuse and caps shall only be used for conventional blasting where:

(i) Extraneous electricity or radio frequency transmissions make the use of electric cap and wire systems dangerous;

(ii) Overhead electric transmission lines cannot be deenergized and there is danger that blasting wires may be thrown into the overhead lines during a blast;

(iii) For avalanche control hand charges;

(iv) For specialized applications where cap and fuse is more suitable than electric or other nonelectric initiation systems.

(6) Use of detonating cord.

(a) Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives used.

(b) Detonating cord shall be handled and used with the same respect and care given other explosives.

(c) For quantity and distance purposes detonating fuse up to 60 grains per foot should be calculated as equivalent to 9 lbs. of high explosives per 1,000 feet. Heavier cord loads should be rated proportionately.

(d) Trunk lines in multiple-row blasts shall make one or more complete loops, with cross ties between loops at intervals of not over two hundred feet.

(e) All detonating cord knots shall be tight and all connections shall be kept at right angles to the trunk lines.

(f) The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges.

(g) Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up.

(h) Detonating cord connections shall be competent and positive in accordance with approved and recommended methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry.

(i) All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.

(j) All detonating cord connections shall be inspected before firing the blast.

(k) When detonating cord millisecond-delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations.

(l) When connecting a blasting cap or an electric blasting cap to detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed.

(m) Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

(7) Initiation of explosive charges - nonelectric blasting.

(a) All nonelectric initiation systems and components of these systems shall be used in accordance with their manufacturer's recommendations and instructions.

(b) All members of the blasting crew shall be instructed in the safe use of the initiation system and its components. It shall be the duty of the blaster in charge to provide adequate on-the-job training and supervision in the safe use of such systems.

(c) When a nonelectric shock tube initiation system is used, the tubing shall be free of all knots and tight kinks. The shock tube shall be free of cuts or abrasions that could expose the core to moisture.

(d) All blasting operations shall cease during the approach and progress of a thunderstorm, regardless of the type of initiation system used, and all personnel shall withdraw to a place of safety.

(e) When an explosive bulk truck or other vehicle is operated on a blast site, care shall be taken to ensure that the vehicle does not tread on the tubing, connectors, or any surface delay component. If a vehicle operated on a blast site must pass over loaded blastholes, precautions shall be made to consolidate these elements at the collar of the hole to prevent vehicle contact.

(f) Before firing the shot, the blaster in charge shall make a visual inspection to ensure that the initiation system is hooked up in accordance with the manufacturer's recommendations.

(8) Firing the blast.

(a) A code of blasting signals equivalent to Table T-1 shall be posted on one or more conspicuous places at the operation, and all employees shall be required to familiarize themselves with the code and conform to it. Warning signs shall be placed at suitable locations.

(b) All charges shall be covered with blasting mats or other protective material before firing, where blasting may cause injury or damage by flying rock or debris.

(c) Before a blast is fired, a loud warning signal shall be given by the blaster in charge, who has made certain that all surplus explosives are in a safe place and all employees, vehicles, and equipment are at a safe distance, or under sufficient cover.

(d) Flaggers shall be safely stationed on highways which pass through the danger zone so as to stop traffic during blasting operations.

(e) It shall be the duty of the blaster to fix the time of blasting. The blaster shall conduct all blasting operations and no shot shall be fired without the blaster's approval.

(f) Before firing an underground blast, warning shall be given, and all possible entries into the blasting area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded. The blaster shall make sure that all employees are out of the blast area before firing a blast.

TABLE T-1

WARNING SIGNAL	— A 1-minute series of long blasts 5 minutes prior to blast signal.
BLAST SIGNAL	— A series of short blasts 1 minute prior to the shot.
ALL CLEAR SIGNAL	— A prolonged blast following the inspection of blast area.

(9) Inspection after blasting.

(a) Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine, or where power switches are used, they shall be locked open or in the off position.

(b) Sufficient time shall be allowed, not less than fifteen minutes in tunnels, for the smoke and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the user (blaster) to determine if all charges have been exploded before employees are allowed to return to the operation, and in tunnels, after the muck pile has been wetted down.

(10) Misfires.

(a) If a misfire is found, the user (blaster) shall provide proper safeguards for excluding all employees or other personnel from the danger zone.

(b) No other work shall be done except that necessary to remove the hazard of the misfire and only those employees necessary to do the work shall remain in the danger zone.

(c) No attempt shall be made to extract explosives from any charged or misfired hole; a new primer shall be put in and the hole reblasted. If refiring of the misfired hole presents a hazard, the explosives may be removed by washing out with water or, where the misfire is under water, blown out with air.

(d) If there are any misfires while using cap and fuse, all employees shall remain away from the charge for at least one hour. Misfires shall be handled under the direction of the person in charge of the blasting.

(e) When electric blasting caps have been used, workers shall not return to misfired holes for at least thirty minutes. All wires shall be carefully traced and a search made for unexploded charges.

(f) If explosives are suspected of burning in a hole, all persons in the endangered area shall move to a safe location and no one shall return to the hole until the danger has passed, but in no case within one hour.

(g) No drilling, digging, or picking shall be permitted until all missed holes have been detonated or the authorized representative has approved that work can proceed.

(11) Underwater blasting.

(a) A user (blaster) shall conduct all blasting operations, and no shot shall be fired without the blaster's approval.

(b) Loading tubes and casings of dissimilar metals shall not be used because of possible electric transient currents from galvanic action of the metals and water.

(c) Only water-resistant initiation systems shall be used for underwater blasting. Loading shall be done through a nonsparking loading tube when tube is necessary.

(d) No blast shall be fired while any vessel under way is closer than 1,500 feet to the blasting area. Those on board

vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired.

(e) No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any persons are in the water.

(f) Blasting flags shall be displayed.

(g) The storage and handling of explosives aboard vessels used in underwater blasting operations shall be according to provisions outlined herein on handling and storing explosives.

(h) When more than one charge is placed under water, a float device shall be attached to an element of each charge in such manner that it will be released by the firing. Misfires shall be handled in accordance with the requirements of WAC 296-52-493(10).

(12) Blasting in excavation work in pressurized air locks.

(a) Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected up. Explosives in transit shall not be left unattended.

(b) When detonators or explosives are brought into an air lock, no employee except the powderperson, user (blaster), lock tender and the employees necessary for carrying, shall be permitted to enter the air lock. No material, supplies, or equipment shall be brought through with the explosives.

(c) Primers, detonators and explosives shall be taken separately into pressure working chambers.

(d) The user (blaster) or powderperson shall be responsible for the receipt, unloading, storage, and on-site transportation of explosives and detonators.

(e) All metal pipes, rails, air locks, and steel tunnel lining shall be electrically bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at not less than 1,000-foot intervals throughout the length of the tunnel. In addition, each air supply pipe shall be grounded at its delivery end.

(f) The explosives suitable for use in wet holes shall be water-resistant and shall be Fume Class 1, or other approved explosives.

(g) When tunnel excavation in rock face is approaching mixed face, and when tunnel excavation is in mixed face, blasting shall be performed with light charges and with light burden on each hole. Advance drilling shall be performed as tunnel excavation in rock face approaches mixed face, to determine the general nature and extent of rock cover and the remaining distance ahead to soft ground as excavation advances.

(13) Vibration and damage control. Blasting operations in or adjacent to cofferdams, piers, underwater structures, buildings, structures, or other facilities shall be carefully planned with full consideration for all forces and conditions involved.

(14) Black blasting powder shall not be used for blasting.

(15) No person shall store, handle, or transport explosives or blasting agents when such storage, handling, and

transportation of explosives or blasting agents constitutes an undue hazard to life.

(16) It shall be unlawful for any person to abandon explosives or explosive substances.

[Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-493, filed 3/6/95, effective 4/20/95; 92-17-022 (Order 92-06), § 296-52-493, filed 8/10/92, effective 9/10/92; 91-03-044 (Order 90-18), § 296-52-493, filed 1/10/91, effective 2/12/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-10-044 (Order 86-24), § 296-52-493, filed 5/6/86.]

WAC 296-52-497 Blasting agents. (1) General. Unless otherwise set forth in this section, blasting agents, excluding water gels, shall be transported, stored, and used in the same manner as explosives. Water gels are covered in WAC 296-52-501.

(2) Fixed location mixing.

(a) Buildings or other facilities used for mixing blasting agents shall be located, with respect to inhabited buildings, passenger railroads, and public highways, in accordance with Table H-20. In determining the distance separating highways, railroads, and inhabited buildings from potential explosions (as prescribed in Table H-20), the sum of all masses which may propagate (i.e., lie at distances less than prescribed in Table H-22) from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only fifty percent of its weight shall be used because of its reduced blast effects.

(b) Buildings used for the mixing of blasting agents shall conform to the requirements of this section.

(i) Buildings shall be of noncombustible construction or sheet metal on wood studs.

(ii) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

(iii) All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.

(iv) The building shall be well ventilated.

(v) Heating units which do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be located outside the mixing building.

(vi) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a fire-wall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

(c) Equipment used for mixing blasting agents shall conform to the requirements of this subsection.

(i) The design of the mixer shall minimize the possibility of frictional heating, compaction, and especially confinement. All bearings and drive assemblies shall be mounted outside the mixer and protected against the accumulation of dust. All surfaces shall be accessible for cleaning.

(ii) Mixing and packaging equipment shall be constructed of materials compatible with the fuel-ammonium nitrate composition.

(iii) Suitable means shall be provided to prevent the flow of fuel oil to the mixer in case of fire. In gravity flow systems

an automatic spring-loaded shutoff valve with fusible link shall be installed.

(d) The provisions of this subsection shall be considered when determining blasting agent compositions.

(i) The sensitivity of the blasting agent shall be determined by means of a No. 8 test blasting cap at regular intervals and after every change in formulation.

(ii) Oxidizers of small particle size, such as crushed ammonium nitrate prills or fines, may be more sensitive than coarser products and shall, therefore, be handled with greater care.

(iii) No hydrocarbon liquid fuel with flashpoint lower than that of No. 2 diesel fuel oil 125°F. minimum shall be used.

(iv) Crude oil and crankcase oil shall not be used.

(v) Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins which are moisture-resistant or weathertight. Solid fuels shall be used in such manner as to minimize dust explosion hazards.

(vi) Peroxides and chlorates shall not be used.

(e) All electrical switches, controls, motors, and lights located in the mixing room shall conform to the requirements in chapter 296-24 WAC, Part L; otherwise they shall be located outside the mixing room. The frame of the mixer and all other equipment that may be used shall be electrically bonded and be provided with a continuous path to the ground.

(f) Safety precautions at mixing plants shall include the requirements of this subsection.

(i) Floors shall be constructed so as to eliminate floor drains and piping into which molten materials could flow and be confined in case of fire.

(ii) The floors and equipment of the mixing and packaging room shall be cleaned regularly and thoroughly to prevent accumulation of oxidizers or fuels and other sensitizers.

(iii) The entire mixing and packaging plant shall be cleaned regularly and thoroughly to prevent excessive accumulation of dust.

(iv) Smoking, matches, open flames, spark-producing devices, and firearms (except firearms carried by law enforcement bomb squad members or qualified guards) shall not be permitted inside of or within 50 feet of any building or facility used for the mixing of blasting agents.

(v) The land surrounding the mixing plant shall be kept clear of brush, dried grass, leaves, and other materials for a distance of at least 25 feet.

(vi) Empty ammonium nitrate bags shall be disposed of daily in a safe manner.

(vii) No welding shall be permitted or open flames used in or around the mixing or storage area of the plant unless the equipment or area has been completely washed down and all oxidizer material removed.

(viii) Before welding or repairs to hollow shafts, all oxidizer material shall be removed from the outside and inside of the shaft and the shaft vented with a minimum one-half inch diameter opening.

(ix) Explosives shall not be permitted inside of or within 50 feet of any building or facility used for the mixing of blasting agents.

(3) Bulk delivery and mixing vehicles.

(a) The provisions of this subsection shall apply to off-highway private operations as well as to all public highway movements.

(b) A bulk vehicle body for delivering and mixing blasting agents shall conform with the requirements of this subsection.

(i) The body shall be constructed of noncombustible materials.

(ii) Vehicles used to transport bulk premixed blasting agents on public highways shall have closed bodies.

(iii) All moving parts of the mixing system shall be designed as to prevent a heat buildup. Shafts or axles which contact the product shall have outboard bearings with 1-inch minimum clearance between the bearings and the outside of the product container. Particular attention shall be given to the clearances on all moving parts.

(iv) A bulk delivery vehicle shall be strong enough to carry the load without difficulty and be in good mechanical condition.

(c) Operation of bulk delivery vehicles shall conform to the requirements of WAC 296-52-489(2). These include the placarding requirements as specified by department of transportation.

(i) The operator shall be trained in the safe operation of the vehicle together with its mixing, conveying, and related equipment. The employer shall assure that the operator is familiar with the commodities being delivered and the general procedure for handling emergency situations.

(ii) The hauling of either blasting caps or other explosives but not both, shall be permitted on bulk trucks provided that a special wood or nonferrous-lined container is installed for the explosives. Such blasting caps or other explosives shall be in DOT-specified shipping containers: See 49 CFR Chapter I.

(iii) No person shall smoke, carry matches or any flame-producing device, or carry any firearms while in or about bulk vehicles effecting the mixing transfer or down-the-hole loading of blasting agents at or near the blasting site.

(iv) Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle on to or dragging hoses over firing lines, cap wires, or explosive materials. The employer shall assure that the driver, in moving the vehicle, has assistance of a second person to guide the driver's movements.

(v) No intransit mixing of materials shall be performed.

(d) Pneumatic loading from bulk delivery vehicles into blastholes primed with electric blasting caps or other static-sensitive systems shall conform to the requirements of this subsection.

(i) A positive grounding device shall be used to prevent the accumulation of static electricity.

(ii) A discharge hose shall be used that has a resistance range that will prevent conducting stray currents, but that is conductive enough to bleed off static buildup.

(iii) A qualified person shall evaluate all systems to determine if they will adequately dissipate static under potential field conditions.

(e) Repairs to bulk delivery vehicles shall conform to the requirements of this section.

(i) No welding or open flames shall be used on or around any part of the delivery equipment unless it has been completely washed down and all oxidizer material removed.

(ii) Before welding or making repairs to hollow shafts, the shaft shall be thoroughly cleaned inside and out and vented with a minimum one-half-inch diameter opening.

(4) Bulk storage bins.

(a) The bin, including supports, shall be constructed of compatible materials, waterproof, and adequately supported and braced to withstand the combination of all loads including impact forces arising from product movement within the bin and accidental vehicle contact with the support legs.

(b) The bin discharge gate shall be designed to provide a closure tight enough to prevent leakage of the stored product. Provision shall also be made so that the gate can be locked.

(c) Bin loading manways or access hatches shall be hinged or otherwise attached to the bin and be designed to permit locking.

(d) Any electrically driven conveyors for loading or unloading bins shall conform to the requirements of chapter 296-24 WAC, Part L. They shall be designed to minimize damage from corrosion.

(e) Bins containing blasting agent shall be located, with respect to inhabited buildings, passenger railroads, and public highways, in accordance with Table H-20 and separation from other blasting agent storage and explosives storage shall be in conformity with Table H-22.

(f) Bins containing ammonium nitrate shall be separated from blasting agent storage and explosives storage in conformity with Table H-22.

(5) Transportation of packaged blasting agents.

(a) When blasting agents are transported in the same vehicle with explosives, all of the requirements of WAC 296-52-489 shall be complied with.

(b) Vehicles transporting blasting agents shall only be driven by and in charge of a driver at least twenty-one years of age who is capable, careful, reliable, and in possession of a valid motor vehicle operator's license. Such a person shall also be familiar with the states vehicle and traffic laws.

(c) No matches, firearms, acids, or other corrosive liquids shall be carried in the bed or body of any vehicle containing blasting agents.

(d) No person shall be permitted to ride upon, drive, load, or unload a vehicle containing blasting agents while smoking or under the influence of intoxicants, narcotics, or other dangerous drugs.

(e) It is prohibited for any person to transport or carry any blasting agents upon any public vehicle carrying passengers for hire.

(f) Vehicles transporting blasting agents shall be in safe operating condition at all times.

(g) When offering blasting agents for transportation on public highways the packaging, marking, and labeling of containers of blasting agents shall comply with the requirements of DOT.

(h) Vehicles used for transporting blasting agents on public highways shall be placarded in accordance with DOT regulations.

(6) Use of blasting agents. Persons using blasting agents shall comply with all of the applicable provisions of WAC 296-52-493.

[Statutory Authority: Chapter 49.17 RCW, 95-07-014, § 296-52-497, filed 3/6/95, effective 4/20/95; 91-03-044 (Order 90-18), § 296-52-497, filed 1/10/91, effective 2/12/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-10-044 (Order 86-24), § 296-52-497, filed 5/6/86.]

WAC 296-52-501 Water gel (slurry) explosives and blasting agents. (1) General provisions. Unless otherwise set forth in this section, water gels and emulsions shall be transported, stored and used in the same manner as explosives or blasting agents in accordance with the classification of the product.

(2) Types and classifications.

(a) Water gels and emulsion explosives containing a substance in itself classified as an explosive shall be classified as an explosive and manufactured, transported, stored, and used as specified for "explosives" in this section, except as noted in subsection (d) of this section.

(b) Water gels and emulsion explosives containing no substance in itself classified as an explosive and which are cap-sensitive as defined in WAC 296-52-417 under blasting agent shall be classified as an explosive and manufactured, transported, stored and used as specified for "explosives" in this section.

(c) Water gels and emulsion blasting agents containing no substance in itself classified as an explosive and which are not cap-sensitive as defined in WAC 296-52-417 under blasting agent shall be classified as blasting agents and manufactured, transported, stored, and used as specified for "blasting agents" in this section.

(d) When tests on specific formulations of water gels result in department of transportation classification as a Class B explosive, bullet-resistant magazines are not required, see WAC 296-52-453.

(3) Fixed location mixing.

(a)(i) Buildings or other facilities used for manufacturing emulsions and water gels shall be located with respect to inhabited buildings, passenger railroads and public highways, in accordance with Table H-21.

(ii) In determining the distances separating highways, railroads, and inhabited buildings from potential explosions (as prescribed in Table H-20), the sum of all masses that may propagate (i.e., lie at distances less than prescribed in Table H-22) from either individual or combined donor masses are included. However, when the ammonium nitrate must be included, only fifty percent of its weight shall be used because of its reduced blast effects.

(b) Buildings used for the manufacture of emulsions of water gels shall conform to the requirements of this subsection.

(i) Buildings shall be of noncombustible construction or sheet metal on wood studs.

(ii) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.

(iii) Where fuel oil is used all fuel oil storage facilities shall be separated from the manufacturing plant and located in such a manner that in case of tank rupture, the oil will drain away from the manufacturing plant building.

(iv) The building shall be well ventilated. Heating units that do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside of the mixing building.

(v) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a fire-wall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

(c) Ingredients of emulsion and water gels shall conform to the requirements of this subsection.

(i) Ingredients in themselves classified as Class A or Class B explosives shall be stored in conformity with WAC 296-52-461.

(ii) Nitrate-water solutions may be stored in tank cars, tank trucks, or fixed tanks without quantity or distance limitations. Spills or leaks which may contaminate combustible materials shall be cleaned up immediately.

(iii) Metal powders such as aluminum shall be kept dry and shall be stored in containers or bins which are moisture-resistant or weathertight. Solid fuels shall be used in such manner as to minimize dust explosion hazards.

(iv) Ingredients shall not be stored with incompatible materials.

(v) Peroxides and chlorates shall not be used.

(d) Mixing equipment shall comply with the requirements of this subsection.

(i) The design of the processing equipment, including mixing and conveying equipment, shall be compatible with the relative sensitivity of the materials being handled. Equipment shall be designed to minimize the possibility of frictional heating, compaction, overloading, and confinement.

(ii) Both equipment and handling procedures shall be designed to prevent the introduction of foreign objects or materials.

(iii) Mixers, pumps, valves, and related equipment shall be designed to permit regular and periodic flushing, cleaning, dismantling, and inspection.

(iv) All electrical equipment including wiring, switches, controls, motors, and lights, shall conform to the requirements of chapter 296-24 WAC, Part L.

(v) All electric motors and generators shall be provided with suitable overload protection devices. Electrical generators, motors, proportioning devices, and all other electrical enclosures shall be electrically bonded. The grounding conductor to all such electrical equipment shall be effectively bonded to the service-entrance ground connection and to all equipment ground connections in a manner so as to provide a continuous path to ground.

(e) Mixing facilities shall comply with the fire prevention requirements of this subsection.

(i) The mixing, loading, and ingredient transfer areas where residues or spilled materials may accumulate shall be cleaned periodically. A cleaning and collection system for dangerous residues shall be provided.

(ii) A daily visual inspection shall be made of the mixing, conveying, and electrical equipment to establish that such equipment is in good operating condition. A program of

systematic maintenance shall be conducted on regular schedule.

(iii) Heaters which are not dependent on the combustion process within the heating unit may be used within the confines of processing buildings, or compartments, if provided with temperature and safety controls and located away from combustible materials and the finished product.

(4) Bulk delivery and mixing vehicles.

(a) The design of vehicles shall comply with the requirements of this subsection.

(i) Vehicles used over public highways for the bulk transportation of emulsion and water gels or of ingredients classified as dangerous commodities, shall meet the requirements of the department of transportation and shall meet the requirements of WAC 296-52-489 and 296-52-497 of this section.

(ii) When electric power is supplied by a self-contained motor generator located on the vehicle the generator shall be at a point separate from where the water gel is discharged.

(iii) The design of processing equipment and general requirements shall conform to subsection (3)(c) and (d) of this section.

(iv) A positive action parking brake which will set the wheel brakes on at least one axle shall be provided on vehicles when equipped with air brakes and shall be used during bulk delivery operations. Wheel chocks shall supplement parking brakes whenever conditions may require.

(b) Operation of bulk delivery and mixing vehicles shall comply with the requirements of this subsection.

(i) The placarding requirements contained in DOT regulations apply to vehicles carrying water gel explosives or blasting agents.

(ii) The operator shall be trained in the safe operation of the vehicle together with its mixing, conveying, and related equipment. The operator shall be familiar with the commodities being delivered and the general procedure for handling emergency situations.

(iii) The hauling of either blasting caps or other explosives, but not both, shall be permitted on bulk trucks provided that a special wood or nonferrous-lined container is installed for the explosives. Such blasting caps or other explosives shall be in DOT-specified shipping containers; see 49 CFR Chapter I.

(iv) No person shall be allowed to smoke, carry matches or any flame-producing device, or carry any firearms while in or about bulk vehicles effecting the mixing, transfer, or down-the-hole loading of water gels at or near the blasting site.

(v) Caution shall be exercised in the movement of the vehicle in the blasting area to avoid driving the vehicle on to or dragging hoses over firing lines, cap wires, or explosive materials. The employer shall furnish the driver the assistance of a second person to guide the driver's movements.

(vi) No intransit mixing of materials shall be performed.

(vii) The location chosen for water gel or ingredient transfer from a support vehicle into the bore hole loading vehicle shall be away from the blasthole site when the bore holes are loaded or in the process of being loaded.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-501, filed 3/6/95, effective 4/20/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-501, filed 5/6/86.]

PART G—MISCELLANEOUS

WAC 296-52-505 Coal mining code unaffected. RCW 70.74.210 applies.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-505, filed 5/6/86.]

WAC 296-52-509 Small arms ammunition, primers, propellants and black powder. Storage, transportation, and display requirements.

(1) Scope. This section does not apply to in-process storage and intra-plant transportation during manufacture of small arms ammunition, small arms primers, and smokeless propellants.

(2) No quantity limitations are imposed on the storage of small arms ammunition in warehouses, retail stores, and other general occupancy facilities, except those imposed by limitations of storage facilities.

(3) Small arms ammunition shall be separated from flammable liquids, flammable solids as classified in 49 CFR, Part 172, and from oxidizing materials by a fire-resistant wall of one-hour rating or by a distance of 25 feet.

(4) Small arms ammunition shall not be stored together with class A or class B explosives unless the storage facility is adequate for this latter storage.

(5) Small arms smokeless propellants.

(a) Small arms smokeless propellant (class B) shall be packed, stored and transported in DOT approved shipping containers. The following shall apply.

	<u>Maximum Pounds Permitted</u>	<u>Special Restrictions</u>
Private residence or car _____	25 pounds or less _____ 25 to 50 pounds _____	None Store in strong box or cabinet constructed of 3/4-inch plywood (minimum) or equivalent, on all sides, top and bottom.
Dealer's warehouse _____	150 pounds _____	20 to 100 pounds shall be stored in portable or fixed wooden boxes having walls at least one inch nominal thickness.
Dealer's display _____	75 pounds _____	In one pound containers.

(b) Quantities in excess of 50 pounds shall be transported in accordance with federal department of transportation regulations. Quantities in excess of 150 pounds shall be stored in approved, licensed magazines as required in WAC 296-52-441 and 296-52-453.

(c) All smokeless propellants shall be stored in shipping containers specified in 49 CFR 173.93 for smokeless propellants.

(d) Commercial stocks of smokeless propellants over 20 pounds and not more than 100 pounds shall be stored in portable wooden boxes having walls of at least 1 inch nominal thickness.

(e) Commercial stocks in quantities not to exceed 150 pounds shall be stored in nonportable storage cabinets having wooden walls of at least 1 inch nominal thickness.

(f) Quantities in excess of 150 pounds shall be stored in magazines in accordance with WAC 296-52-461.

(6) Small arms ammunition primers.

(a) Small arms ammunition primers shall be packed, stored, and transported in DOT approved shipping containers. They shall be separate from flammable liquids, flammable solids, and oxidizing materials by a fire-resistant wall of one-hour rating or by a distance of 25 feet. The following shall also apply.

	<u>Maximum Number Permitted</u>	<u>Special Restrictions</u>
Private residence	10,000 primers	None
Private car	25,000 primers	None
Dealer's display	10,000 primers	None
Dealer's warehouse	750,000 primers	No more than 100,000 shall be stored in a pile and piles shall be separated by at least 15 feet.

(b) Quantities in excess of 750,000 primers shall be stored in approved, licensed magazines as required by WAC 296-52-441 and 296-52-453.

(7) Black powder, as used in muzzle loading firearms, shall be packed, stored and transported in DOT approved shipping containers and the following shall apply.

	<u>Maximum Pounds Permitted</u>	<u>Special Restrictions</u>
Private residence	5 pounds	None
Private car	5 pounds	None
Dealer's warehouse	25 pounds	None
Dealer's display	4 pounds	In one pound containers.

(8) Quantities in excess of 25 pounds of black powder, as used in muzzle loading firearms, shall be stored in approved, licensed magazines as required by WAC 296-52-441 and 296-52-453.

(9) Black powder manufactured for muzzle loading firearms shall not be used for blasting operations.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-509, filed 3/6/95, effective 4/20/95; 90-03-029 (Order 89-20), § 296-52-509, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-10-044 (Order 86-24), § 296-52-509, filed 5/6/86.]

WAC 296-52-510 Explosives at piers, railway stations, and cars or vessels not otherwise specified in this

(1999 Ed.)

standard. (1) Railway cars. Except in an emergency and with permission of the local authority, no person shall have or keep explosives in a railway car unless said car and contents and methods of loading are in accordance with the United States Department of Transportation Regulations for the Transportation of Explosives, 49 CFR Chapter I.

(2) Packing and marking. No person shall deliver any explosive to any carrier unless such explosive conforms in all respects, including marking and packing, to the United States Department of Transportation Regulations for the Transportation of Explosives.

(3) Marking cars. Every railway car containing explosives which has reached its designation, or is stopped in transit so as no longer to be in interstate commerce, shall have attached to both sides and ends of the car, cards with the words "explosives—handle carefully—keep fire away" in red letters at least 1 1/2 inches high on a white background.

(4) Storage. Any explosives at a railway facility, truck terminal, pier, wharf, harbor facility, or airport terminal whether for delivery to a consignee, or forwarded to some other destination shall be kept in a safe place, isolated as far as practicable and in such manner that they can be easily and quickly removed.

(5) Hours of transfer. Explosives shall not be delivered to or received from any railway station, truck terminal, pier, wharf, harbor facility, or airport terminal between the hours of sunset and sunrise.

[Statutory Authority: Chapter 49.17 RCW. 90-03-029 (Order 89-20), § 296-52-510, filed 1/11/90, effective 2/26/90.]

PART H—APPENDICES

WAC 296-52-550 Appendix I—IME two-compartment transportation units (mandatory). Storage of blasting caps (detonators) in the same magazine with other explosives is prohibited by WAC 296-52-457. The department of labor and industries (DLI) recognizes that it is often operationally desirable to transport both caps and other explosives in the same vehicle or trailer unit. Then, after the explosives laden vehicle arrives at the blast site, to utilize that vehicle and/or trailer unit as a mobile "day box" from which to dispense explosives into loading operations or into storage magazines.

The Institute of Makers of Explosives (IME) pamphlet No. 22, as revised in 1993, publishes construction criteria for two-compartment transportation units which are accepted by both the Bureau of Alcohol, Tobacco and Firearms (ATF) and U.S. Department of Transportation (DOT) for this purpose.

(1) Department of labor and industries will accept these "IME transportation units" as being approved for transporting both caps and explosives in the same vehicle or trailer, subject to the following:

(a) The dual-compartment units are constructed to the applicable IME specifications which are published in this Appendix I for the convenience of state users; and

(b) The units are correctly maintained and used in accordance with applicable federal regulations and this chapter (see in particular WAC 296-52-489); and

[Title 296 WAC—p. 1131]

(c) Only blasting caps which are classified by DOT as being nonmass-detonating are permitted to be transported in dual compartment units; and

(d) Detonators shall not be transported in the same compartment with other explosives or blasting agents; and

(e) Both the detonators and explosives, in separate appropriate compartments, shall be contained in the original DOT approved packages/containers; and

(f) The packages/containers shall be stacked or otherwise restrained from being easily displaced about the compartment during transit; and

(g) Even though constructed on the same motor vehicle or trailer frame, each compartment will be considered a separate container with individual construction and security requirements; and

(h) These IME transportation units are constructed to specifications which are greatly less bullet resistant and theft resistant than standard portable magazines. For that reason, these units cannot be utilized for unattended storage in this state; and

(i) On two compartment units, both compartments must be securely attached to the vehicle or trailer.

(2) Construction specifications.

(a) Each compartment must provide for total enclosure of the blasting caps or explosives.

(b) The partition between the explosives storage compartment and the blasting cap compartment must be of laminate construction consisting of A/C grade or better exterior plywood, gypsum board (sheetrock) and low carbon steel plates. In order of arrangement, the laminate must conform to the following, with minimum thickness of each lamination as indicated:

1/2 Inch plywood;

1/2 Inch gypsum board (sheetrock);

1/8 Inch low carbon steel; and

1/4 Inch plywood.

With the 1/4 inch plywood facing the explosives storage compartment.

See Appendix I-C for details of laminate construction. The door to the blasting cap compartment must be of metal construction or solid wood covered with metal. The outside walls and top must be of the same construction as the rest of the vehicle or trailer.

(c) As an alternative to the construction requirements shown in (b) of this subsection, a container for use only as illustrated in Appendix I-A may be used when constructed as follows:

(i) The top, lid or door, and the sides and bottom of each container must be of laminate construction consisting of A/C grade or better exterior plywood, solid hardwood, gypsum board (sheetrock), and sheet metal. In order of arrangement, the laminate must conform to the following, with minimum thickness of each lamination as indicated:

1/4 Inch plywood;

1 Inch solid hardwood;

1/2 Inch plywood;

1/2 Inch gypsum board (sheetrock)

(or 1/4 inch particle board); and

22 Gauge sheet metal.

Constructed inside to outside in that order. See Appendix I-D for detail of laminate construction.

(ii) The hardwood must be fastened together with wood screws, the 1/2 inch plywood must be fastened to the hardwood with wood screws, the inner 1/4 inch plywood must be fastened to the hardwood with adhesive, and the 22 gauge sheet metal must be attached to the exterior of the container with screws.

(d) The laminate composite material must be securely bound together by waterproof adhesive or other equally effective means.

(e) The steel plates at the joints of laminations must be secured by continuous fillet welds.

(f) All interior surfaces of the container or compartment must be constructed so as to prevent contact of contents with any sparking metal.

(g) There must be direct access into each compartment from outside the vehicle.

(h) Each container or compartment must have a snug fitting continuous piano-type hinged lid or door equipped with a locking device (or devices).

(i) Without permitting direct access to contents under normal conditions, the locking or hinging mechanisms must permit at least one edge of the lid or door to rise or move outward at least 1/2 inch when subjected to internal pressure.

(j) The exterior of the container or compartment must be weather-resistant.

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APPENDIX I-A

PERMANENTLY MOUNTED CONTAINERS

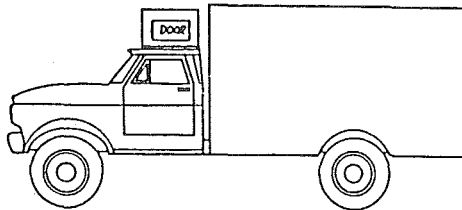


Figure 1

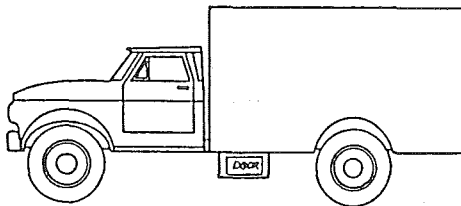


Figure 2

NOTE: The configurations shown in Figures 1 and 2 are equally applicable to multi-axle and "cab-over" vehicles.

[Diagrams: Courtesy of IME]

APPENDIX I-B

COMPARTMENTS

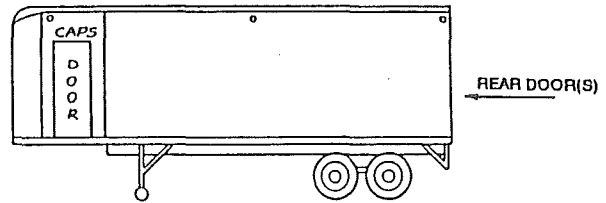


Figure 1

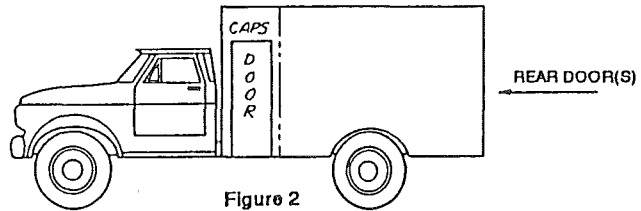


Figure 2

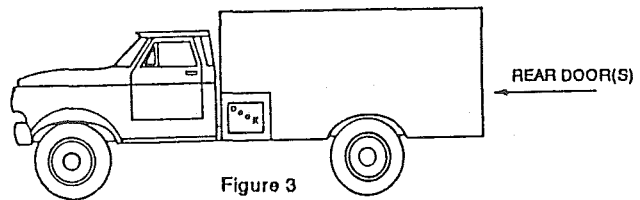


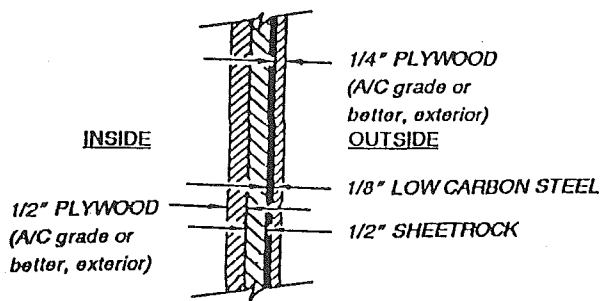
Figure 3

NOTE: The configurations shown in Figures 1 and 2 are equally applicable to multi-axle and "cab-over" vehicles.

[Diagrams: Courtesy of IME]

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APPENDIX I-C



Sketch of laminate construction for container or compartment for electric blasting caps use, as illustrated in Appendix A, B, and E.

APPENDIX I-E

PORTABLE WHEELED TRAILERS

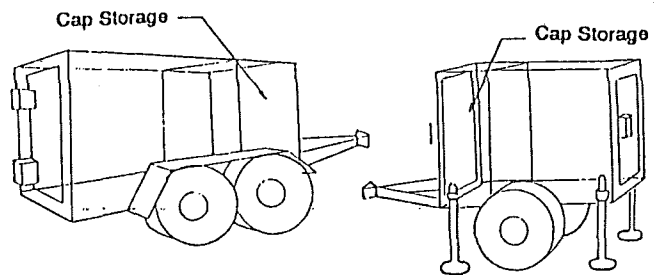
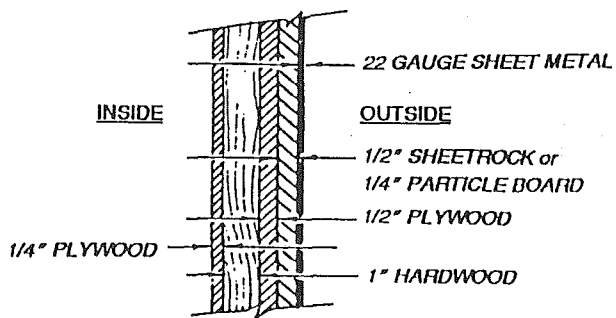


Figure 1

Figure 3

APPENDIX D



Sketch of laminate construction for container or compartment for electric blasting caps; restricted to use as illustrated in Appendix A.

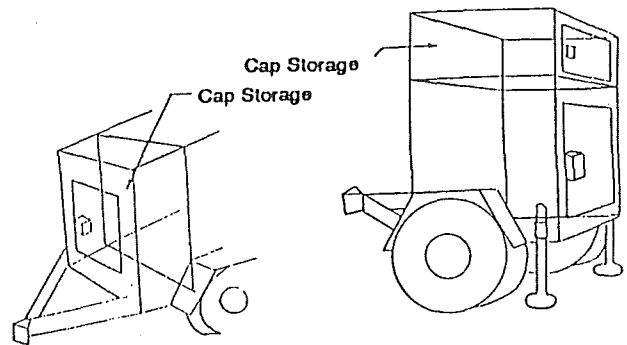


Figure 2

Figure 4

[Diagrams: Courtesy of IME]

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-550, filed 3/6/95, effective 4/20/95.]

WAC 296-52-552 Appendix II—Radio frequency warning signs (mandatory). (1) This chapter requires that blasters using electric blasting caps shall post warning signs to prohibit the use of radio frequency transmitters within a clearance zone around all locations where the electric caps are being used. This appendix provides specific sign illustrations and posting instructions.

(a) In construction operations, including demolition, the clearance zone around electric caps shall be 1000 feet.

(b) In general industry operations not subject to construction requirements, the clearance zone around electric caps shall be 350 feet.

(c) On public highways, the Washington utilities and transportation commission and Washington department of transportation requires compliance with ANSI D6.1-1988, the *Uniform Traffic Control Devices* manual. On private roads under the jurisdiction of the department of labor and industries, strict compliance with ANSI is not required provided that: All roads or right of ways where RF transmitters would be carried are adequately posted to achieve the necessary notice; the signs are maintained in the necessary positions throughout the time when electric caps are present.

(2) Signs shall be reflectorized or illuminated to show the same shape, color and wording in both daylight or night when blasting is being done during hours of darkness.

(3) The signs shall be "CONSTRUCTION ORANGE" with black letters and borders, all upper case letters, not less than the sizes shown.

Note: Larger signs may be required where the highway speed limit is more than 55 M.P.H.

(4) Site survey.

(a) To comply with this section, the blaster in charge shall conduct, or cause to be conducted, an accurate survey of the entire intended blast site. The survey shall determine the clearance points where any road(s) or right-of-way(s) enter and exit the required clearance zone.

(b) If the blast zone moves along as the job progresses, the 1000 foot clearance zone shall be adjusted to correctly maintain the permissible clearance borders at all times.

(5) The "TURN OFF 2-WAY RADIO" sign shall be posted at the beginning of the blast zone minimum clearance point.

(6) The "BLASTING ZONE 1000 FEET" sign shall be posted in sequence 1000 feet ahead of the "TURN OFF 2-WAY RADIO" sign.

In very slow vehicle travel zones such as off-road construction right-of-ways, rock pits or quarries, the separation distance between the signs may be reduced to as little as 300 feet.

(7) The "END BLASTING ZONE" sign shall be posted past the point where the blasting zone clearance limit ends.

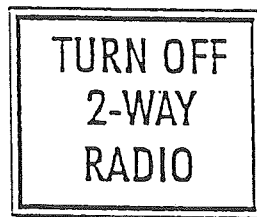
(8) The warning signs required by the appendix shall be prominently displayed at all times when blasting operations are being conducted with an electric blasting cap initiation system. Blasting operations being conducted shall include any and all times when electric caps are present and have been removed from the original DOT approved shipping container.

(9) The blasting signs shall be covered or removed when blasting operations are not being conducted.

STANDARD WARNING SIGNS



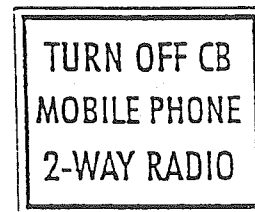
W22-1
48" x 48"



W22-2
42" x 36"



W22-3
42" x 36"



42" x 36"

(10) New "TURN OFF 2-WAY RADIO" signs purchased after the effective date of this standard shall be modified to read "TURN OFF CB, MOBILE PHONE, 2-WAY RADIO."

(a) Modified signs may be used in place of the currently required sign immediately.

(b) Modified signs shall replace all currently required 2-way radio signs before January 1, 2000.

[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-552, filed 3/6/95, effective 4/20/95.]

WAC 296-52-555 Appendix III—ATF regulations.
U.S. Department of Transportation Regulations as Excerpted from 49 CFR Part 173, 10/01/92 Edition.

Subpart C-Definitions, Classification, and Packaging for Class 1

Source: Amdt. 173-224, 55 FR 52617, Dec. 21, 1990, unless otherwise noted.

§ 173.50 Class 1-definitions. (a) Explosive. For the purpose of this subchapter, an *explosive* means any substance or article, including a device, which is designed to function by explosion (i.e., an extremely rapid release of gas and heat) or which, by chemical reaction within itself, is able to function in a similar manner even if not designed to function by explosion, unless the substance or article is otherwise classed under the provision of this subchapter.

(b) Explosives in Class 1 are divided into six divisions as follows:

(1) *Division 1.1* consists of explosives that have a mass explosion hazard. A mass explosion is one which affects almost the entire load instantaneously.

(2) *Division 1.2* consists of explosives that have a projection hazard but not a mass explosion hazard.

(3) *Division 1.3* consists of explosives that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard.

(4) *Division 1.4* consists of explosives that present a minor explosion hazard. The explosive effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of this package.

(5) *Division 1.5*¹ consists of very insensitive explosives. This division is comprised of substances which have a mass explosion hazard but are so insensitive that there is very little probability of initiation or of transition from burning to detonation under normal conditions of transport.

(6) *Division 1.6*² consists of extremely insensitive articles which do not have a mass explosive hazard. This division is comprised of articles which contain extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

¹The probability of transition from burning to detonation is greater when large quantities are transported in a vessel.

²The risk from articles of *Division 1.6* is limited to the explosion of a single article.

§ Classification codes and compatibility groups of explosives.

(a) This classification code for an explosive, which is assigned by the Associate Administrator for Hazardous Materials Safety in accordance with this subpart, consists of the division number followed by the compatibility group letter. Compatibility group letters are used to specify the controls for the transportation, and storage related thereto, of explosives and to prevent an increase in hazard that might result if certain explosives were stored together. Transportation compatibility requirements for carriers are prescribed in §§ 174.81, 175.78, 176.83 and 177.848 of this subchapter for transportation by rail, air, vessel, and public highway, respectively, and storage incidental thereto.

(b) Compatibility groups and classification codes for the various types of explosives are set forth in the following table. The table sets forth compatibility groups and classification codes for substances and articles described in the first column.

TABLE 1 - CLASSIFICATION CODES

Description of substances or article to be classified	Compatibility Group	Classification Code
Primary explosive substance.	A	1.1A
Article containing a primary explosive substance and not containing two or more effective protective features.	B	1.1B
		1.2B
		1.4B
Propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance.	C	1.1C
		1.2C
		1.3C
		1.4C
Secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features.	D	1.1D
		1.2D
		1.4D
		1.4D
		1.5D
	E	1.1E
		1.2E
		1.4E

Description of substances or article to be classified	Compatibility Group	Classification Code
Article containing a secondary detonating explosive substance, without means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid).	F	1.1F
		1.2F
		1.3F
		1.4F
Article containing a secondary detonating explosive substance with its means of initiation, with a propelling charge (other than one containing flammable liquid or hypergolic liquid) or without a propelling charge.	G	1.1G
		1.2G
		1.3G
		1.4G
	H	1.2H
		1.3H
Pyrotechnic substance or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating incendiary, tear-producing or smoke-producing substance (other than a water-activated article or one containing white phosphorus, phosphide or flammable liquid or gel or hypergolic liquid).	J	1.1J
		1.2J
		1.3J
	K	1.2K
	1.3K	
L	1.1L	
	1.2L	
	1.3L	
Article containing both an explosive substance and white phosphorus.	N	1.6N
Article containing both an explosive substance and flammable liquid or gel. Article containing both an explosive substance and a toxic chemical agent. Risk (e.g., due to water-activation or presence of hypergolic liquids, phosphide or pyrophoric substances) needing isolation of each type.	S	1.4S

Articles containing extremely insensitive detonating substances.

§ 173.53 Provisions for using old classifications of explosives.	Current Classification	Class Name Prior to January 1, 1991
Where the classification system in effect prior to January 1, 1991, is referenced in State or local laws, ordinances or regulations not pertaining to the transportation of hazardous materials, the following table may be used to compare old and new hazard class names:	Division 1.1	Class A explosives
	Division 1.2	Class A or Class B explosives
	Division 1.3	Class B explosives
	Division 1.4	Class C explosives
	Division 1.5	Blasting agents
	Division 1.6	No applicable hazard class

Part H, Appendicies Chapter 296-52 WAC Safety Standards for the Possession and Handling of Explosives		
<p>Bureau of Alcohol, Tobacco and Firearms</p> <p>[Notice No. 695]</p> <p>COMMERCE IN EXPLOSIVES; LIST OF EXPLOSIVE MATERIALS</p> <p>Pursuant to the provisions of section 6-11(d) of Title 18, United States Code, and 27 CFR 63.23, the Director, Bureau of Alcohol, Tobacco and Firearms, must publish and revise at least annually in the Federal Register a list of explosives determined to be within the coverage of 18 U.S.C. Chapter 40, Importation, Manufacture, Distribution, and Storage of Explosive Materials. This Chapter covers not only explosives, but also blasting agents and detonators, all of which are defined as explosive materials in section 841(c) of Title 18, United States Code. Accordingly, the following is the 1989 List of Explosive Material subject to regulation under 18 U.S.C. Chapter 40, which includes both the list of explosives (including detonators) required to be published in the Federal Register and blasting agents. This list is intended to include any and all mixtures containing any of the materials in the list. Materials constituting blasting agents are marked by an asterisk. While the list is comprehensive, it is not all inclusive. The fact that an explosive material may not be on the list does not mean that it is not within the coverage of the law if it otherwise meets the statutory definitions in Section 841 of Title 18, United States Code. Explosive materials are listed alphabetically by their common names followed by chemical names and synonyms in brackets. This revised list supersedes the List of Explosive Materials dated December 28, 1988 (53 FR 52561) and will be effective as of January 12, 1990.</p> <p>List of Explosive Materials</p> <p>A</p> <p>Acetylides of heavy metals. Aluminum containing polymeric propellant. Aluminum ophomte explosive. Amatex. Ammonal. Ammonium nitrate explosive mixtures (cap sensitive), Ammonium nitrate explosive mixtures (non Ammonium perchlorate having particle size less than 15 microns.</p>	<p>Ammonium perchlorate composite propellant. Ammonium picrate (picrate of ammonia, Explosive D). ammonium salt lattice with isomorphously substituted inorganic salts. - ANFO (ammonium nitrate-fuel oil).</p> <p>B</p> <p>Baratol. Baronol. BEAF (1, 2-bis (2-3-difluoro-2-nitroacatoxyethane)). Black powder. Black powder based explosive mixtures, - Blasting agents , nitro-carbo-nitrates, including non cap sensitive slurry and water-gel explosives Blasting caps. Blasting gelatin. Blasting powder. BTNEC (bis (trinitroethyl) carbonate). BTNEN (bis (trinitroethyl(nitramine)). BTTN (1, 2, 4 butanetriol trinitrate). Butyl tetryl.</p> <p>C</p> <p>Calcium nitrate explosive mixture. Cellulose hexanitrate explosive mixture. Chlorate explosive mixtures. Composition A and variations. Composition B and variations. Composition C and variations. Copper acetylide. Cyanuric triaxide. Cyclotrimethylenetrinitramine (RDX). Cyclotetramethylenetetranitramine (HMX). Cyclonite (RDX). Cyclotol.</p> <p>D</p> <p>DATB (diaminotrinitrobenzene). DDNP (diazodinitrophenol). DEGND (diethyleneglycol dinitrate). Detonating cord. Detonators. Dimethylol dimethyl methane dinitrate composition. Dinitroethylensures. Dinitroglycerine (glycerol dinitrate). Dinitrophenol. Dinitrophenolates. Dinitrotolnene-sodium nitrate explosive mixtures. DIPAM</p>	<p>Dipicryl sulfone. Dipicrylamina DNNDP (dinitropentano nitrile).</p> <p>E</p> <p>EDDN (ethylene diamine dinitrate) EDNA Ednatol EDNP (ethyl 4, 4-ddipitropentanoate) Erythritol tetranitrate explosives Eslers of nitro-substituted alcohols EGDN (ethylene glycol dinitrate) Ethyl-tetryl Explosive conitrates Explosive gelatins Explosive mixtures containing oxygen releasing inorganic salts and hydrocarbons Explosive mixtures containing oxygen releasing inorganic salts and nitro bodies Explosive mixtures containing oxygen releasing inorganic salts and water soluble fuels Explosive mixtures containing sensitized nitromethane Explosive mixtures containing tetraintromethane (nitroform) Explosive nitro compounds of aromatic hydrocarbons Explosive organic nitrate mixtures Explosive liquids Explosive powders</p> <p>F</p> <p>Flash powder Fulminate of mercury Fulminate of silver Fulminating gold Fulminating mercury Fulminating platinum Fulminating silver</p> <p>G</p> <p>Gelatinized nitrocellulose Gem-dinitro aliphatic explosive mixtures Guanyl nitrosamino tetrazene Guanyl nitrosamino guanylidene hydrazine</p> <p>H</p> <p>Heavy metal azides Hexanite Hexanitrodiphenylamine Hexanitrostilbene Hexogen [RDX]</p>

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<p>Hexogene or octogene and a nitrated N-methylaniline Hexolites HMX [cyclo-1, 3, 5, 7-tetramethylene-2, 4, 6, 8-tetranitramine; Octogen] Hydrazinium nitrate/hydrazine/aluminum explosive system Hydrazoic acid</p> <p>I</p> <p>Igniter cord Igniters Initiating tube systems</p> <p>K</p> <p>KDNBF [potassium dinitrobenzo-furoxane]</p> <p>L</p> <p>Lead azide Lead mannite Lead mononitroresorcinate Lead picrate Lead salts, explosive Lead styphnate [styphnate of lead, lead trinitroresorcinate] Liquid nitrated polyol and trimethylolethane Liquid oxygen explosives</p> <p>M</p> <p>Magnesium ophorite explosives Mannitol hexanitrate MDNP [methyl 4, 4-dinitropentanoate]MEAN [monoethanolamine nitrate] Mercuric fulminate Mercury oxalate Nitric acid and carboxylic fuel explosive Nitric acid explosive mixtures Nitro aromatic explosive mixtures Mercury tartrate Metriol trinitrate Minol-2 [40% TNT, 40% ammonium nitrate, 20% aluminum] MMAN [monomethylamine nitrate]; methylamine nitrate Mononitrotoluene-nitroglycerin mixture Monopropellants</p>	<p>N</p> <p>NIBTN [nitroisobutametrial trinitrate] Nitrate sensitized with gelled nitropraffin Nitrated carbohydrate explosives Nitrated glucoside explosive Nitrated polyhydric alcohol explosives Nitrates of soda explosive mixtures Nitric acid and a nitro aromatic compound explosive Nitro compounds of furane explosive mixtures Nitrocellulose explosive Nitroderivative of urea explosive mixture Nitrogelatin explosive Nitrogen trichloride Nitrogen tri-iodide Nitroglycerine [NG, RNG, nitro, glyceryl trinitrate, trinitroglycerine] Nitroglycide Nitroglycol (ethylene glycol dinitrate, EGDN) Nitroguanidine explosives Nitroparaffins Explosive Grade and ammonium nitrate mixtures Nitronium perchlorate propellant mixtures Nitrostrach Nitro-substituted carboxylic acids Nitrourea</p> <p>O</p> <p>Octogen [HMX] Octol [75% HMX, 25% TNT] Organic amine nitrates Organic nitramines</p> <p>P</p> <p>PBX [RDX and plasticizer] Pellet Powder Penthrinite composition Pentolite PYX [2, 6-bis(picrylamino)-3, 5-dinitropyridine Perchlorate explosive mixtures Peroxide based explosive mixtures PETN [nitropentaerythrite, pentaerythrite tetranitrate, pentaerythritol tetranitrate] Picramic acid and its salts Picramide Picrate of potassium explosive mixtures</p>	<p>Picratol Picric acid (manufactured as an explosive) Picryl chloride Picryl fluoide PLX [95% nitromethane, 5% ethylenediamine] Polynitro aliphatic compounds Polyolpolynitrate-nitrocellulose explosive gels Potassium chlorate and lead sulfocyanate explosive Potassium nitrate explosive mixtures Potassium Nitroaminotetrazole</p> <p>R</p> <p>RDX [cyclonite, hexogen, T4, cyclo-1, 3, 5, -trimethylene-2, 4, 6, -trinitramine: hexahydro-1, 3, 5-trinitro-S-triazine]</p> <p>S</p> <p>Safety fuse Salutes, (bulk) Salts of organic ammino sulfonic acid explosive mixtures Silver acetyline Silver azide Silver fulminate Silver oxalate explosive mixtures Silver styphnate Silver tartrate explosive mixtures Silver tetrazene Slurried explosive mixtures of water, inorganic oxidizing salts, gelling agent, fuel and sensitizer (cap sensitive) Smokeless powder Sodotal Sodium amatol Sodium azide explosive mixture Sodium dinitro-ortho-cresolate Sodium nitrate-potassium nitrate explosive mixture Sodium picramate Special fireworks Squibs Styptic acid explosives</p> <p>T</p> <p>Tacot [tetranitro-2, 3, 5, 6-dibenzo-1, 3a, 4, 6a-tetrazapentalene] TATB [triaminotrinitrobenzene]</p>
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<p>TEGDN [triethylene glycol dinitrate] Tetrazene [tetracene, tetrazine, 1(5-tetrazol)-4-guanyl tetrazene hydrate] Tetranitrocarbazole Tetryl [2, 4, 6 tetranitro-N-methylaniline] Tetrytol Thickened inorganic oxidizer salt slurried explosive mixture TMETN (trimethylolethane trinitrate) TNEF [trinitroethyl formal] TNEOC [trinitroethyl orthocarbonate] TNEOF [trinitroethyl orthoformate] TNT [trinitrotoluene, trotyl, trillite, triton] Tropex Tridite Trimethylol ethyl methane trinitrate composition Trimethylolthane trinitrate-nitrocellulose Trimonite Trinitroanisole Trinitrobenzene Trinitrobenzoic acid Trinitrocresol Trinitro-meta-cresol trinitronaphthalene Trinitrophenetol Trinitrophenol Trinitroresorcinol Tritonal</p> <p>U</p> <p>Urea nitrate</p> <p>W</p> <p>Water bearing explosives having salts of oxidizing acids and nitrogen bases, sulfates, or sulfamates (cap sensitive)</p>	<p>Water-in-oil emulsion explosive compositions</p> <p>X</p> <p>Xanthomonas hydrophilic colloid explosive mixture</p> <p>FOR FURTHER INFORMATION CONTACT: Linda Deel, Specialist, Firearms and Explosives Operations Branch, Bureau of Alcohol, Tobacco and Firearms, 650 Massachusetts Avenue, NW., Washington DC 20226 (202) 927-8310</p> <p>Approved: January 2, 1992.</p>	
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[Statutory Authority: Chapter 49.17 RCW. 95-07-014, § 296-52-555, filed 3/6/95, effective 4/20/95.]

Chapter 296-54 WAC

SAFETY STANDARDS—LOGGING OPERATIONS

WAC

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- 296-54-607 Radio signal systems—Specifications and test procedures.
- 296-54-99002 Appendix I—Figure 2—High lead yarding system.
- 296-54-99003 Appendix I—Figure 3—North Bend yarding system.
- 296-54-99004 Appendix I—Figure 4—Slack skyline yarding system.
- 296-54-99007 Appendix I—Figure 7—Heel boom loading.
- 296-54-99008 Appendix I—Figure 8—Guyline loading.
- 296-54-99009 Appendix I—Figure 9—Hayrack boom loading.
- 296-54-99010 Appendix I—Figure 10—Spreader bar loading.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

- 296-54-001 Scope and application. [Order 72-14, § 296-54-001, filed 7/31/72, effective 9/1/72; Rules (part), filed 6/2/67, effective 7/10/67.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-003 Waiver and variance. [Order 72-14, § 296-54-003, filed 7/31/72, effective 9/1/72; Rules (part), filed 6/2/67, effective 7/10/67.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-010 Definitions of terms used in the logging standards for the purpose of this chapter. [Order 76-29, § 296-54-010, filed 9/30/76; Order 72-14, § 296-54-010, filed 7/31/72, effective 9/1/72; Rules (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/30/62; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-020 Introduction. [Order 72-14, § 296-54-020, filed 7/31/72, effective 9/1/72; Rules (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-030 Management's responsibility. [Order 72-14, § 296-54-030, filed 7/31/72, effective 9/1/72; Rules, § I, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-040 Employee's responsibility. [Order 72-14, § 296-54-040, filed 7/31/72, effective 9/1/72; Rules, § II, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-050 through 296-54-125. Safety and first aid. [Rules (part), filed 7/6/61, 3/23/60.] Decodified. See chapter 296-25 WAC, General safety standards.
- 296-54-051 Safety educational and first aid requirements. [Order 72-14, § 296-54-051, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-052 General requirements. [Order 72-14, § 296-54-052, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-130 Camps. [Order 72-14, § 296-54-130, filed 7/3/72, effective 9/1/72; Rules, § IV, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-140 Railroad and truck road construction and maintenance—Railroads. [Order 72-14, § 296-54-140, filed 7/31/72, effective 9/1/72; Rules, § V (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-150 Truck roads. [Order 72-14, § 296-54-150, filed 7/31/72, effective 9/1/72; Rules, § V (part), filed 6/2/67, 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-160 Transportation of crews—General requirements. [Order 72-14, § 296-54-160, filed 7/31/72, effective 9/1/72; Rules, § VI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-170 Transportation of crews by use of speeders and trailers. [Order 72-14, § 296-54-170, filed 7/31/72, effective 9/1/72; Rules, § VI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61, 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-180 Transportation of crews by motor vehicles. [Order 72-14, § 296-54-180, filed 7/31/72, effective 9/1/72; Rules, § VI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-185 Methods of crew transportation other than those specified. [Order 72-14, § 296-54-185, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-190 Rigging. [Order 72-14, § 296-54-190, filed 7/31/72, effective 9/1/72; Rules, § VIII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60; Addendum, filed 3/30/62.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-195 Additional requirements for portable spars and boom type yarding and loading machines. [Order 72-14, § 296-54-195, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-200 Yarding. [Order 72-14, § 296-54-200, filed 7/31/72, effective 9/1/72; Rules, § XII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-202 Yarding—Signal transmission, signaling equipment and related items. [Rules AB-2 through AB-11, effective 1/2/65; Rules L-4, L-5, L-6, L-16, L-22 through L-27, filed 7/6/61; Rules (part), filed 3/23/60.] Superseded by Rules, filed 6/27/67, effective 7/10/67. See WAC 296-54-350 through 296-54-393.
- 296-54-210 Tractor logging. [Order 72-14, § 296-54-210, filed 7/31/72, effective 9/1/72; Rules, § XIII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-215 Canopy guards, barricades, seat belts, screens and other items required for industrial equipment. [Order 72-14, § 296-54-215, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-216 Roll-over protective structures and overhead protection. [Order 72-14, § 296-54-216, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-217 Braking systems for tractors and other mobile equipment. [Order 72-14, § 296-54-217, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-218 Emergency steering. [Order 72-14, § 296-54-218, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-220 Log loading. [Order 72-14, § 296-54-220, filed 7/31/72, effective 9/1/72; Rules, § XIV, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-230 Lines, blocks and shackles. [Order 72-14, § 296-54-230, filed 7/31/72, effective 9/1/72; Rules, § IX, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
- 296-54-240 Yarding, loading, and skidding units. [Order 72-14, § 296-54-240, filed 7/31/72, effective 9/1/72; Rules, § X,

	filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-350	Signals and signal systems. [Order 72-14, § 296-54-350, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-250	New and used boiler or pressure vessels. [Rules (part), filed 7/6/61, 3/23/60.] Superseded by Rules, filed 6/2/67, effective 7/10/67. See WAC 296-54-240(9) and chapter 70.79 RCW.	296-54-360	Skidder whistle signals. [Order 72-14, § 296-54-360, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-260	Falling—Bucking. [Order 72-14, § 296-54-260, filed 7/31/72, effective 9/1/72; Rules, § VII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-370	Slackline whistle signals. [Order 72-14, § 296-54-370, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-270	Moving machines. [Order 72-14, § 296-54-270, filed 7/31/72, effective 9/1/72; Rules, § XI, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-380	High lead logging whistle signals. [Order 72-14, § 296-54-380, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67; Rules AB-1, effective 1/2/65; Rule Z-3, filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-280	General requirements. [Order 76-29, § 296-54-280, filed 9/30/76; Order 72-14, § 296-54-280, filed 7/31/72, effective 9/1/72; Rules, § XIX, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-390	High lead whistle signal—General whistle signals. [Rules (part), filed 7/6/61, 3/23/60.] Superseded by Rules, filed 6/2/67, effective 7/10/67. For later enactment see WAC 296-54-391 through 296-54-393.
296-54-281	Water dumps. [Order 72-14, § 296-54-281, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-391	General requirements for signaling and signal equipment. [Rules, § XXI (part), filed 6/2/67, effective 7/10/67.] Repealed by omission, Order 72-14, filed 7/31/72.
296-54-282	Boom and rafting grounds. [Order 76-7, § 296-54-282, filed 3/1/76; Order 72-14, § 296-54-282, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-392	Electric signal systems. [Order 72-14, § 296-54-392, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-284	Dry land sorting and storage. [Order 72-14, § 296-54-284, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-393	Radio systems used for voice communications, activation of audible signals or equipment. [Order 72-14, § 296-54-393, filed 7/31/72, effective 9/1/72; Rules, § XXI (part), filed 6/2/67, effective 7/10/67.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-286	Boats and mechanical devices on water. [Order 76-7, § 296-54-286, filed 3/1/76; Order 72-14, § 296-54-286, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-39301	Form No. 157—Application for permit to operate radio signal system in designated area. [Order 72-14, Form No. 157 (codified as WAC 296-54-39301), filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-290	Electrical logging equipment. [Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-399	Special rigging standards. [Rules (part), filed 7/6/61, 3/23/60. Recodified from WAC 296-54-400 to avoid duplication of numbering.] Superseded by Rules, filed 6/2/67, effective 7/10/67. See WAC 296-54-190.
296-54-300	Explosives. [Order 72-14, § 296-54-300, filed 7/31/72, effective 9/1/72; Rules, § XX, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-400	Radio-signaling systems—Minimum requirements. [Order 72-14, § 296-54-400, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.
296-54-310	Railroad operations. [Order 72-14, § 296-54-310, filed 7/31/72, effective 9/1/72; Rules, § XVI, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-450	Rules and regulations of the state board of health concerning labor camps. [Rules (part), filed 7/6/61, 3/23/60.] Decodified. See WAC 296-54-130, and chapters 296-26 and 248-60 WAC.
296-54-320	Railroad maintenance, loading or unloading. [Order 72-14, § 296-54-320, filed 7/31/72, effective 9/1/72; Rules, § XVII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-45001	Pulpwood logging. [Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-54-45001, filed 11/14/88; Order 76-7, § 296-54-45001, filed 3/1/76; Order 74-20, § 296-54-450 (codified as WAC 296-54-45001), filed 5/6/74.] Repealed by 96-22-013, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060.
296-54-330	Motor truck log transportation. [Order 72-14, § 296-54-330, filed 7/31/72, effective 9/1/72; Rules, § XV, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-990	Map. [Order 72-14, Map (codified as WAC 296-54-990), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
296-54-335	Stationary log truck trailer loading. [Order 72-14, § 296-54-335, filed 7/31/72, effective 9/1/72.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-99001	Appendix I—Figure 1—Rigging up, wrapping a guyline. [Order 72-14, Figure 1 (codified as WAC 296-54-99001), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
296-54-340	Maintenance shops. [Order 72-14, § 296-54-340, filed 7/31/72, effective 9/1/72; Rules, § XVIII, filed 6/2/67, effective 7/10/67; Rules (part), filed 7/6/61; Rules (part), filed 3/23/60.] Repealed by 79-10-081 (Order 79-14), filed 9/21/79. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240.	296-54-99005	Appendix I—Figure 5—Standard signals for tractor logging. [Order 72-14, Figure 5 (codified as WAC 296-54-99005), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.

- 296-54-99006 Appendix I—Figure 6—Standard signals for loading logs. [Order 72-14, Figure 6 (codified as WAC 296-54-99006), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
- 296-54-99011 Appendix I—Figure 11—Placement and number of binders. [Order 72-14, Figure 11 (codified as WAC 296-54-99011), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
- 296-54-99012 Appendix I—Figure 12—Standard signals for high lead logging. [Order 72-14, Figure 12 (codified as WAC 296-54-99012), filed 7/31/72, effective 9/1/72.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.

WAC 296-54-501 Scope and application. This standard establishes safety practices, means, methods and operations for all types of logging, regardless of the end use of the wood. These types of activities include, but are not limited to, pulpwood and timber harvesting and the logging of sawlogs, veneer bolts, poles, pilings and other forest products. The requirements herein contained do not apply to log handling at sawmills, plywood mills, pulp mills or other manufacturing operations governed by their own specific safety standards.

These requirements are minimum safety requirements and shall augment other safety standards developed by the department which are of a general nature and apply to all industrial operations such as those contained in the general safety standards, chapter 296-24 WAC; occupational health standards, chapter 296-62 WAC; or others which may be applicable. Regulations adopted by the department concerning certain types of equipment or conditions, such as metal and nonmetallic mines, quarries, pits and crushing operations, chapter 296-61 WAC, and possession, handling and use of explosives, chapter 296-52 WAC shall be complied with when applicable.

Copies of all society of automotive engineers reports (SAE) referred to in these standards are on file in all regional offices of the department of labor and industries, and may be reviewed by any interested person. Individuals desiring to obtain copies of such material shall arrange to do so directly from the publishers or from other sources. The department of labor and industries will not assume the responsibility of acquiring such material for uses other than its own needs.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-501, filed 10/28/96, effective 1/1/97. Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-54-501, filed 11/14/88. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-501, filed 9/21/79.]

WAC 296-54-503 Variance. The assistant director may, upon receipt of application and after adequate investigation by the department, permit a variation from these requirements when an approved alternate means or manner of protection is provided, which affords an equivalent measure of safety as required by the rule from which a variance is requested.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-503, filed 9/21/79.]

WAC 296-54-505 Definitions applicable to this chapter. A-frame - a structure made of two independent columns fastened together at the top and separated by a reasonable

width at the bottom to stabilize the unit from tipping sideways.

An operation - any place where logging or log related activities are taking place.

Approved - approved by the department of labor and industries.

Arch - any device attached to the back of a vehicle and used for raising one end of logs to facilitate movement.

Authorized person - a person approved or assigned by the employer to perform a specific type of duty(s) or to be at a specific location at a certain time(s).

Backcut (felling cut) - the cut in a felling operation made on the opposite side from the undercut.

Ballistic nylon - a nylon fabric of high tensile properties designed to provide protection from lacerations.

Barrier - a fence, wall or railing to prevent passage or approach.

Base of tree - that portion of a natural tree not more than three feet above ground level.

Bight of the line - any area where a person is exposed to a controlled or uncontrolled moving line.

Binder - a hinged lever assembly for connecting the ends of a wrapper to tighten the wrapper around the load of logs or materials.

Boat - any boat used to push or pull logs, booms, bundles, or bags, in booming ground operations.

Boomscooter - a small boat, usually less than fourteen feet in length, equipped with an outboard motor, having directional pushing capabilities of 360 degrees.

Brailing - when tiers of logs, poles, or piles are fastened together with a type of dogline and the ends of the side members are then fastened together for towing.

Brow log - a log or a suitable substitute placed parallel to any roadway at a landing or dump to protect the carrier and facilitate the safe loading or unloading of logs, timber products, or materials.

Buck - means the process of severing a tree into sections (logs or bolts).

Butt - the bottom of the felled part of a tree.

Butt welding - the practice of welding something end to end.

Cable yarding - the movement of felled trees or logs from the area where they are felled to the landing on a system composed of a cable suspended from spars and/or towers. The trees or logs may be either dragged across the ground on the cable or carried while suspended from the cable.

Chock - a block, often wedge shaped, which is used to prevent movement; e.g., a log from rolling, a wheel from turning.

Choker - a length of wire rope with attachments for encircling the end of a log to be yarded.

Competent person - one who is capable of identifying hazards in the surrounding or working conditions which are unsanitary, hazardous or dangerous.

Corner block - the first block the haulback passes through on its way to the tail block.

Crotch line - two short lines attached to the same ring or shackle, used for loading or unloading.

Danger trees - any tree of any height, dead or alive, that presents a hazard to workers because of rot, root, stem or

limb damage, lean, or any other observable condition created by natural process or man-made activity.

Debark - to remove bark from trees or logs. Debark generally denotes mechanical means as opposed to manual peeling.

Deck - a stack of trees or logs.

Designated person - an employee who has the requisite knowledge, training, and experience to perform specific duties.

Dog line - type of line used to fasten logs or timber products together by the use of dogs.

Domino felling - the partial cutting of multiple trees which are left standing and then pushed over with a pusher tree.

Double ended logs - two logs end to end on the same lay.

Droplines - a short line attached to the carriage or carriage block which is used as an extension to the main line.

Drum - a mechanical device on which line is spooled or unspooled.

Dry land storage - decks of logs stored for future removal or use.

Dutchman -

A block used to change direction of line lead.

A method of falling timber consisting of inserting a piece of material into one side of the undercut to assist in pulling a tree against the lean or a section of the undercut can be left in a corner to accomplish the same purpose.

Experienced person - a person who has been trained and has participated in the subject process for a period of time long enough to thoroughly acquaint the person with all facets of the process.

F.O.P.S. - falling object protective structure.

Fair lead - sheaves, rolls, or a combination thereof arranged to receive a line coming from any direction for proper line spooling on to a drum.

Fell (fall) - to cut down trees.

Feller (faller) - an employee who fells trees.

Front end loader - a mobile machine mounted on a wheeled or tracked chassis, equipped with a grapple, tusk, bucket, or fork-lift device, and employed in the loading, unloading, stacking, or sorting of logs or materials.

Grounded - the placement of a component of a machine on the ground or on a device where it is firmly supported. Grounded may also relate to the placement of a tree on the ground or a method to dissipate static or electrical charges.

Guarded - covered, shielded, fenced, enclosed, or otherwise protected by means of suitable enclosures, covers, casings, shields, troughs, railings, screens, mats, or platforms, or by location, to prevent injury.

Guard rail - a railing to restrain a person.

Guyline - a line used to support or stabilize a spar.

Gypsy drum - a mechanical device wherein the line is not attached to the drum and is manually spooled to control the line movement on and off the drum.

Haulback - a line used to pull the buttrigging and mainline to the logs to be yarded.

Haulback block - any block the haulback line passes through including the corner block and tailblock.

Hay rack - a type of loading boom where two tongs are used and logs are suspended.

A transporting vehicle with multiple sets of bunks attached to a rigid frame usually used for hauling logs.

Hazardous falling area - the area within a circle centered on the tree being felled and having a radius not less than twice the height of that tree.

Head tree - the tree where yarding and/or loading takes place. (See spar)

Heel boom - a type of loading boom where one tong is used and one end of the log is pulled up against the boom.

High lead - a system of logging wherein the main line is threaded through the main line block, which is attached near the top of the spar, to obtain a lift of the logs being yarded.

Hobo log and/or hitchhiker - a free or unattached log that is picked up by a turn and is transported with the turn.

Hooktender - the worker that supervises the method of moving the logs from the woods to the landing.

Hydraulic jack - a mechanical device, powered by internal pressure, used to control the direction in which a tree is to be felled.

In the clear - being in a position where the possibility of harmful physical contact is minimized.

Jackstrawed - trees or logs piled in an unorderedly manner.

Jaggers - any projecting broken wire in a strand of cable.

Knob - a metal ferrule attached to the end of a line.

Landing - any place where logs are laid after being yarded, awaiting subsequent handling, loading, and hauling.

Lift tree - an intermediate support for skylines.

Limbing - to cut branches off felled or standing trees.

Loading boom - any structure projecting from a pivot point to guide a log when lifted.

Lodged tree (hung tree) - a tree leaning against another tree or object which prevents it from falling to the ground.

Logging operations - operations associated with felling and moving trees and logs from the stump to the point of delivery, such as, but not limited to, marking, felling, bucking, limbing, debarking, chipping, yarding, loading, unloading, storing, and transporting machines, equipment and personnel from one site to another.

Log dump - a place where logs are removed from transporting equipment. It may be either dry land or water, par-buckled over a brow log or removed by machine.

Logging machine - a machine used or intended for use to yard, move, or handle logs, trees, chunks, trailers, and related materials or equipment. This shall include self-loading log trucks only during the loading and unloading process.

Log - a tree segment suitable for subsequent processing into lumber, pulpwood, or other wood products, including but not limited to poles, piling, peeler blocks, sections and/or bolts.

Log stacker - a mobile machine mounted on a wheeled or tracked chassis, equipped with a frontally mounted grapple, tusk, or forklift device, and employed in the loading, unloading, stacking, or sorting of logs.

Long sticks - an overlength log that creates a hazard by exceeding the safe perimeters of the landing.

Machine - a piece of stationary or mobile equipment having a self-contained power plant, that is operated off-road and used for the movement of material. Machines include but are not limited to tractors, skidders, front-end loaders, scrapers, graders, bulldozers, swing yarders (rough terrain logging

shovels), log stackers and mechanical felling devices, such as tree shears and feller-bunchers.

Mainline - the line attached to the buttrigging used to pull logs to the landing.

Matchcutting - the felling of trees without using an undercut.

Mechanized falling - falling of standing timber by a self-propelled mobile wheeled or tracked machine equipped with a shear or other powered cutting device.

Mechanized feller - any such machine as described in WAC 296-54-535 and 296-54-537, and includes feller/bunchers and similar machines performing multiple functions.

Mobile log loader - a self-propelled log loading machine mounted on wheels or tracks.

Mobile yarder - a logging machine mounted on wheels, tracks, or skids, incorporating a vertical or inclined spar, tower, or boom.

Must - the same as "shall" and is mandatory.

New area or setting - a location of operations when both the loading station and the yarder are moved.

Pass line - a small line threaded through a block at the top of the spar to assist the high climber.

Permissible (as applied to any device, equipment or appliance) - such device, equipment, or appliance has the formal approval of the United States Bureau of Mines, American Standards Association, or National Board of Fire Underwriters.

Portable spar or tower - a movable engineered structure designed to be used in a manner similar to which a wood spar tree would be used.

Qualified person - a person, who by possession of a recognized degree, certificate, professional standing, or by extensive knowledge, training, and experience, has successfully demonstrated ability to solve or resolve problems relating to the subject matter, the work, or the project.

Rated capacity - the maximum load a system, vehicle, machine or piece of equipment was designed by the manufacturer to handle.

Reach - a steel tube or wood timber or pole connected to the truck and inserted through a tunnel on the trailer. It steers the trailer when loaded and pulls the trailer when empty.

Receding line - the line on a skidder or slackline comparable to the haulback line on a yarder.

Reload - an area where logs are dumped and reloaded or transferred as a unit to another mode of transportation.

Rollway - any place where logs are dumped and they roll or slide to their resting place.

Root wad - the ball of a tree root and dirt that is pulled from the ground when a tree is uprooted.

R.O.P.S. - roll over protection structure.

Running line - any line which moves.

Safety factor - the ratio of breaking strength to a safe working strength or loading.

Safety glass - a type of glass that will not shatter when broken.

Sail block - a block hung inverted on the sail guy to hold the tong block in proper position.

Scaler - the person who measures the diameter and length of the logs, determines specie and grade, and makes deductions for footage calculations.

Serviceable condition - a state or ability of a tool, machine, vehicle or other device to operate as it was intended by the manufacturer to operate.

Shall - a requirement that is mandatory.

Shear log - a log placed in a strategic location to divert passage of objects.

Shore skids - any group of timbers spaced a short distance apart on which logs are rolled.

Signal person - the person designated to give signals to the machine operator.

Siwash - to change the lead of a line with a physical object such as a stump or tree instead of a block.

Skidder - a machine or animal used to move logs or trees to a landing.

Skidding - movement of logs or trees on the surface of the ground to the place where they are to be loaded.

Skyline - the line suspended between two points on which a block or carriage travels.

Slackline - a form of skyline where the skyline cable is spooled on a donkey drum and can be raised or lowered.

Slack puller - any weight or mechanical device used to increase the movement of a line when its own weight is inadequate.

Slope (grade) - the increase or decrease in altitude over a horizontal distance expressed as a percentage. For example, change of altitude of 20 feet (6 m) over a horizontal distance of 100 feet (30 m) is expressed as a 20 percent slope.

Snag - a dead standing tree or a portion thereof. (See Danger tree)

Spar/spar tree - a device rigged for highlead, skyline or slackline yarding.

Speeder - a small self-powered vehicle that runs on a railroad track.

Springboard - a board with an iron tip used by fallers to stand on while working above ground level.

Spring pole - a tree, segment of a tree, limb, or sapling which is under stress or tension due to the pressure or weight of another object.

Square lead - the angle of 90 degrees.

Squirrel - a weight used to swing a boom when the power unit does not have enough drums to do it mechanically.

Squirrel tree - a topped tree, guyed if necessary, near the spar tree in which the counter balance (squirrel) of a tree rigged boom is hung.

Stiff boom - two or more boom sticks wrapped together on which boom persons walk or work.

Strap - any short piece of line with an eye or "D" in each end.

Strawline - a small line used for miscellaneous purposes.

Strip - a definite location of timber on which one or more cutting crews work.

Swamping - the falling or cutting of brush around or along a specified place.

Swifter - a piece of equipment used to tie the side sticks of a log raft together to keep the raft from spreading.

Swing cut - a back cut in which the holding wood on one side is cut through.

Tail block - the haulback block at the back end of the show.

Tail hold - an anchor used for making fast any line or block.

Tail tree - the tree at the opposite end from the head tree on which the skyline or other type rigging is hung.

Tie down - a chain, cable, steel strips or fiber webbing and binders attached to a truck, trailer or other conveyance as a means to secure loads and to prevent them from shifting or moving when they are being transported.

Tight line - when either the mainline or haulback are held and power is exerted on the other or when power is exerted on both at the same time.

Tong line block - the block hung in a boom through which the tong line operates.

Tongue - a device used to pull and/or steer a trailer.

Topping - cutting off the top section of a standing tree.

Tower - (see portable spar or tower).

Tractor - a machine of wheel or track design used in logging.

Tractor logging - the use of any wheeled or tracked vehicle in the skidding or yarding of logs.

Transfer (as used in loading) - changing of logs in a unit from one mode of transportation to another.

Tree jack - a grooved saddle of wood or metal rollers contained within two steel plates, attached to a tree with a strap, used as a guide for skyline, sail guy, or similar static line. It is also formed to prevent a sharp bend in the line.

Tree plates - steel bars sometimes shaped as elongated J's, which are fastened near the top of a tree to hold guylines and prevent them from cutting into the tree when tightened. The hooks of the J are also used to prevent the mainline block strap from sliding down the tree.

Tree pulling - a method of falling trees in which the tree is pulled down with a line.

Turn - any log or group of logs attached by some means to power and moved from a point of rest to a landing.

Undercut - a notch cut in a tree to guide the direction of the tree fall and to prevent splitting or kickback.

Vehicle/crew bus - a car, bus, truck, trailer or semi-trailer owned, leased, or rented by the employer that is used for transportation of employees or movement of material.

WAC - Washington Administrative Code.

Waistline - that portion of the haulback running between the corner block and the tail block.

Winching - the winding of cable or rope onto a spool or drum.

Wrapper - a cable assembly or chain used to contain a load of logs.

Wrapper rack - barrier used to protect a person while removing binders and wrappers from a loaded logging truck.

Yarder (donkey) - a machine with a series of drums used to yard logs.

Yarding - the movement of logs from the place they are felled to a landing.

filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-505, filed 9/21/79.]

WAC 296-54-507 Management's responsibility. In addition to observance of the general safety and health standards:

(1) The employer shall assume the responsibility of safety training for new employees.

(2) The employer shall develop and maintain a hazard communication program as required by chapter 296-62 WAC, Part C, which will provide information to all employees relative to hazardous chemicals or substances to which they are exposed, or may become exposed, in the course of their employment.

(3) The employer shall assume the responsibility of work assignments so that no employee shall be allowed to work in a position or location so isolated that he/she is not within ordinary calling distance of another employee who can render assistance in case of emergency. In any operation where cutting, yarding, loading, or a combination of these duties is carried on, there shall be a minimum of two employees who shall work as a team and shall be in visual or hearing contact with one another to allow prompt awareness of injury or cessation of work activity of one employee by the other. No employee shall be left alone for a period of time to exceed fifteen minutes without visual or hearing contact. In addition, there shall be some system of back-up communication in the near proximity to enable an employee to call for assistance in case of emergency.

Note: This does not apply to operators of motor vehicles, watchpersons or certain other jobs which, by their nature, are singular employee assignments. However, a definite procedure for checking the welfare of all employees during their working hours shall be instituted and all employees so advised.

(4) The employer shall establish a method of checking the employees in from the woods at the end of each shift. Each immediate supervisor shall be responsible for his/her crew being accounted for. This standard also includes operators of all movable equipment.

(5) Prior to the commencement of logging operations in a new area or setting, a safety meeting shall be held and a plan shall be developed and implemented whereby management shall ascertain by direct supervision that the work is being carried out with special emphasis on safety and safe work practices.

(6) When extreme weather or other extreme conditions are such that additional hazards arise, additional precautions shall be taken to assure safe operations. If the operation cannot be made safe because of the aforementioned conditions, the work shall be discontinued until safe to resume.

(7) Danger trees within reach of landings, roads, rigging, buildings or work areas shall be either felled before regular operations begin or work shall be arranged so that employees shall not be exposed to hazards involved.

(8) Management shall ensure that intoxicating beverages and narcotics are not permitted or used by employees on or in the vicinity of the work site. Management shall cause employees under the influence of alcohol or narcotics to be removed from the work site. This requirement does not apply to employees taking prescription drugs and/or narcotics as

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-505, filed 10/28/96, effective 1/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-54-505, filed 11/30/87. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-505,

directed by a physician providing such use shall not endanger the employee or others.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-54-507, filed 8/3/94, effective 9/12/94; 89-11-035 (Order 89-03), § 296-54-507, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-507, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-507, filed 9/21/79.]

WAC 296-54-509 Employee's responsibility. (1) Employees shall coordinate and cooperate with management and other employees in an attempt to eliminate accidents.

(2) Employees shall study and observe all safe work practices governing their work.

(3) They should offer safety suggestions, wherein such suggestions may contribute to a safer work environment.

(4) Intoxicating beverages and narcotics shall not be permitted or used by employees in or around the work sites. Employees under the influence of alcohol or narcotics shall not be permitted on the work site. This rule does not apply to employees taking prescription drugs and/or narcotics as directed by a physician providing such use shall not endanger the employee or others.

(5) Employees shall conduct themselves in a workman-like manner while on the work site.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-509, filed 9/21/79.]

WAC 296-54-511 Personal protective equipment. (1) General requirements.

(a) Protective equipment, including personal protective equipment for eyes, face, head, hearing and extremities, protective clothing, respiratory devices and protective shields and barriers, shall be used, and maintained in a sanitary and reliable condition wherever it is necessary by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation or physical contact.

(b) The employer shall assure that personal protective equipment, including any personal protective equipment provided by an employee, is maintained in a serviceable condition.

(c) Design. All personal protective equipment shall be of safe design and construction for the work to be performed. All safety belts and attachments shall meet the requirements of section 3 of ANSI A10.14-1975.

(d) The employer shall assure that personal protective equipment, including any personal protective equipment provided by an employee, is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable personal protective equipment shall be replaced before work is commenced.

(2) Eye and face protection. The employer shall provide, at no cost to the employee, and assure that each employee wears the following:

(a) Eye protection meeting the requirements of chapter 296-24 WAC, Part A-2 where there is potential for eye injury due to falling or flying objects; and

(b) Face protection meeting the requirements of chapter 296-24 WAC, Part A-2 where there is potential for facial injury such as, but not limited to, operating a chipper. Logger-type mesh screens may be worn by employees performing chain-saw operations and yarding. Note to subsection (2): The employee does not have to wear a separate eye protection device where face protection covering both the eyes and face is worn.

(3) Respiratory protection. The respiratory protection requirements of the general occupational health standards, chapter 296-62 WAC, shall apply.

(4) Occupational head protection. The employer shall provide, at no cost to the employee, and assure that all employees involved in the logging operation or any of its related activities wears head protection, unless such employees are protected by F.O.P.S., cabs or canopies, meeting the requirements of this chapter. Protective helmets shall be maintained in serviceable condition.

(a) Protective helmets purchased after February 20, 1995, shall comply with ANSI Z89.1-1986, "American National Standard for Personnel Protection—Protective Headwear for Industrial Workers—Requirements," which is incorporated by reference, or shall be demonstrated to be equally effective.

(b) Protective helmets purchased before February 20, 1995, shall comply with the ANSI standard "American National Standard Safety Requirements for Industrial Head Protection," ANSI Z89.1-1969, or shall be demonstrated by the employer to be equally effective.

(5) Personal flotation devices. Employees working on, over or along water, where the danger of drowning exists, shall be provided with and shall wear approved personal flotation devices in accordance with General safety and health standards, WAC 296-24-086.

(6) Occupational footwear. The employer shall assure that each employee wears foot protection, such as heavy-duty logging boots that are waterproof or water repellent, cover and provide support to the ankle. The employer shall assure that each employee who operates a chain saw wears foot protection that is constructed with cut-resistant material which will protect the employee against contact with a running chain saw. Example: The traditional heavy-duty logging boot will meet the cut-resistant requirements of this subsection.

(a) All employees whose duties require them to walk on logs or boomsticks, shall wear sharp-calked (boots) shoes, or the equivalent, except when conditions such as ice, snow, etc., render calks ineffective. When calks are ineffective and other footwear does not afford suitable protection, workers shall not be required to work on logs or boomsticks.

(b) When nonslip type shoes or boots afford a greater degree of employee protection than calk (boots) shoes, such as at scaling stations, log sorting yards, etc., then this type footwear may be worn in lieu of calk shoes providing firm ankle support and secure footing are maintained.

(7) Leg protection. The employer shall provide, at no cost to the employee, and assure that each employee who operates a chain saw wears leg protection constructed with cut-resistant material, such as ballistic nylon. The leg protection shall cover the full length of the thigh to the top of the

boot on each leg to protect against contact with a moving, chain saw.

Exception: This requirement does not apply when an employee is working as a climber if the employer demonstrates that a greater hazard is posed by wearing leg protection in the particular situation, or when an employee is working from a vehicular mounted elevating and rotating work platform meeting the requirements of chapter 296-24 WAC, Part J-2, Vehicle-mounted elevating and rotating work platforms.

(8) Hand protection. The employer shall provide, at no cost to the employee, and assure that each employee handling wire rope or other rough materials wears hand protection which provides adequate protection from puncture wounds, cuts and lacerations.

(9) Hearing protection. The hearing protection requirements of the general occupational health standards, chapter 296-62 WAC, shall apply.

(10) Protective clothing. Employees working on landings or in log sorting yards, when working on or from the ground, shall wear highly visible hard hats and/or yellow or orange vests, or similarly colored garments, to enable equipment operators to readily see them. It is recommended that such hard hats and vests or outer garments be of a luminous or reflectorized material. Employees performing duties of a flagperson shall wear a hard hat and vest or garment of contrasting colors. Warning vests and hard hats worn at night shall be of a reflectorized material.

Note: See chapter 296-24 WAC, Part A-2, for additional personal protective equipment requirements.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-511, filed 10/28/96, effective 1/1/97. Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-54-511, filed 9/30/94, effective 11/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-54-511, filed 11/30/83. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-511, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-511, filed 9/21/79.]

WAC 296-54-513 Safety education, training and first-aid requirements. The general safety and health standards, WAC 296-24-040 through 296-24-055 accident prevention program requirements are applicable to this chapter.

(1) Training. The employer shall provide training for each employee, including supervisors, at no cost to the employee.

(2) Frequency. Training shall be provided as follows:

(a) Before an employee is assigned to work independently on new tasks, tools, equipment, machines or vehicles; and

(b) Whenever an employee demonstrates unsafe job performance.

(3) Content. At a minimum, training shall consist of the following elements:

(a) Safe performance of assigned work tasks;

(b) Safe use, operation and maintenance of tools, machines and vehicles the employee uses or operates, including emphasis on understanding and following the manufacturer's operating and maintenance instructions, warnings and precautions;

(c) Recognition of safety and health hazards associated with the employee's specific work tasks, including the use of measures and work practices to prevent or control those hazards;

(d) Recognition, prevention and control of other safety and health hazards in the logging industry;

(e) Procedures, practices and requirements of the employer's work site; and

(f) The requirements of this chapter.

(4) Training of an employee due to unsafe job performance, or assignment of new work tasks, tools, equipment, machines, or vehicles; may be limited to those elements in subsection (3) of this section which are relevant to the circumstances giving rise to the need for training.

(5) Portability of training.

(a) Each current employee who has received training in the particular elements specified in subsection (3) of this section shall not be required to be retrained in those elements.

(b) Each new employee who has received training in the particular elements specified in subsection (3) of this section shall not be required to be retrained in those elements prior to initial assignment.

(c) The employer shall train each current and new employee in those elements for which the employee has not received training.

(d) The employer is responsible for ensuring that each current and new employee can properly and safely perform the work tasks and operate the tools, equipment, machines, and vehicles used in their job.

(6) Each new employee and each employee who is required to be trained as specified in subsection (2) of this section, shall work under the close supervision of a designated person until the employee demonstrates to the employer the ability to safely perform their new duties independently.

(7) First-aid training.

(a) The employer shall assure that each employee, including supervisors, receives or has received first-aid and CPR training.

(b) First-aid and CPR training shall comply with the requirements of this section and WAC 296-24-060 (3)(e), Part A-1.

(c) The employer shall assure that each employee's first-aid and CPR training and/or certificate of training remain current.

Note: First-aid trained personnel at sorting yards may be provided as prescribed in WAC 296-24-060 "First-aid training and certification."

(8) All training shall be conducted by a designated person.

(9) The employer shall assure that all training required by this standard is presented in a manner that the employee is able to understand. The employer shall assure that all training materials used are appropriate in content and vocabulary to the educational level, literacy, and language skills of the employees being trained.

(10) Certification of training.

(a) The employer shall verify compliance with subsection (1) of this section by preparing a written certification record. The written certification record shall contain the

name or other identity of the employee trained, the date(s) of the training, and the signature of the person who conducted the training or the signature of the employer.

(b) The most recent training certification shall be maintained.

(11) Safety and health meetings.

The employer shall hold safety and health meetings as necessary and at least each month for each employee. Safety and health meetings may be conducted individually, in crew meetings, in larger groups, or as part of other staff meetings.

(12) First-aid kits. The employer shall provide first-aid kits at each work site where trees are being cut (e.g., felling, bucking, limbing), at each active landing, and on each employee transport vehicle. The number of first-aid kits and the content of each kit shall reflect the degree of isolation, the number of employees, and the hazards reasonably anticipated at the work site.

(13) First-aid kits shall meet the requirements of WAC 296-24-065 of the general safety and health standard. The size and quantity of first-aid kits can be determined by the following table:

Number of employees assigned to worksite	Minimum first-aid supplies required at worksite
1-5	10 package kit*
6-15	16 package kit*
16-50	24 package kit*

*Refer to WAC 296-24-065(7) for a list of required contents.

(14) When required by the department, there shall be available within the closest practicable distance from the operations (not to exceed 1/2 mile) the following items:

1 set of arm and leg splints.

2 all wool blankets or blankets equal in strength and fire resistance (properly protected and marked).

1 stretcher. (For crew and emergency vehicles, see WAC 296-54-519(11).)

(15) The employer shall maintain the contents of each first-aid kit in a serviceable condition.

(16) First-aid kits shall also be equipped with the following items:

(a) Latex gloves (1 pr.).

(b) Resuscitation equipment such as resuscitation bag, airway, or pocket mask.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-513, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-513, filed 9/21/79.]

WAC 296-54-515 General requirements. (1) Emergency stops. Speed limiting devices, safety stops or emergency shut down devices or shut off valves shall be provided, with the controls so located that in the event of an emergency, the prime mover may be shut down from a safe place.

(2) Machine operators. Machine operators shall be experienced in operating the equipment they are using, except that inexperienced persons may operate the equipment to gain experience while in training and may do so only while working under immediate supervision of an experienced authorized person.

(3) Refueling vehicles. Each machine, vehicle, and portable powered tool shall not be fueled while the motors are running with the exception of helicopters, which is permitted under certain conditions. (See WAC 296-54-559(36).)

(4) Hydraulic lines. If failure of hydraulic lines would create a hazard to an equipment operator while at the operating station, safeguards shall be installed in such a manner as to eliminate the hazard. All hydraulic lines shall be maintained free of leaks and shall be shielded from damage wherever possible.

(5) Defective equipment.

(a) Equipment in need of repair shall be reported to management in writing as soon as possible and such equipment shall not be used until repairs are completed if there is a possible hazard to safety of the operator or other employees.

(b) The employer shall assure that each vehicle used to perform any logging operation is maintained in serviceable condition.

(c) The employer shall assure that each vehicle used to perform any logging operation is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable vehicle shall be replaced before work is commenced.

(6) Lock out - tag out. Procedures for lock out - tag out shall be established and implemented to prevent the accidental starting of equipment that is shut down for repairs, maintenance or adjustments.

(7) Control marking. The controls of all machines shall be marked as to their purpose in the operation of the machine.

(8) Metal objects. Metal objects driven into trees or logs shall be removed immediately after serving their intended purpose.

(9) Fire protection. The employer shall provide and maintain portable fire extinguishers on each machine and vehicle in accordance with the requirements of chapter 296-24 WAC, Part G-3, Fire suppression equipment.

(10) Hand and portable powered tools.

(a) The employer shall assure that each hand and portable powered tool, including any tool provided by an employee, is maintained in serviceable condition.

(b) The employer shall assure that each tool, including any tool provided by an employee, is inspected before initial use during each workshift. At a minimum, the inspection shall include the following:

(i) Handles and guards, to assure that they are sound, tight-fitting, (properly shaped, free of splinters and sharp edges, and in place);

(ii) Controls, to assure proper function;

(iii) Chain saw chains, to assure proper adjustment;

(iv) Chain saw mufflers, to assure that they are operational and in place;

(v) Chain brakes and/or nose shielding devices, to assure that they are in place and function properly;

(vi) Heads of shock, impact-driven and driving tools, to assure that there is no mushrooming.

(c) The employer shall assure that each tool is used only for purposes for which it has been designed.

(d) When the head of any shock, impact-driven or driving tool begins to chip, it shall be repaired or removed from service.

(e) The cutting edge of each tool shall be sharpened in accordance with manufacturer's specifications whenever it becomes dull during the workshift.

(f) Each tool shall be stored in the provided location when not being used at a work site.

(g) Hand and portable powered tools and other hand-held equipment not addressed by this chapter shall be maintained and used in accordance with the general safety and health standards, WAC 296-24-650.

(11) Flammable and combustible liquids shall be stored, handled, transported and used in accordance with the requirements of chapter 296-24 WAC, Part E, and the following:

(a) Flammable and combustible liquids shall not be transported in the driver compartment or in any passenger-occupied area of a machine or vehicle.

(b) Flammable or combustible liquids, including chain-saw and diesel fuel, may be used to start a fire, provided the employer assures that in the particular situation its use does not create a hazard for an employee.

(12) Smoking prohibited. Smoking shall be prohibited in battery charging areas and within fifty feet of all refueling operations. Precautions shall be taken to prevent open flames, sparks or electric arcs in battery charging or refueling areas.

(13) Charging batteries. When charging batteries, the vent caps shall be kept in place to avoid electrolyte spray. Care shall be taken to ensure caps are functioning. The battery (or compartment) cover(s) shall be open to dissipate heat.

(14) Uncovered batteries. Tools and other metallic objects shall be kept away from the tops of uncovered batteries.

(15) Work areas.

(a) Employees shall be spaced and the duties of each employee shall be organized so the actions of one employee will not create a hazard for any other employee.

(b) Work areas shall be assigned so that trees cannot fall into an adjacent occupied work area. The distance between adjacent occupied work areas shall be at least two tree lengths of the trees being felled. The distance between adjacent occupied work areas shall reflect the degree of slope, the density of the growth, the height of the trees, the soil structure and other hazards reasonably anticipated at that work site. A distance of greater than two tree lengths shall be maintained between adjacent occupied work areas on any slope where rolling or sliding of trees or logs is reasonably foreseeable.

(16) Signaling and signal equipment. Engine noise, such as from a chain saw, is not an acceptable means of signaling. Signaling and signal equipment shall comply with the requirements of this chapter.

(17) Overhead electric lines.

(a) Logging operations near overhead electric lines shall be done in accordance with the requirements of WAC 296-54-557(25).

(b) Special precautions shall be taken to prevent trees from falling into power lines. The employer shall notify the power company immediately if a felled tree makes contact with any power line. If it appears that a tree will hit a power line, the power company shall be notified before it is attempted to fall the tree. If an unsuspected tree does contact a power line, each employee shall remain clear of the area

until the power company advises that there are no electrical hazards.

(18) Explosives and blasting agents. Explosives and blasting agents shall be stored, handled, transported, and used in accordance with the requirements of chapter 296-52 WAC, Possession and handling of explosives.

(19) Seat belts. For each vehicle or machine (equipped with ROPS/FOPS or overhead guards), including any vehicle or machine provided by an employee, the employer shall assure:

(a) That a seat belt is provided for each vehicle or machine operator;

(b) That each employee uses the available seat belt while the vehicle or machine is being operated;

(c) That each employee securely and tightly fastens the seat belt to restrain the employee within the vehicle or machine cab;

(d) That each machine seat belt meets the requirements of the Society of Automotive Engineers Standard SAE J386, June 1985, "Operator Restraint Systems for Off-Road Work Machines." Prior to February 9, 1995, seat belts and assemblies shall be designed, constructed and maintained to conform to the requirements specified in the society of automotive engineers technical report J386 or J333a. Seat belts need not be provided for equipment which is designed for stand-up operations;

(e) That seat belts are not removed from any vehicle or machine. The employer shall replace each seat belt which has been removed from any vehicle or machine that was equipped with seat belts at the time of manufacture; and

(f) That each seat belt is maintained in a serviceable condition.

(20) The rated capacity of any vehicle transporting a machine shall not be exceeded.

(21) Machines shall be loaded, secured and unloaded in a manner so that it will not create a hazard for any employee.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-515, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-515, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-515, filed 9/21/79.]

WAC 296-54-517 Camps. Rules, regulations and standards for camps shall be in accordance with WAC 296-24-125.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-517, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-517, filed 9/21/79.]

WAC 296-54-519 Motor vehicles. (1) Seats. The seats of each vehicle shall be securely fastened.

(2) Seat belts. The driver of a crew vehicle shall be provided with and shall wear a seat belt according to the provisions of WAC 296-54-515(19).

(3) Barricade. After May 1, 1980, a substantial barricade shall be provided behind the driver of a crew bus or vehicle that will transport nine or more passengers. The barricade shall extend from the floor to at least a level even with the top of the driver's head.

(4) Safe entrance and exits. Adequate provisions shall be made for safe entrance and exits. Mounting steps and handholds shall be provided for each vehicle wherever it is necessary to prevent an employee from being injured when entering or leaving the vehicle.

(5) Enclosed racks. When equipment or tools are carried inside the vehicle, racks, boxes, holsters or other means shall be provided, arranged and used for the transportation of tools so that a hazard is not created for any vehicle operator or passenger.

(6) Vehicle to be stopped. Persons shall not enter or exit from any vehicle until the vehicle is completely stopped.

(7) Keep within vehicle. Persons shall keep all parts of the body within the vehicle.

(8) Stoves prohibited. Provisions shall be made for heat and light in the passenger portion of the vehicle. Use of stoves in vehicles is prohibited.

(9) Emergency exit. On vehicles designed to transport nine or more passengers, an emergency exit not less than six and one-half square feet in area, with the smaller dimension being not less than 18 inches, shall be placed at the back of the vehicle or near the back on the side opposite the regular entrance. The route to and egress from the exit must be unobstructed at all times.

(10) Fire extinguisher. When no fuel is transported in the crew vehicle, a minimum rated 5/BC dry chemical fire extinguisher shall be kept in the passenger compartment. When fuel is transported on the crew vehicle in accordance with subsection (14) of this section, a minimum rated 10/BC dry chemical fire extinguisher shall be kept in the passenger compartment. The extinguishing agent shall be nontoxic and preferably a noncorrosive type.

(11) Crew and emergency vehicles. Vehicles designed to transport five or more passengers shall be equipped with stretchers, two blankets, and first-aid kits. If used as a means of transporting injured persons, it shall be designed to enable persons to pass a loaded stretcher into the vehicle. Provisions shall be made for proper securing of the stretcher.

(12) Exhaust systems. Exhaust systems shall be designed and maintained to eliminate the exposure of passengers to toxic agents.

(13) The employer shall assure that operating and maintenance instructions are available in each vehicle. Each vehicle operator and maintenance employee shall comply with the operating and maintenance instructions.

(14) Limitation of transportation of fuels. Fuels shall be transported or stored only in approved safety containers. Enclosed areas where fuels are carried or stored shall be vented in such a manner that a hazardous concentration of fumes cannot accumulate. All containers or drums shall be properly secured to the vehicle while being transported. Commercially built vehicles of the pick-up or flatbed type with a seating capacity of not to exceed six persons may be used to carry fuels in or on the bed of such vehicles, providing such fuels are not carried in the crew compartment. Van-type vehicles may be used to carry fuels only when a vapor-proof bulkhead is installed between the passenger compartment and storage compartment. Not more than forty-two gallons of gasoline may be carried or stored in the compartment

and each container shall have a capacity not exceeding seven gallons.

(15) Motor vehicle laws. Motor vehicles used as crew vehicles regularly for the transportation of workers shall be covered against the weather and equipped and operated in conformity with applicable state of Washington motor vehicle laws.

(16) Operator's license. The employer shall assure that all operators of crew vehicles are experienced drivers and have a valid operator's license for the class of vehicle being operated.

(17) Daily vehicle check. Operators of crew vehicles shall check brakes and lights daily and shall keep windshields and mirrors clean.

(18) Good repair. Crew vehicles shall be maintained in good repair and safe condition.

(19) Dump trucks. Dump trucks shall only be used in an emergency to transport workers and shall be equipped with adequate safety chains or locking devices which will eliminate the possibility of the body of the truck being raised while employees are riding in the truck. Emergency shall mean any unforeseen circumstances which calls for immediate action when danger to life or danger from fire exists.

(20) Means of signaling. An effective means of signaling shall be provided for communication between the driver and the passengers being transported when they are in separate compartments.

(21) Load limit. The passenger load limit of a crew vehicle shall not exceed the seating capacity of the vehicle.

(22) Vehicle check. Crew vehicles shall be thoroughly inspected by a mechanic for defects which could create a hazardous condition for operation. Such inspections shall be carried out at least every month. Defects known to the operator shall be reported in writing to the mechanic or person in charge. If defects are found, they shall be corrected before the vehicle is used for the transportation of crews.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060, 96-22-013, § 296-54-519, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW, 80-11-057 (Order 80-15), § 296-54-519, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240, 79-10-081 (Order 79-14), § 296-54-519, filed 9/21/79.]

WAC 296-54-521 Transportation of crews by use of speeders and trailers. (1) Braking systems. All speeders shall be equipped with two separate and independently operated braking systems either of which shall be of sufficient capacity to lock all wheels when speeder is fully loaded.

(2) Sanding methods. All speeders used for transporting crews shall be equipped with methods for sanding tracks, operative for both directions of travel.

(3) Lights, windshield wipers. Electric lights of sufficient candle power and range so that vehicle can be stopped within the range of the beam, and which will shine in the direction of travel, shall be provided on all speeders. Adequate tail lights shall be installed and maintained in good order. Automatic windshield wipers of sufficient capacity to maintain clear visibility shall be installed on all speeders.

(4) Trailers. When trailers are coupled behind speeders, they shall be equipped with two separate and independent braking systems, either shall be of sufficient capacity to lock

all wheels when the trailer is fully loaded. One of these shall be power operated and shall be controlled from the speeder; the other manually operated from the trailer. One person shall be designated to operate this brake in case of emergency.

(5) Trailer coupling. All trailers shall be coupled to speeders with metal couplings and safety chains or straps of sufficient strength to withstand the impact caused by a broken coupling.

(6) Trailer not to coast. No trailer shall coast or be used as a crew car without being attached to a speeder.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-521, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-521, filed 9/21/79.]

WAC 296-54-523 Methods of crew transportation other than those specified. Special approval. Persons or firms desiring to transport crews by methods other than those specified in these rules shall so inform the department of labor and industries, so that an evaluation of that method may be made. Should the proposed method be found to afford a measure of safety acceptable to the department of labor and industries, a written order stating that finding shall be issued to the person or firm concerned by the department of labor and industries and the proposed method may be utilized.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-523, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-523, filed 9/21/79.]

WAC 296-54-525 Railroad construction and maintenance. (1) Construction. All construction shall be according to safe logging practice as to size of rails, ties, track accessories and methods of installing same.

(2) Rail guards. Rail guards shall be placed on main lines and spurs, consistent with type of traffic and general local conditions.

(3) Rail anchors. Rail anchors of approved design shall be installed wherever practicable.

(4) Frogs, switches and guard rail ends. Frogs, switches and ends of guard rails shall have either patent or wooden foot guard blocking installed.

(5) Slip plates. Slip plates shall be used under all switches and switch points.

(6) Wire for telephone lines. All above ground wire for permanent telegraph or telephone lines used for dispatching must be well strung on insulators and shall be clear of ground and obstruction.

(7) Insulators. Where telephone lines are strung under or near power lines, foot stools mounted on insulators in front of telephone boxes must be used, unless other protection is provided, which affords a substantially equivalent measure of safety.

(8) Trestles. Foundations, pile trestles, framed bent trestles, mud sills, or other framework of all structures shall be adequate to support the maximum imposed loads without exceeding the maximum safe working unit stresses. Such structure shall be maintained in good condition and repair and shall be inspected at least annually by a qualified person and a record maintained of inspection which shall be made

available to the division of industrial safety and health on request.

(9) Wooden guard. Outside wooden guard rails shall be installed on all railroad bridges except that outside wooden rails will not be required where inside steel guard rails are used. They shall extend not less than six inches above the top of the ties and shall be bolted or spiked to ties at intervals of not more than five feet. Spacer blocks shall be used unless ties are spiked to stringers, or guard rails are dapped to avoid need for spacer blocks.

(10) Bridge ties. Regular bridge ties of not less than ten feet in length shall be used on all railroad bridges constructed after the effective date of these standards.

(11) Safety platforms. On trestles and bridges whose length exceeds two hundred fifty feet, safety platforms providing safe standing space for two persons shall be installed and spaced so that a person on the trestle or bridge is never more than one hundred twenty-five feet from a safety platform or the end of the bridge or structure.

(12) Bridges and trestles used as footways. All railroad bridges and trestles used habitually as footways shall be provided with a plank walkway not less than twelve inches wide and two inches thick, located between the rails, and shall extend from end to end of bridge or trestle.

(13) Walkway. A suitable substantial walkway not less than three feet wide with handrail shall be installed on bridges or trestles where train crews are required to perform routine inspection or repair work on trains. Substantial platforms and handrails shall be provided where switches are located on bridges or trestles. Adequate clearance shall be allowed for the throw of the switch.

(14) Clearing right of way. All dangerous trees, snags or brush shall be cleared a safe distance from both sides of the track and any obstruction that will create a transportation hazard shall be removed.

(15) Secure footing at switches. Material shall be provided which will promote secure footing at places alongside the track where employees customarily perform duties, such as inspect loads, set brakes by hand or throw switches.

(16) Clearance between tracks. The distance between any main tracks and side track shall be such that there shall be a clearance of four feet between bunk ends and locomotive cabs.

(17) Clearances. The minimum horizontal clearances on each side of the center line of standard gauge mainline railroads shall be eight feet, and the vertical clearance shall be twenty-two feet above the top of each rail (in accordance with standard railroad engineering practices).

(18) Derailers.

(a) Derailers shall be installed and used on all landings, passing tracks and spurs where cars are left on a grade.

(b) These derails shall be located in such a manner that they will be close to standing equipment and will not operate to create a hazard to buildings and other railroad lines.

(c) Derailers shall not be located on the inside rail on a sharp curve.

(d) Derail signs shall be set on both sides of the track even with derailer.

(e) When a derailer is no longer needed, it shall be removed or rendered inoperative.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-525, filed 9/21/79.]

WAC 296-54-527 Truck roads. (1) Truck road grades. Truck road grades shall not be too steep for safe operation of logging or work trucks which operate over them and shall not exceed twenty percent in any case unless a positive means of lowering trucks is provided.

(2) Truck road surfaces.

(a) Truck roads shall be of sufficient width and evenness to insure the safe operation of equipment.

(b) Hazards such as broken planking, deep holes, large rocks, logs, etc., which prevent the safe operation of equipment, shall be immediately corrected.

(c) Road width. On blind curves, truck roads shall be of sufficient width for two trucks to pass, or some type of signal system shall be maintained or speed limited to such that the vehicle can be stopped in one-half the visible distance.

(3) Safe roadways. All danger trees shall be felled a safe distance back from the roadway. Rocks, which present a hazard, shall be cleared from banks. Brush and other materials that obstruct the view at intersections or on sharp curves shall be cleared. (This subsection is applicable only to those portions of roads under direct control of the employer.)

(4) Bridges. All structures shall be adequate to support the maximum imposed loads without exceeding the maximum safe working unit stresses. All bridges shall have an adequate number of reflectors to clearly define the entrance to the bridge. All structures shall be maintained in good condition and repair and shall be inspected at least annually by a qualified authorized person and a record maintained of each inspection, which shall be made available to the division of industrial safety and health, department of labor and industries on request.

(5) Shear rails. Shear rails shall be installed on both outside edges of bridges. The shear rails must be securely fastened and made of material capable of withstanding the impact generated by contact with the wheels of a loaded vehicle. The top of shear rails shall be not less than fifteen inches above the bridge surface. Bridges in use prior to the effective date of these regulations with outside shear rails of a minimum of ten inches high or center type shear rails of not less than five inches high are permissible until such time repairs are needed.

(6) Control of dust on logging roads. Measures shall be instituted which will minimize dust to such degree that visibility will not be reduced beyond the point where an operator can safely operate a vehicle. Vehicle operators shall govern the speed of vehicles by road conditions.

(7) Fenders. Pneumatic-tired equipment shall be equipped with fenders as described in the Society of Automotive Engineers Technical Report J321a.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-527, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-527, filed 9/21/79.]

WAC 296-54-529 Falling and bucking—General. (1) Before starting to fall or buck any tree or snag, conditions such as, but not limited to, snow and ice accumulation, the wind, the lean of tree, dead limbs, and the location of other

trees, shall be evaluated by the feller and precautions taken so a hazard is not created for an employee. Accumulations of snow and ice that may create a hazard for an employee shall be removed before felling is commenced in the area or the area shall be avoided. Snags which are unsafe to cut shall be blown down with explosives or felled by other safe methods.

(2) No employee shall approach a feller closer than two tree lengths of trees being felled until the feller has acknowledged that it is safe to do so, unless the employer demonstrates that a team of employees is necessary to manually fell a particular tree.

(3) Before falling or bucking any tree:

(a) A sufficient work area shall be swamped;

(b) The feller shall plan and clear a retreat path; and

(i) The retreat path shall extend diagonally away from the expected felling line unless the employer demonstrates that such a retreat path poses a greater hazard than an alternate retreat path; and

(ii) An escape path shall be used as soon as the tree or snag is committed to fall, roll, or slide.

(4) Warning to be given. Fallers shall give timely and adequate warning prior to falling each tree; such warning shall be given with the saw motor at idle or shut off. Persons in the area shall give response to the faller and shall also notify faller(s) when they are in the clear.

(5) A competent person, properly experienced in this type of work, shall be placed in charge of falling and bucking operations. Inexperienced workers shall not be allowed to fall timber or buck logs unless working under the direct supervision of an experienced worker.

(6) Each danger tree shall be carefully checked for signs of loose bark, broken branches and limbs or other damage before they are felled or removed. Accessible loose bark and other damage that may create a hazard for an employee shall be removed or held in place before felling or removing the tree. When a danger tree has elevated loose bark which cannot be removed, the buddy system shall be used to watch for and give warning of falling bark or other hazards.

(7) Tools of fallers and buckers, such as axes, sledges, wedges, saws, spring boards, etc., must be maintained in safe condition. Case hardened or battered sledges and wedges shall not be used.

(8) Trees shall not be felled if the falling tree can endanger any worker or strike any line or any unit in the operation.

(9) When practical, strips shall be laid out so cutters face out into opening when starting strip, and all trees shall be felled into the open whenever conditions permit.

(10) Trade leaners. Cutters shall not fall into another strip; leaners on the line shall be traded.

(11) When there is danger from kickback of a sapling, the same must be either undercut or felled.

(12) Cutters shall place an adequate undercut and leave sufficient holding wood to insure the tree will fall in the intended direction. When required, mechanical means shall be used to accomplish this objective.

(13) Cutters shall be careful their chopping range is unobstructed.

(14) Cutters shall confer with their supervisor regarding a safe manner of performing the work and in unusually haz-

ardous situations shall not proceed with the work until their method has been approved by their supervisor.

(15) The person in charge of cutting crews shall regularly inspect the work of the cutting crews and shall be responsible for seeing the work is performed in a proper and safe manner.

(16) Domino felling of trees, including danger trees, is prohibited. The definition of domino felling does not include the felling of a single danger tree by felling another single tree into it.

(17) Cutters shall be assigned to work in locations where they are in contact with others or their welfare shall be checked on as provided for by WAC 296-54-507(3).

(18) Persons in charge of cutting crews shall account for all persons in their crews being on hand when work ceases as provided for by WAC 296-54-507(4).

(19) All fallers and buckers shall have a current first-aid card.

(20) All fallers and buckers shall carry or have with them in near proximity at all times, an axe, a minimum of two wedges, a whistle and a first-aid kit. The whistle shall be carried on their person.

(21) While manual felling is in progress, no yarding machine shall be operated within two tree lengths of trees being manually felled. Exception: This provision does not apply to yarding machines performing tree pulling operations or grounding of hazard trees according to WAC 296-54-557(24).

(22) Wedges shall be of soft metal, hardwood or plastic.

(23) Wedges shall be driven with a hammer or other suitable tool. Double-bitted axes or pulaskies shall not be used for this purpose.

(24) While wedging, fallers shall watch for falling limbs or other material that might be jarred loose. Cutting of holding wood in lieu of using wedges is prohibited.

(25) Undercuts are required except in matchcutting, and shall be large enough to safely guide trees and eliminate the possibility of splitting. Trees with no perceptible lean having undercuts to a depth of one-fourth of the diameter of the tree with a face opening equal to one-fifth of the diameter of the tree, will be assumed to be within reasonable compliance with this rule. Swing cuts are prohibited except by an experienced person.

(26) Undercuts shall be completely removed except when a dutchman is required on either side of the cut.

(27) Backcuts.

(a) All backcuts shall be as level as possible and shall leave sufficient hinge wood to hold the tree to the stump until the tree is committed to the path of fall in the intended direction.

(i) The backcut alignment on larger trees shall be approximately two inches above the undercut hinge point to provide a platform to help prevent kickback when the holding wood breaks off.

(ii) On moderate or smaller size trees the backcut alignment shall be above the undercut but can be less than two inches.

(b) In tree-pulling operations the backcut may be at or below the undercut hinge point.

(c) A backcut shall be made in each tree being felled.

(28) Trees with face cuts or backcuts shall not be left standing. When a tree is not completely felled, the faller shall clearly mark the tree, shall discontinue work in the hazardous area and notify the immediate supervisor. The supervisor shall be responsible for notifying all workers who might be endangered and shall take appropriate measures to ensure that the tree is safely felled before other work is undertaken in the hazardous area.

(29) To avoid use of wedges, which might dislodge loose bark or other material, snags shall be felled in the direction of lean unless other means (mechanical or dynamite) are used.

(30) Lodged trees shall be clearly marked and identified by a predetermined method and all persons in the area shall be instructed not to pass or work within two tree lengths of such trees except to ground them.

(31) Work areas shall be assigned so that a tree cannot fall into an adjacent occupied work area. The distance between work areas shall be at least twice the height of the trees being felled. A greater distance may be required on downhill slopes depending on the degree of the slope and on the type of trees and other considerations.

(32) Where felled trees are likely to roll and endanger workers, cutting shall proceed from the bottom toward the top of the slope, and performed uphill from previously felled timber.

(33) Cutters shall not be placed on a hillside immediately below each other or below other operations where there is probable danger.

(34) Fallers shall be informed of the movement and location of buckers or other cutters placed, passing or approaching the vicinity of trees being felled.

(35) A flagperson(s) shall be assigned on roads where hazardous conditions are created from falling trees. Where there is no through traffic, such as on a dead end road, warning signs or barricades shall be used.

(36) No tree or danger tree shall be felled by one cutter where and when the assistance of a fellow cutter is necessary to minimize the dangers or hazards involved.

(37) Cutters shall be in the clear as the tree falls.

(38) Undercuts and backcuts shall be made at a height above the highest ground level to enable the cutter to safely begin the cut, control the tree, and have freedom of movement for a quick escape to be in the clear from a falling tree.

(39) When falling, a positive means, method or procedure that will prevent accidental cutting of necessary holding wood shall be established and followed. Particular care shall be taken to hold enough wood to guide the tree or snag and prevent it prematurely slipping or twisting from the stump.

(40) The undercut shall not be made while buckers or other workers are in an area into which the tree could fall.

(41) Matchcutting should not be permitted and shall be prohibited for trees larger than six inches in diameter breast high.

(42) The tree (and root wad if applicable) shall be carefully examined to determine which way the logs (and root wad) will roll, drop, or swing when the cut is completed. No worker shall be allowed in this danger zone during cutting.

(43) Logs shall be completely bucked through whenever possible. If it becomes hazardous to complete a cut, then the log shall be marked and identified by a predetermined

method. Rigging crews shall be instructed to recognize such marks and when possible, cutters shall warn the rigging crew of locations where such unfinished cuts remain.

(44) Cutters shall give timely warning to all persons within range of any log which may have a tendency to roll after being cut off.

(45) Propping of logs or trees as a means to protect workers downslope from the logs or trees, shall be prohibited.

(46) Logs shall not be jackstrawed when being bucked in piles or decks at a landing.

(47) The chain saw shall not be used to cut directly over head.

(48) The chain saw operator shall be certain of footing before starting to cut. The chain saw shall not be used in a position or at a distance that could cause the operator to become off-balance, to have insecure footing, or to relinquish a firm grip on the saw.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060, 96-22-013, § 296-54-529, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW, 80-11-057 (Order 80-15), § 296-54-529, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240, 79-10-081 (Order 79-14), § 296-54-529, filed 9/21/79.]

WAC 296-54-531 Power saws and power equipment.

(1) Operators shall inspect chain saws daily to ensure that handles and guards are in place, and controls and other moving parts are functional.

(a) Each chain saw placed into initial service after February 9, 1995, shall be equipped with a chain brake and, shall otherwise meet the requirements of the ANSI B175.1-1991 "Safety Requirements for Gasoline-Powered Chain Saws" and the requirements of this chapter; and

(b) Each chain saw placed into service before February 9, 1995, shall be equipped with a protective device that minimizes chain saw kickback i.e., reduced kick back bar, chains, bar tip guard or chain brake; and

(c) No chain saw kick back device shall be removed or otherwise disabled.

(2) Fuel outdoors. The chain saw shall be fueled outdoors at least fifty feet (15.2 meters) from persons smoking or from other potential sources of ignition.

(3) Chain saws shall not be operated unless equipped with a muffler.

(4) Chain saws shall be operated and adjusted in accordance with the manufacturer's instructions and the requirements of this chapter.

(5) Combustion-engine type power saws shall be equipped with a positive means of stopping the engine.

(6) Electric power saws shall be equipped with an automatic (deadman type) control switch. Saws with faulty switches shall not be used.

(7) Unless the carburetor is being adjusted, the saw shall be shut off before any adjustments or repairs are made to the saw, chain or bar.

(8) Combustion-engine type power saws shall be equipped with a clutch.

(9) The chain saw clutch shall be properly adjusted to prevent the chain from moving when the engine is at idle speed.

(10) Power chain saws with faulty clutches shall not be used.

(11) The bar shall be handled only when the power chain saw motor is shut off.

(12) Power chain saws shall have the drive end of the bar guarded.

(13) Combustion-engine driven power saws shall be equipped with an automatic throttle control (deadman type), which will return the engine to idle speed upon release of the throttle (idle speed is when the engine is running and the chain does not rotate on the bar).

(14) When falling of tree is completed, the power saw motor shall be at idle or shutoff. The power saw motor shall also be shutoff while fueling.

(15) Saw pinching and subsequent chain saw kickback shall be prevented by using wedges, levers, guidelines, and saw placement, or by undercutting.

(16) The chain saw shall be started at least 10 feet (3 m) from the fueling area.

(17) Reserve fuel shall be handled and stored in accordance with WAC 296-54-515(11).

(18) Hand-held files shall be equipped with a handle.

(19) Only experienced cutters shall buck windfalls.

(20) The chain saw shall be started on the ground or where otherwise firmly supported. Drop starting a chain saw is prohibited.

(21) Chain saws equipped with chain brakes shall be started with the chain brake engaged.

(22) The chain saw shall be held with the thumbs and fingers of both hands encircling the handles during operation unless the employer demonstrates that a greater hazard is posed by keeping both hands on the chain saw in that particular situation.

(23) The chain saw shall be carried in a manner that will prevent operator contact with the cutting chain and muffler.

(24) The chain saw shall be shut off or at idle before the feller starts to retreat.

(25) The chain saw shall be shut down or the chain brake shall be engaged whenever a saw is carried further than 50 feet (15.2 m). The chain saw shall be shut down or the chain brake shall be engaged when a saw is carried less than 50 feet if conditions such as, but not limited to, the terrain, underbrush and slippery surfaces, may create a hazard for an employee.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060, 96-22-013, § 296-54-531, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW, 80-11-057 (Order 80-15), § 296-54-531, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240, 79-10-081 (Order 79-14), § 296-54-531, filed 9/21/79.]

WAC 296-54-533 Falling and bucking—Springboards and tree jacking. (1) Springboards shall be of clear, straight-grained sound stock of sufficient length, width and strength and shall be replaced when they will no longer safely support the expected load at the extreme end.

(2) Springboard irons shall be well lipped and firmly attached with bolts or a means of attachment furnishing equivalent strength.

(3) Two workers shall be present when falling any tree or snag when springboards are used.

(4) Power saw chains shall be stopped while shifting springboards.

(5) Jack plates shall be used with hydraulic tree jacks and the base plate shall be seated on solid wood inside the bark ring as close to level as possible.

(6) Two workers shall be present at all times during the use of tree jacks.

(7) Wedges shall be used as a follow-up method while using tree jacks. The wedges shall be continuously moved in as the tree is jacked.

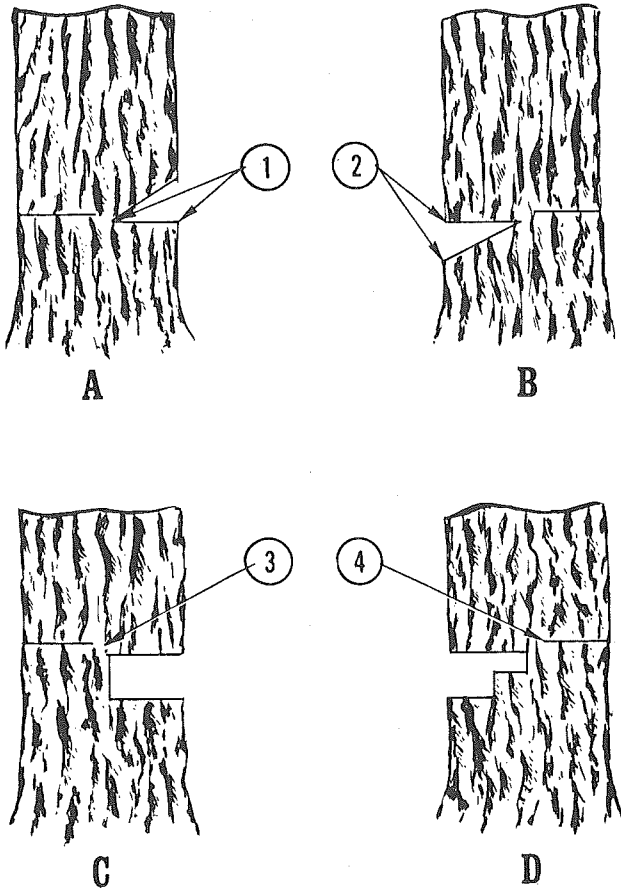
(8) Effective January 1, 1980, all hydraulic tree jacks shall be equipped with an operable velocity fuse (check valve) and the pump shall be equipped with an operable pressure gauge.

(9) When tree jacking, the facecut shall be nominally one-fourth the diameter of the tree.

(10) The vertical height of the facecut shall be not less than one-fifth of the diameter of the tree when tree jacking.

Note: See Figure No. 1, for illustrations of undercuts.

UNDERCUTS



(A) **Conventional undercut.** Can be made with parallel saw cut and axe diagonal cut or both cuts with the saw. Generally used on trees of small diameter.

(B) **Both cuts made with the saw.** Leaves square-end log. Same as (A), except that waste is put on the stump.

(C) **Two parallel cuts with the saw.** The material between the cuts is chipped out with an axe-adz (pulaski) combination. Used on trees over 30 inches in diameter.

(D) **Three parallel cuts with the saw, leaving a step.** Same in principle as (C). Used on trees of very large diameters.

Item

- 1 Undercut depth
- 2 Undercut height
- 3 Holding wood
- 4 Backcut

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-533, filed 9/21/79.]

WAC 296-54-535 Tree pulling. (1) The cutter shall be responsible for determining if a tree can be safely pulled. If, for any reason, the cutter believes the tree pulling cannot be completed safely, the tree shall be conventionally felled.

(2) When using radio positive radio communications shall be maintained at all times between the tree pulling machine and cutter when tree pulling. An audible signal shall be blown when the initial pull is made on the tree and the line is tightened. Hand signals, in lieu of radio communications and an audible signal, may be used only if the cutter is clearly visible to the tree puller operator.

(3) A choker, with bell, or a line and sleeve shackle shall be used as the means of attachment around the tree when tree pulling. The bight on the line shall be only that necessary to hold the choker or line around the tree.

(4) The tree pulling machine shall be equipped with a torque converter, fluid coupler, or an equivalent device to insure a steady even pull on the line attached around the tree.

(5) The tree pulling line shall have as straight and direct path from the machine to the tree as possible. Physical obstructions which prevent a steady even pull on the tree pulling line shall be removed or the line shall be rerouted.

(6) Siwashing, in lieu of a block, in order to change tree pulling lead, is prohibited.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-535, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-535, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-535, filed 9/21/79.]

WAC 296-54-537 Mechanized falling. (1) When using selfpropelled mobile falling devices, a watchman and/or warning signs shall be posted at appropriate locations indicating that devices of this type are being used to fall trees.

(2) Self-propelled mobile falling equipment used for falling trees shall be designed in a manner or shall have auxiliary equipment installed which will cause the tree to fall in the intended direction.

(3) Mechanized falling shall be conducted in such a manner as not to endanger persons or equipment.

(4) Where a mechanized feller incorporates a cab structure having a single entrance door, it shall be equipped with an alternate means of escape from the cab should the door be blocked in the event of vehicle rollover or fire. Cab doors shall be fitted with latches operable from both sides of the door.

(5) No employee shall approach a mechanical felling operation closer than two tree lengths of the trees being felled until the machine operator has acknowledged that it is safe to do so.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-537, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-537, filed 9/21/79.]

WAC 296-54-539 Climbing equipment and passline.

(1) Standard climbing equipment shall be furnished by the employer; however, this shall not be construed to mean that the climber may not use personal equipment, provided it meets the following standards and is permitted by the employer. The climbing ropes shall be of steelcore type. The climber may fasten climbing rope by passing it through "D" rings fastened to the belt and around his body before tying it to itself. When topping standing trees, it is recommended that a steel chain of 3/16-inch or larger, with appropriate fittings attached, shall be used in addition to the climbing rope. All climbing equipment shall be maintained in good condition. An extra set of climbing equipment shall be kept at the climbing operation and another person with climbing experience shall be present.

(2) A person shall ride only the passline to thread lines, oil blocks or to inspect rigging.

(3) No one shall work directly under a tree except when directed by the climber. Warning shall be given prior to intentionally dropping any objects or when objects are accidentally dropped.

(4) Running lines shall not be moved while the climber is working in the tree, except such "pulls" as climber directs and are necessary for the work.

(5) One experienced person shall be dispatched to transmit the climber's signals to the machine operator and shall not otherwise be occupied during the time the climber is in the tree, nor shall the machine operator be otherwise occupied while the climber is using the passline. The designated signal person shall position themselves clear of hazards from falling, flying or thrown objects.

(6) Long or short splices and knots in passline are not permitted. Chains used in passlines shall be in good condition and shall not contain cold shuts or wire strands.

(7) The climber shall be an experienced logger with proper knowledge of logging methods and the safety of rigging spar and tail trees.

(8) Trees shall not be topped during windy weather.

(9) At no time shall topping, rigging-up, or stripping work be done when visibility is impaired.

(10) When the friction lever and passline drum is on the opposite side of the machine from the operator, an experienced person shall operate the friction lever while the engineer operates the throttle. While being used, the passline drum shall be properly attended by another person to guide the passline onto the passline drum with a tool suitable for the purpose.

(11) The use of a gypsy drum for handling persons in the tree is prohibited.

(12) Danger trees leaning towards and within reach of landings, roads, rigging or work areas shall either be felled

before the regular operations begin or work shall be arranged so that workers will not be exposed to hazards involved.

(13) Noisy equipment such as power saws, tractors and shovels shall not be operated around the area where a climber is working when such noise will interfere with the climber's signals.

(14) Climbing and passline equipment shall not be used for other purposes.

(15) Defective climbing equipment shall be immediately removed from service.

(16) The climber shall be equipped with a climbing equipment assembly having a breaking strength of not less than five thousand four hundred pounds.

The equipment shall include:

(a) A safety belt with double "D" rings;

(b) Steel spurs long and sharp enough to hold in any tree in which they are used; and

(c) A climbing rope made of wire-core hemp, wire or chain construction.

(17) When the climber is using a chain saw in the tree, the climbing rope shall be made of material that cannot be severed by the saw.

(18) Lineman hooks shall not be used as spurs.

(19) When power saws are used in topping or limbing standing trees, the weight of the saw shall not exceed thirty pounds.

(20) Tools used by the climber, except the power saw, shall be safely secured to climber's belt when not in use.

(21) Snaps shall not be used on a climber's rope unless a secondary safety device between the belt and snap is used.

(22) A climber's rope shall encircle the tree before the climber leaves the ground except when the climber is riding the passline.

(23) While the climber is working in the tree, persons shall keep at sufficient distance from the tree to be clear of falling objects.

(24) When used, passline fair-leads shall be kept in alignment and free from fouling at all times.

(25) Spikes, used by the climber as a temporary aid in hanging rigging, shall be removed before the tree is used for logging.

(26) Loose equipment, rigging or material shall either be removed from the tree or securely fastened.

(27) All spar trees shall be equipped with passlines that shall:

(a) Be not less than 5/16-inch and not be over 1/2-inch in diameter;

(b) Not be subjected to any sawing on other lines or rigging, and kept clear of all moving lines and rigging;

(c) Be of one continuous length and in good condition with no splices, knots, molles, or eye-to-eye splices between the ends;

(d) Be long enough to provide three wraps on the drum before the climber leaves the ground.

(28) Drums used for passlines shall have sufficient flange depth to prevent the passline from running off the drum at any time.

(29) Passline chains shall:

(a) Be not less than 5/16-inch alloy or 3/8-inch high test chain and shall not contain cold shuts or wire strands;

(b) Be attached to the end of the passline with a screw-pin shackle, a slip-pin shackle with a nut and molle, or a ring large enough to prevent going through the pass block; and

(c) Be fitted with links or rings to prevent workers from being pulled into the passline block.

(30) Pass blocks shall:

(a) Be inspected before placing in each spar and the necessary replacements or repairs made before they are hung;

(b) Have the shells bolted under the sheaves;

(c) Have the bearing pin securely locked and nuts keyed or the block be of the type which positively secures the nut and pin;

(d) Equipped with sheaves not less than six inches in diameter; and

(e) Comply with applicable portions of WAC 296-54-543(6) pertaining to blocks.

(31) When workers are required to go up vertical metal spars, passlines, chains and blocks shall be provided and used.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-539, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-539, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-539, filed 9/21/79.]

WAC 296-54-541 Selection of spar, tail and intermediate trees. (1) Douglas fir or spruce shall be used as spar, tail, or intermediate support trees when they are available. If other species must be used, additional guylines, tree plates, or other precautions shall be taken to insure the tree will withstand the strains to be imposed.

(2) Spar, tail and intermediate support trees shall be examined carefully for defects before being selected. They shall be sound, straight, green and of sufficient diameter to withstand the strains to be imposed.

(3) Trees having defects that impair their strength shall not be used for spar, tail or intermediate support trees. Raised trees shall be identified and marked as such.

(4) Before raising spar trees, dummy trees shall be topped and guyed with three guylines equivalent in breaking strength to the mainline.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-541, filed 9/21/79.]

WAC 296-54-543 General requirements. (1) Rigging.

(a) Rigging shall be arranged and operated so rigging or loads will not foul, or saw against lines, straps, blocks or other equipment.

(b) A thorough inspection of all blocks, straps, guylines and other rigging shall be made before they are placed in positions for use. Inspections shall include an examination for damaged, cracked or worn parts, loose nuts and bolts, and of lubrication, and the condition of straps and guylines. All necessary repairs or replacements for safe operation shall be made before the rigging is used.

(c) Rigging equipment, when not in use, shall be stored so as to not present a hazard to employees.

(d) Running lines shall be arranged so workers will not be required to work in the bight. When this is not possible,

workers shall move out of the bight of lines before the lines are tightened or moved.

(2) Shackles.

(a) Shackles with screw pins should have either a molle or cotter key when used to fasten guylines to spar trees.

(b) All shackles used to hang blocks, jacks, or rigging on trees or loading booms shall have the pins fastened by a nut secured with a cotter pin or molle. When used, molles shall be as large as the pin hole will accommodate and with the loose ends rolled in.

(c) The size of the opening between the jaws of shackles used to hang blocks, jacks, rigging, and for joining or attaching lines, shall not be more than one inch greater than the size of the rope, swivel, shackle, or similar device to which it is attached.

(d) All shackles used for mainline or skyline extensions shall be of a type designed for that purpose.

(e) Shackles used other than for mainline extension connections, shall be of the screw-pin type or with the pin secured by a nut and cotter pin or molle, except as specified elsewhere for specific purposes.

(f) Shackles, swivels, links and tree plates shall be replaced or repaired when they will not safely support the imposed strains of their intended use.

(g) Shackles shall not be loaded in excess of the working load recommended by the manufacturer.

(h) All shackles must be made of forged steel or material of equivalent strength and one size larger than the line it connects.

(3) Straps.

(a) Safety straps of appropriate size shall be placed on all high lead blocks; also other blocks whenever practicable. Safety straps shall be shackled, with closed end of shackle up, to a guyline which extends as near as possible at right angles with power unit, but shall not be placed on a guyline having an extension within one hundred feet of the tree. When the top guyline on which the safety strap of the high lead block is fastened is changed, safety strap must be attached to another guyline or loosened guyline tightened after change.

(b) All tree straps shall be at least 1/4-inch larger than the pulling line. If impossible to use safety strap, all tree straps shall be 1/2-inch larger than the pulling line.

(c) All straps in back of show must be as large as the running line.

(d) All blocks other than passline and straw line lead blocks shall be hung in both eyes or "D's" of straps. Threading eye through eye is prohibited.

(e) Skyline jack shall not be hung by double strap through shackle and hanging jack in two eyes.

(f) Tree straps shall initially be made of new wire rope when made up. They shall be replaced when there is evidence of damage or broken wires.

(g) A guyline safety strap or equivalent device shall be installed at the top of metal spars to prevent guylines from falling more than five feet in case of structural or mechanical failure of the guyline attachment.

(h) Metal spar guyline safety straps or equivalent devices shall be equal to the strength of the guyline.

(i) Nylon straps may be used in accordance with manufacturer recommendations.

(j) Nylon straps shall be removed from service when the wear reaches the limits prescribed by the manufacturer. The person responsible for inspecting the condition of rigging shall be aware of these limits.

(4) Guylines.

(a) All component parts of the guyline system on head tree shall be of equal or greater strength than the mainline and guylines shall be properly spaced to effectively oppose the pull of the mainline.

(b) Guylines on wood spar trees shall be secured to solid stumps with not less than two and one-half complete wraps with at least six staples or eight railroad spikes driven solidly into sound wood on the first and last wrap. The bark shall be removed and the stump adequately notched or other equivalent means shall be used to prevent movement of the line on the stump or tree. Guyline stumps shall be inspected periodically. Guylines may be secured to properly installed "dead-men" when suitable stumps are not available. It is permissible, on the tail tree, to secure the guylines by placing three wraps around a tree or stump and securing them properly by use of clamps.

(c) When a mainline of 7/8-inch or less is used, the spar shall be supported by at least five top guylines or other positive means of supporting the spar.

(d) When tail hold on skyline is choked on stump, there shall be no excessive bight against shackle.

(e) In removing guylines and skylines from stumps, etc.:

(i) A reversed safety wrap shall be put on and secured before loosening the last wrap.

(ii) An experienced person shall be in charge loosening guylines or skylines using proper precautions, and giving warning before lines are released.

(iii) Safety holdbacks shall be used when necessary for the safety of workers.

(iv) Powder or power shall be used for releasing the last wrap on skylines.

(f) Guylines shall be used with any logging equipment when required by the equipment manufacturer.

(g) Guying shall not be less than the minimum recommended by the equipment manufacturer.

(h) Top guys on vertical metal and wooden spars which require five or more guylines shall be so arranged that at least three guys oppose the pull of the load, with at least one guyline anchored adjacent to the yarding quarter.

(i) Guylines shall be of plow steel or better material, and shall be maintained in good condition.

(j) When side blocking or lateral yarding, lateral stability to the head spar tree shall be insured by guylines sufficient in number, breaking strength and spacing.

(k) All guylines shall be kept well tightened while the spar, tree, equipment or rigging they support is in use.

(l) All trees that interfere with proper alignment, placement or tightening of guylines shall be felled.

(m) Guylines shall be hung in a manner to prevent a bight or fouling when they are tightened.

(n) All spliced guyline eyes shall be tucked at least three times.

(o) Extensions to guylines shall be:

(i) Equal in strength to the guyline to which they are attached; and

(ii) Connected only by a shackle connecting two spliced eyes or by double-end hooks. Connections shall have at least one and one-half times the strength of the guyline.

(p) Portable metal spars and their appurtenances shall be inspected by a qualified person each time the spar is lowered and at any time its safe condition is in doubt. When damage from over-stress is noted or suspected, the part in question shall be inspected by a suitable method and found to be safe, or the part repaired or replaced before the spar is again used.

(q) No person shall go up a raised metal spar unless suitable passline equipment is provided and used.

(r) Repairs, modifications or additions which affect the capacity or safe operation of metal spars shall be made only under the direction of a registered engineer and within the manufacturer's recommendations.

(i) In no case shall the original safety factor of the equipment be reduced.

(ii) If such modifications or additions are made, the identification plate required by WAC 296-54-553(1) shall reflect such changes.

(s) When using skylines 7/8-inch or smaller, tail trees shall be supported by at least two guylines when the rigging is placed on the tail tree at a height greater than five times the tree diameter (dbh) or higher than ten feet from the highest ground point, whichever is lower.

(t) When using skylines one inch or larger, tail trees shall be supported by at least four guylines when the rigging is placed on the tail tree at a height greater than five times the tree diameter (dbh) or higher than ten feet from the highest ground point whichever is lower.

(u) Tail trees shall be supported by additional guylines if necessary to insure stability of the tree.

(v) Wood head spar trees shall be guyed as follows:

(i) All spar trees one hundred ten feet and over in height shall be provided with a minimum of six top guys and three buckle guys, each of which shall be substantially equal in strength to the strength of the mainline. This requirement, however, shall not be construed as applying where more than three buckle guys are specifically required.

(ii) Spar trees used for loading and yarding at the same time, or for loading and swinging at the same time, or supporting a skyline yarding system, shall have not less than six top and four buckle guylines each of which shall be substantially equal in strength to the strength of the mainline.

(iii) Spar trees under one hundred ten feet high used only for yarding with heavy equipment (over 7/8-inch mainline) shall have not less than six top guys each of which shall be substantially equal in strength to the strength of the mainline.

(iv) Spar trees used for yarding with light equipment (7/8-inch or smaller mainline) shall be guyed in such a manner that strains will be imposed on not less than two guylines. If less than five top guys are used, guylines shall be at least 1/4-inch larger than the mainline.

(v) More guylines shall be added if there is any doubt as to the stability of any spar tree, raised tree, tail trees and lift trees, or other equipment or rigging they support.

(w) Guylines shall alternately be passed around the wood spar in opposite directions to prevent twisting of the spar.

(x) Guylines shall be attached to the upper portion of the wood spar by means of shackles.

(y) A-frames shall be guyed by at least two quarter-guylines and one snap guyline or equivalent means to prevent A-frame from tipping back.

(5) Anchoring.

(a) Stump anchors used for fastening guylines and sky-lines shall be carefully chosen as to position, height and strength. When necessary, stump anchors shall be tied back in a manner that will distribute the load.

(b) Stump anchors shall be barked where attachments are to be made, or devices designed to accomplish the same purpose shall be used.

(c) Stump anchors shall be notched to a depth not greater than one and one-half times the diameter of the line to be attached.

(d) Deadman anchors may be used if properly installed. Guylines shall not be directly attached to deadman anchors. Suitable straps or equally effective means shall be used for this purpose.

(e) Rock bolts and other types of imbedded anchors may be used if properly designed and installed.

(f) Stumps, trees and imbedded type guyline anchors shall be regularly inspected while the operation is in progress. Insecure or hazardous anchors shall be immediately corrected.

(g) Workers shall not stand close to the stump, or in the bight of lines as the guyline or wraps are being tightened.

(6) Blocks.

(a) All blocks shall:

(i) Not be used for heavier strains or lines than those for which they are constructed;

(ii) Be fitted with line guards and shall be designed and used in a manner that prevents fouling, with the exception of special line blocks not designed with line guards;

(iii) Be kept in proper alignment when in use;

(iv) Have bearing and yoke pins of a material that will safely withstand the strains imposed and shall be securely fastened;

(v) Have sheaves of a size designed for the size of the wire rope used.

(b) Blocks with cracked or excessively worn sheaves shall not be used.

(c) Lead blocks used for yarding, swinging, loading and unloading used in wood spars shall:

(i) Be of the type and construction designed for this purpose;

(ii) Be bolted with not less than two bolts through the shells below the sheaves in a manner that will retain the sheave and line in case of bearing pin failure (this does not apply to haulback lead blocks); and

(iii) Mainline blocks shall have a sheave diameter of not less than twenty times the diameter of the mainline.

(d) Block bearing shall be kept well lubricated.

(e) All blocks must be of steel construction or of material of equal or greater strength and so hung that they will not strike or interfere with other blocks or rigging.

(f) All pins in blocks shall be properly secured by "Molle Hogans" or keys of the largest size the pin hole will accommodate. When blocks are hung in trees, threaded pins and nuts shall be used.

(g) Sufficient corner or tail blocks to distribute the stress on anchors and attachments shall be used on all logging systems.

(h) Blocks used to lead lines directly to yarding, loading or unloading machines other than passline or strawline blocks shall be hung by the following method: In both eyes or "D"s of straps; threading eye through eye is prohibited.

(i) Tail, side or corner blocks used in yarding shall be hung in both eyes of straps.

(7) Wire rope.

(a) Wire rope shall be of the same or better grade as originally recommended by the equipment manufacturer.

(b) Wire rope shall be removed from service when any of the following conditions exist:

(i) In running ropes, six randomly distributed broken wires in one lay or three broken wires in one strand in one lay;

(ii) Wear of one-third the original diameter of outside individual wires. Kinking, crushing, bird-caging, or any other damage resulting in distortion of the rope structure;

(iii) Evidence of any heat damage from any cause;

(iv) Reductions from nominal diameter of more than 3/64-inch for diameters to and including 3/4-inch, 1/16-inch for diameters 7/8-inch to 1-1/8-inch, inclusive, 3/32-inch for diameters 1-1/4-inches to 1-1/2-inches inclusive;

(v) In standing ropes, more than two broken wires in one lay in sections beyond end connections or more than one broken wire at an end connection;

(vi) In standing ropes, when twelve and one-half percent of the wires are broken within a distance of one wrap (lay); and

(vii) Corroded, damaged or improperly applied end connections.

(c) Wire rope shall be kept lubricated as conditions of use require.

(8) Splicing wire rope.

(a) Marlin spikes or needles in good condition and large enough for the size of the line being spliced, shall be used for splicing.

(b) When available, and practical to use, a patented wire cutter shall be used. If using a wire axe to cut cable, the hammer used to strike the axe shall be made of soft nonspalling type material. Eye and face protection shall be worn in accordance with WAC 296-54-511(2).

(c) Short splices, eye-to-eye splices, cat's paws, knots, molles and rolled eyes are prohibited except for use in the moving of slack lines. Knots will be permitted for use on single drum tractors and grapple pick-up lines when properly tied.

(d) Wire rope 1/2-inch or less in diameter may be tucked two times provided the rope is used only as straw line.

(e) Splices other than eye splices in lang lay lines are prohibited. Eye splices in lang lay lines shall be tucked at least four times.

(f) Long splices shall be used for permanently joining "regular lay" running lines.

(g) When U-bolt wire rope clips (clamps) are used to form eyes on high strength wire rope, an additional clip (clamp) for each grade of line above improved plow steel shall be used over and above the following table: (See Figure

No. 2, following this section, for proper application of wire rope clips.)

Improved Plow Steel Diameter of Rope	Number of Clips Drop Forged	Required Other Material	Minimum Space Between Clips
3/8 to 5/8 inch	3	4	3-3/4 inches
3/4 inch	4	5	4-1/2 inches
7/8 inch	4	5	5-1/4 inches
1 inch	5	6	6 inches
1-1/8 inch	6	6	6-3/4 inches
1-1/4 inch	6	7	7-1/2 inches
1-3/8 inch	7	7	8-1/4 inches
1-1/2 inch	7	8	9 inches

(h) All line eye splices shall be tucked at least three full tucks. D's and knobs are recommended for line ends.

(i) Two lines may be connected by a long splice, or by shackles or patent links of the next size larger than the line being used where practical. Double "Molle Hogans" may be used on drop lines only and single "Molle Hogans" may be used on strawline.

(j) Splicing of two lines together for loading line or pass line is prohibited.

(k) Safe margin of line must be used for making long splices. The following table shows comparative safe lengths as to size of cable in making long splices:

Rope Diameter	To Be Unraveled	Total Length
1/4"	8'	16'
3/8"	8'	16'
1/2"	10'	20'
5/8"	13'	26'
3/4"	15'	30'
7/8"	18'	36'
1 "	20'	40'
1 -1/8"	23'	46'
1 -1/4"	25'	50'
1 -3/8"	28'	56'
1 -1/2"	30'	60'
1 -5/8"	33'	66'
1 -3/4"	35'	70'
1 -7/8"	38'	76'
2 "	40'	80'

(9) Miscellaneous requirements.

(a) All lines, straps, blocks, shackles, swivels, etc., shall be inspected frequently and shall be used only when found to be in good condition. Such items shall be of sufficient size and strength as to safely withstand the stress which can be imposed by the maximum pull of the power unit against such equipment or devices as rigged or used in that particular logging operation.

(b) When used or second-hand cables are purchased, they shall not be used for any purpose until inspection determines they will withstand the maximum imposed strain.

(c) Skyline shall be anchored by placing three full wraps around tail hold and staples or spikes shall be used to securely hold each wrap or choked and secured with a shackle or three wraps and at least three clamps securely tightened.

(d) When using haulback lines greater than 7/8-inch diameter on interlocking drum-type yarders, additional precautions shall be taken to prevent the corner blocks or tail

blocks from dislodging the anchors to which the blocks are secured.

(e) Where "dutchman" is used, either for yarding or on skyline, a block of heavy construction must be used. Regular tree shoe or jack may be used for "dutchman" on skyline. Cable must be fastened securely.

(f) Choker drops shall be connected to the butt rigging by knobs or shackles. The use of molles or cold shuts is prohibited in all components of the butt rigging. All butt rigging shall be designed to prevent loss of chokers and defective swivels shall not be used. Open hooks shall not be used to connect lines to the butt rigging.

(g) When heel tackle is fastened near machine, safety line must be placed in such manner that in case of breakage, lines shall not strike power unit and endanger operator.

(h) Only in case of necessity shall any metallic object be driven into a log. The metal must be removed immediately when splice or other work is completed. Stumps shall be used whenever possible for splicing.

PUT CLIPS ON RIGHT



Figure No. 2

Clips should be spaced at least six rope diameters apart to get the maximum holding power and should always be attached with the base or saddle of the clip against the longer or "live" end of the rope. The "U" bolt goes over the dead end. This is the only right way. Do not reverse the clips or stagger them. Otherwise the "U" bolt will cut into the live rope when the load is applied. After the rope has been used and is under tension, the clips should again be tightened to take up any looseness caused by the tension reducing the rope diameter. Remember that even when properly applied, a clip fastening has only about eighty percent of the strength of the rope and far less than that when on wrong.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-543, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-543, filed 9/21/79.]

WAC 296-54-545 Rigging—Wood spar trees. (1)

Wood spar trees shall be of sound material of sufficient size and strength to withstand any stresses which may be imposed by any equipment used for that specific operation. The top of the tree shall extend not more than sixteen feet above the top guylines on spar trees over fifty feet in height. Spar trees less than fifty feet in height shall extend no more than eight feet above the top guylines. School marms used as spar trees shall be topped at the forks. Spar trees, except cedar, must be barked where guylines, straps, bull blocks and tree plates are placed.

(2) Spar trees must be topped and limbs must be cut off close so that running lines will not foul or saw on protruding knots.

(3) At least four tree plates shall be placed under top guylines on spar trees over fifty feet in height and at least three tree plates shall be used on spar trees less than fifty feet in height.

(4) Tree plates shall be equipped with lugs or other suitable means of holding them in place.

(5) When spar trees are raised, stumps used for snubbing shall be properly notched. Guylines shall be held by some mechanical means. Snubbing by hand is prohibited.

(6) All rub trees shall be limbed and topped.

(7) Guylines.

(a) Wood spar trees using a line greater than 7/8-inch and used as loading and yarding trees shall have at least six top guys and four buckle guys, providing a sail guy is used.

(b) Wood spar trees using a mainline greater than 7/8-inch and used only as yarding trees shall have at least six top guys and, at least three buckle guys shall be used.

(c) Wood spar trees used for loading only with crotch line, spreader bar or swinging boom shall have at least four top guys and, at least three buckle guys shall be used.

(d) Wood spar trees used for any skyline system of logging shall have additional guylines as are necessary to assure rigidity of tree at skyline jack, skidding block, receding and transfer line blocks, and loading rigging.

(e) Wood spar trees used for transfer shall have at least five top guys and, at least three buckle guys shall be used.

(f) When high lead block is hung below buckle guys, at least three top guys of equal strength to the mainline shall be used to keep the top from swaying.

(g) When buckle guys are required, they shall be installed on the tree where they will provide the maximum effectiveness.

(8) Loose material such as bark, spikes, straps or chains not in use and slabs caused by bumping logs or chafing straps must be removed from the spar tree. Heavy bark shall be removed from trees used for a permanent installation.

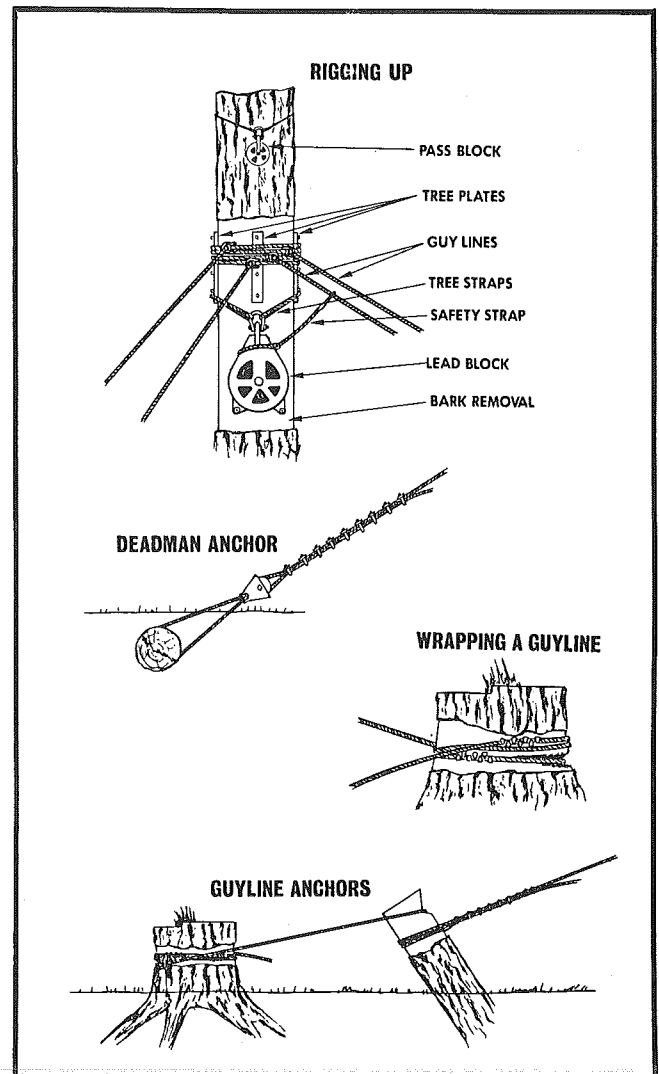
[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-545, filed 9/21/79.]

WAC 296-54-547 Rigging—Tail tree. (1) No work shall continue on tail tree while the climber is working on the head tree or vice versa, if trees are connected by any line.

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(2) Tail trees shall be adequately guyed to withstand any stress to which the tree may be subjected. Live (slackline) or standing skylines may be anchored to the base of standing trees only if no part of the tree will enter the work area (cutting unit) if pulled over. The guyline shall be anchored as low as possible to the base of the tree. If using a live (slackline) standing or running (Grabinski) skyline, the tail tree need not be topped provided the slackline or skyline passes through a jack or block on the tree before being anchored. At least two guylines shall be installed to support the tail tree and may be anchored to the base of standing trees if the above conditions are complied with. Attaching the end of the skyline or slackline to the base of the tail tree is prohibited.

Note: See Figure No. 3 for rigging illustrations.



[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-547, filed 9/21/79.]

WAC 296-54-549 Lines, straps and guyline attachments—Steel spars. (1) When in use, steel tower guyline safety straps shall have a minimum amount of slack.

(2) A safety strap shall be installed on steel towers at the bight of the guylines to prevent the guylines from falling in the case of failure of guyline attachments, guyline lug rings or collar plates, where such exist. Such devices shall have a breaking strength at least equivalent to that of the guylines.

(3) The use of cable clips or clamps for joining the ends of steel tower guylines safety straps is prohibited, unless used to secure end of rolled eye.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-549, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-549, filed 9/21/79.]

WAC 296-54-551 Yarding, loading, skidding and chipping machines—General requirements. (1) The employer shall assure that each machine, including any machine provided by an employee, is maintained in serviceable condition and the following:

(a) The employer shall assure that each machine, including any machine provided by an employee, is inspected before initial use during each workshift. Defects or damage shall be repaired or the unserviceable machine shall be replaced before work is commenced.

(b) The employer shall assure that operating and maintenance instructions are available on the machine or in the area where the machine is being operated. Each machine operator and maintenance employee shall comply with the operating and maintenance instructions.

(c) Each machine shall be operated only from the operator's station or as otherwise recommended by the manufacturer.

(d) No employee shall ride on any load.

(2) Overhead protection and other barriers shall be installed to protect the operator from lines, limbs and other moving materials on or over all yarding, loading or skidding machines. The overhead cab covering shall be of solid material and shall extend over the entire canopy.

Exception:

Tower or spar type cable yarders may be equipped with a "sunroof" viewport in the solid material cab cover to enable the operator to see the top of the spar while seated in the normal operating position. When a viewport is provided it shall be constructed to sustain the same structural loading factors as the solid material cover or the viewport shall also be covered by standard cab-opening guards.

(3) When using a yarder, loader or skidding machine, the location of the machine or position of the yarder shall be such that the operator will not be endangered by incoming logs or debris.

(4) Logging machines and their components shall be securely anchored to their bases.

(5) A safe and adequate means of access and egress to all parts of logging machinery where persons must go shall be provided and maintained in a safe and uncluttered condition. Machine access systems, meeting the specifications of the Society of Automotive Engineers, SAE J185, June 1988, "Recommended Practice for Access Systems for Off-Road Machines," shall be provided for each machine where the operator or any other employee must climb onto the machine

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to enter the cab or to perform maintenance. Walking and working surfaces of each machine and machine work station shall have a slip-resistant surface to assure safe footing.

(6) Any logging equipment having a single cab entrance door, shall be equipped with an alternate means of escape from the cab should the door be blocked in the event of vehicle rollover or fire. Door latches shall be operable from both sides.

(7) Logging machines shall be kept free of flammable waste materials and any materials which might contribute to slipping, tripping or falling.

(8) Logging machine engines shall be stopped during inspection or repairing, except where operation is required for adjustment.

(9) Grab rails shall be provided and maintained in good repair on all walkways of stationary units elevated more than four feet.

(10) Standard safeguards shall be provided at every place on a machine where persons may be exposed to contact with revolving parts or pinchpoints during normal operations.

(11) To protect workers from exposure to the hazardous pinchpoint area between the rotating superstructure and the nonrotating undercarriage of any logging machine, signs shall be conspicuously posted on all sides of that type machine warning workers: "DANGER - STAY CLEAR." This requirement shall not apply when:

(a) The distance from the highest point of the undercarriage to the lowest point of the rotating superstructure is greater than eighteen inches. This applies only to that portion of the rotating superstructure that swings directly over the undercarriage;

(b) The distance from the ground to the lowest point of the rotating superstructure is greater than five feet six inches. This applies only to that portion of the rotating superstructure that swings directly over the undercarriage; or

(c) On crawler-type track-mounted logging machines only, the rotating superstructure is positioned at a right angle to the tracks, and the distance from the side of the cab to the extreme end of the track is four feet or less. This exemption shall apply to side barricades only; barricades between the tracks at both ends of any crawler-type logging machine are required regardless of the right angle dimension.

(12) Items of personal property, tools or other miscellaneous materials shall not be stored on or near any logging machine if retrieval of such items would expose a worker to the hazardous pinchpoint referred to in subsection (11) of this section.

(13) Workers shall approach the hazardous pinchpoint area referenced in subsection (11) of this section, only after informing the operator of their intent and receiving acknowledgment that the operator understands their intention. All such machines shall be stopped while any worker is in the hazardous pinchpoint area.

(14) A minimum distance of thirty-six inch clearance shall be maintained between the counterweight of a loading machine and trees, logs, banks, trucks, etc., while the machine is in operation. If this clearance cannot be maintained, suitable barricades with warning signs attached, similar to a standard guardrail, shall be installed to isolate the hazardous area. "DANGER—36 inch clearance" shall be marked

in contrasting colors on sides and face of counterweight on shovels, loaders and other swing-type logging equipment.

(15) Guarding.

(a) Each machine shall be equipped with guarding to protect employees from exposed moving elements, such as but not limited to, shafts, pulleys, belts on conveyors, and gears, in accordance with the requirements of this standard and chapter 296-24 WAC, Part C, Machinery and machine guarding.

(b) Each machine used for debarking, limbing and chipping shall be equipped with guarding to protect employees from flying wood chunks, logs, chips, bark, limbs and other material in accordance with the requirements of chapter 296-24 WAC, Part C, Machinery and machine guarding.

(16) Stationary logging machines and their components shall be securely anchored or otherwise stabilized to prevent movement while yarding or skidding.

(17) Ends of drum lines shall be securely fastened to the drum and at least three wraps shall be maintained on the drum at all times. (This rule does not apply to tractor winch lines.)

(18) Such units shall not be tied to any part of the towing unit, when they are being moved on truck and trailer units.

(19) Logs shall not be moved, swung or held over any persons.

(20) Brow logs in the loading or unloading area shall be blocked or secured to prevent movement. Log decks shall be maintained in a safe condition and shall not present a hazard of logs rolling or sliding on workers.

(21) Brakes shall be set and brake locking devices engaged on logging machines when the operator leaves his normal operating position.

(22) Guyline drum controls and outrigger controls shall be separated, color coded or marked in a manner that will prevent engaging of the wrong control.

(23) Exhaust systems.

(a) Engines not equipped with turbochargers shall comply with the department of natural resources chapter 332-24 WAC requirements for spark emitting equipment; and

(b) Each machine muffler provided by the manufacturer, or their equivalent, shall be in place at all times the machine is in operation; and

(c) Exhaust pipes shall be located or insulated to protect workers from accidental contact with the pipes or muffler and shall direct exhaust gases away from the operator and other persons.

(24) Glass on logging machines shall be safety glass or equivalent and shall be free of deposits of oil, mud, or defects that could endanger the operator or other persons. When transparent material is used to enclose the upper portion of the cab, it shall be made of safety glass or other material that the employer demonstrates provides equivalent protection and visibility.

(25) Broken or defective glass shall be removed and replaced.

(26) Where safety glass or equivalent, does not provide adequate operator protection from flying chokers, chunks, saplings, limbs, etc., an additional metal screen and/or barrier shall be provided over the safety glass. The operator's vision shall not be impaired. Barriers shall consist of 1/4-inch diameter woven wire material with maximum two inch openings,

3/4-inch diameter steel rod with eight inch maximum openings in any direction or barriers so designed and constructed to provide equivalent operator protection. Such barriers shall be installed no closer than four inches to the glass to enable keeping the glass clean.

(27) Except for hydraulic drums, brakes shall be installed on all logging machines and maintained in effective working condition. Brake levers shall be provided with a ratchet or other effective means for securely holding drums. Brakes shall be tested prior to putting the machine in operation. If defective, they shall be repaired immediately.

(28) A stable base shall be provided under outriggers or leveling pads and a means shall be provided to hold outriggers in both the retracted and extended position.

(29) Abrasive contact with hydraulic hose, tubing or fittings shall be eliminated before further use and defective hydraulic hoses, lines and fittings shall be replaced.

(30) When moving logging machines, the driver or operator shall have a clear and unobstructed view of the direction of travel. When this is not possible, a signalperson with a clear and unobstructed view of the direction of travel shall be designated and used to direct movement of the machine.

(31) Where a signalperson is used, the equipment operator shall move the equipment only on signal from the designated signalperson and only when the signal is distinct and clearly understood.

(32) When moving power units, persons other than the operator and the person in charge shall not be permitted to ride thereon.

(33) All obstructions which may reach the operator while moving machines, shall be removed.

(34) Only shackles with threaded pins shall be used for connecting moving rigging.

(35) Anchors used for moving power units shall be carefully chosen and must be stable.

(36) When snubbing a machine down a steep slope, use the mainline for snubbing and pull with the haulback whenever possible.

(37) Self-powered mobile logging machines of the type where towers or spars can be raised, shall not travel on steep road grades unless they are securely snubbed or towed.

(38) When moving, all persons working on the landing shall stay in the clear of the machine and shall inform the operator of their intention to approach or be near the machine.

(39) Service brakes shall be provided on crawler crane-type logging machines that will bring the machine to a complete stop from normal travel speeds.

(40) A traction lock or brake or an equivalent locking and braking system shall be provided on crawler crane-type machines that is capable of holding the machine stationary under normal working conditions, and on any grade the machine is capable of negotiating.

(41) No modifications or additions which affect the capacity or safe operation of the equipment shall be made by the employer without written approval of the manufacturer or a qualified engineer. If such modifications or changes are made, the capacity, operation and maintenance instruction plates, tags, or decals, shall be changed accordingly. In no

case shall the original safety factor of the equipment be reduced.

(42) Equipment shall be classed and used according to the manufacturer's rating. Where low gear ratios or other devices are installed to increase the line pull in accordance with subsection (41) of this section, the size of the rigging shall be increased accordingly so that it will safely withstand the increased strains.

(43) Every tractor, skidder, front-end loader, scraper, grader and dozer shall be equipped with a roll-over protective structure (R.O.P.S.). Such structures shall be installed, tested and maintained in accordance with:

(a) WAC 296-155-950 through 296-155-965 of the safety standards for construction, if manufactured prior to October 21, 1979.

(b) The society of automotive engineers SAE 1040a-1975, "performance criteria for roll-over protective structures (ROPS) for earthmoving, construction, logging and industrial vehicles," if manufactured after the effective date of this chapter.

(44) The ROPS shall be of sufficient height and width so that it will not impair the movements of the operator or prevent his immediate escape from the vehicle in emergencies and shall allow as much visibility as possible. Clearance above the deck and the ROPS of the vehicle at points of egress shall not be less than fifty-two inches (1.3 meters).

(45) Certified roll-over protective systems shall be identified by a metal tag permanently attached to the ROPS in a position where it may be easily read from the ground. The tag shall be permanently and clearly stamped, etched or embossed indicating the name and address of the certifying manufacturer or registered professional engineer, the ROPS model number (if any) and the vehicle make, model or serial number the ROPS is designed to fit.

(46) Roll-over protective structure systems shall be maintained in a manner that will preserve their original strength. Welding shall be performed by qualified welders only. (A qualified welder is defined under "welder qualification" in American Welding Society A.W.S. A3.0-69.)

(47) Every tractor, skidder, front-end loader, log stacker, forklift truck, scraper, grader and dozer shall be equipped with a FOPS. Such structures shall be installed, tested and maintained in accordance with:

(a) The society of automotive engineers SAE J231-1971, "minimum performance criteria for falling object protective structures (F.O.P.S.) prior to February 9, 1995."

(b) Society of automotive engineers SAE J231, January 1981, "minimum performance criteria for falling object protective structures (FOPS) for each tractor, skidder, log stacker, log loader and mechanical felling device, such as tree shears or feller-buncher, placed into initial service after February 9, 1995."

(c) The employer shall replace FOPS which have been removed from any machine.

(48) Vehicles equipped with ROPS or FOPS as required in subsections (43) and (47) of this section, shall comply with the society of automotive engineers SAE J397a-1972, "deflection limiting volume for laboratory evaluation of roll-over protective structures (ROPS) and falling object protective structures (FOPS) of construction and industrial vehi-

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cles." Vehicles placed into initial service after February 9, 1995, shall meet the requirements of SAE J397-1988.

(49) The opening in the rear of the ROPS on the crawler or rubber-tired tractors (skidders) shall be covered with 1/4-inch diameter woven wire having not less than 1-1/2-inches or more than 2-inch mesh, or material which will afford equivalent protection for the operator. The covering shall be affixed to the structural members so that ample clearance is provided between the screen and the back of the operator. Structural members shall be free from projections which would tend to puncture or tear flesh or clothing. Suitable safeguards or barricades shall be installed, in addition to the screen, to protect the operator when there is a possibility of being struck by any material that could enter from the rear.

(50) Crawler and rubber-tired tractors (skidders) working in areas where limbs or brush may endanger the operator shall be guarded. Shear or deflector guards shall be installed on each side of the vehicle at an angle leading forward and down from the top front edge of the canopy of the vehicle, which will tend to slide the brush or limbs up and over the top of the canopy. Open mesh material with openings of a size that will reject the entrance of an object larger than 1-3/4-inches in diameter, shall be extended forward as far as possible from the rear corners of the cab sides to give the maximum protection against obstacles, branches, etc. entering the cab area. Deflectors shall also be installed ahead of the operator to deflect whipping saplings and branches. These shall be located so as not to impede ingress or egress from the compartment area. The floor and lower portion of the cab shall be completely enclosed with solid material, except at entrances, to prevent the operator from being injured by obstacles which otherwise could enter the cab compartment.

(51) Enclosures for agricultural and industrial tractors manufactured after September 1, 1972, shall be constructed, designed and installed as detailed in the society of automotive engineers technical report J168. Each machine manufactured after August 1, 1996, shall have a cab that is fully enclosed with mesh material with openings no greater than 2 inches (5.08 cm) at its least dimension. The cab may be enclosed with other material(s) where the employer demonstrates such material(s) provides equivalent protection and visibility. Exception: Equivalent visibility is not required for the lower portion of the cab where there are control panels or similar obstructions in the cab, or where visibility is not necessary for safe operation of the machine.

(52) All bidirectional machines, such as rollers, compactors, front-end loaders, log stackers, log loaders, bulldozers, shovels, and similar equipment, shall be equipped with a horn distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in an operative condition.

(53) No employer shall permit earthmoving, compacting, or yarding equipment, which has an obstructed view to the rear, to be used in reverse gear unless the equipment has in operation a reverse signal alarm distinguishable from the surrounding noise level or an employee signals that it is safe to do so.

(54) Overhead guards. Each forklift shall be equipped with an overhead guard meeting the requirements of the

American Society of Mechanical Engineers, ASME B56.6-1992 (with addenda), "Safety Standard for Rough Terrain Forklift Trucks."

(55) Chipping (in-woods locations).

(a) Chipper access covers or doors shall not be opened until the drum or disc is at a complete stop.

(b) Infeed and discharge ports shall be guarded to prevent contact with the disc, knives, or blower blades.

(c) The chipper shall be shut down and locked out in accordance with the requirements of chapter 296-24 WAC, Part A-4 when an employee performs any servicing or maintenance.

(d) Detached trailer chippers shall be chocked during usage on any slope where rolling or sliding of the chipper is reasonably foreseeable.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-551, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-551, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-551, filed 9/21/79.]

WAC 296-54-553 Yarding, loading and skidding machines—Mobile towers and boom-type yarding and loading machines. (1) Portable (mobile) tower specification plate. A specification plate shall be permanently attached to the base of each portable (mobile) tower so it can be easily read by a person standing on the ground or on the base platform. It shall contain the following information:

(a) Name and address of manufacturer and model number;

(b) The maximum diameter of the mainline or skyline for which the unit is designed and size of haulback and mainline to be used together if drums are interlocking or automatic tensioning type;

(c) The number and size of guylines required to stabilize the unit;

(d) The maximum length and capacity of a loading boom or similar equipment which may be attached if the structure is engineered for such;

(e) If the unit is designed for use on any skyline system of logging; and

(f) Maximum degree of inclination from vertical at which the spar (tower) may be used.

(2) The critical parts of portable spars (towers) shall be inspected by a qualified person at reasonable intervals while in service and each time the spar (tower) is lowered. If indication of failure or weakness is noted or suspected, the part shall be inspected by an approved method and found to be safe, or it shall be repaired or replaced before the operation is allowed to proceed.

(3) Blocks and fair leads shall be so located that there will be no chafing or sawing of any line or part of the structure.

(4) Guyline attachments.

(a) Power guylines used for stabilizing any unit may be chocked around an adequately notched stump if using a shackle or approved choker attachment. Three full wraps or more must be placed around an adequately notched stump to secure the guyline if clamps are used. Guyline extensions shall be property shackled to the guylines.

(b) When using a deadman anchor to support a guyline, the connection shall be made by properly shackling both eyes of the anchor strap to the guyline.

(c) If guylines on metal spars or towers are not power guylines, they shall be secured to stumps or anchorages in the same manner as guylines on wood spar trees.

(5) Power driven devices shall be securely anchored when used to tighten guylines. Holding of such devices manually is prohibited.

(6) Machine stabilization.

(a) Machines or equipment shall be stabilized by their design or the attachment of guylines or other devices which will prevent the machine from overturning. Machine operators shall be advised of the stability limitations of the equipment.

(b) If stabilization of a machine is dependent upon the use of hydraulic outriggers, a pilot operated hydraulic check valve or other locking device shall be installed to prohibit the outrigger from retracting in case a hydraulic line breaks, except when proper blocking is provided.

(7) A qualified person shall direct each raising or lowering of a portable spar or tower.

(8) All persons not engaged in the actual raising or lowering of portable spars or towers shall stay in the clear during such operations.

(9) Guylines required in rigging spars or towers shall be evenly spooled to prevent fouling.

(10) Portable spars or towers shall be leveled to provide even line spooling and avoid excessive stress on component parts.

(11) The portable spar or tower shall be lowered or supported so the stability of the machine is not impaired during movement of the portable spar or tower.

(12) Guylines of portable spars or towers shall not be anchored to standing trees if the unit is used for yarding as a head tree.

(13) Timbers used for masts or booms shall be straight-grained, solid, and capable of withstanding the working load.

(14) Boom points of timber booms shall be equipped with metal straps, plates, or other devices as needed to properly secure eyebolts and fittings used to support lines, blocks, or other rigging.

(15) All mobile vehicles on which yarding equipment, towers, spars, masts or booms are installed, shall be maintained in a safe operating condition.

(16) A-frames shall be secured against displacement and the tops shall be securely bolted or lashed to prevent displacement.

(17) When any portable-type tower, A-frame or spar is used, the base shall be securely and solidly supported.

(18) All loading, unloading and skidding machines shall be equipped with a horn or whistle which is audible above the surrounding noise level. Such horn or whistle shall be maintained in an operative condition.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-553, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-553, filed 9/21/79.]

WAC 296-54-555 Yarding—General requirements.

(1) Workers shall be alert and be positioned in the clear where they will not be exposed to the hazards of moving logs, saplings, root wads, chunks, rigging, or any other material which might be put in motion by the rigging or turn, before the "go ahead" signal is given. They shall remain in the clear at all times while the rigging is moving.

(2) No person shall be near rigging which is stopped at a hangup, until the rigging has been slacked to reduce the hazard.

(3) No person shall stand or remain within the bight of any running line, nor in a position where he could be struck by a line were it to break or come loose.

(4) Whenever possible, chokers shall be set from the uphill side of a log. Persons shall not be on the lower side of a log which appears to be unstable or likely to roll.

(5) Wire rope used for chokers shall not exceed seventy-five percent of the breaking strength of the mainline.

(6) Chokers shall be placed near the end of the log/tree whenever possible.

Exception: A longer butt attachment point may be used when abnormally long logs or tree-length logs are being yarded and the long-butt is necessary to safely land the logs/trees on the available landing space.

(7) When pulling lines, do not stand close to fair leads or blocks.

(8) Lines shall not be guided on drums with hands or feet. The use of a bar or equivalent means is recommended.

(9) Yarding with more than one unit on any one head spar is prohibited.

(10) The angle between the power unit, the high lead block, and the mainline road shall not exceed a square lead on rigged spars. When using portable spars or towers, the location of the machine or position of the operator shall be such that the operator shall not be endangered by incoming logs.

(11) When there is danger of tail block straps slipping up or off the stump or tree, the stump or tree shall be adequately notched or the line properly wrapped and secured. When the tail tree or stump is not secure, it shall be tied back.

(12) When yarding is being done during the hours of darkness, the area shall be provided with illumination which will allow persons to safely perform their duties. The source of illumination shall be located and directed creating a minimum of shadows and glare. If using a portable tail-hold, lights shall be directed on the equipment to allow the person to visually ascertain that the tail-hold equipment remains stabilized.

(13) No person shall be required or allowed to ride on a turn of logs or rigging excepting the passline. The practice of holding on to moving rigging or chokers to assist a person by being pulled uphill shall be prohibited.

(14) Wire rope shall be wound evenly on the drum and not be allowed to lap one layer on another in an irregular manner. Sheaves shall be smooth and free from defects that could cause rope damage.

(15) Chaser shall be sure that turns are safely landed before approaching to remove the chokers.

(16) Signaling machine operator at landings by throwing bark, chips or other material in the air is prohibited. Whistle or hand signals shall be used at all times.

(17) Logs shall not be landed while loaders or chasers are working in the chutes. Logs shall not be removed from yarder tree by the loader or tractors while the chaser is unhooking a turn from the yarder.

(18) Landings shall be as level as possible and of sufficient size to safely accommodate the majority of type turns to be yarded. At least two-thirds of the log shall rest on the ground or other substantial material when landed. Logs shall be set on the ground or deck and not dropped when being landed. Long sticks shall be safely removed before additional logs are landed.

(19) Chokers shall not be used on a grapple system when the yarder operator cannot clearly see the persons setting the choker, unless conventional whistle signals are used.

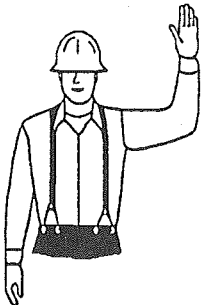
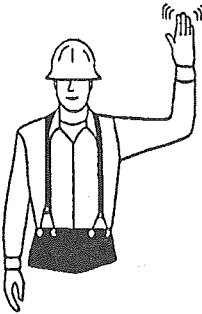

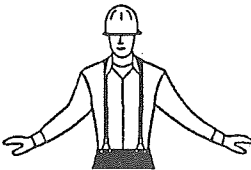
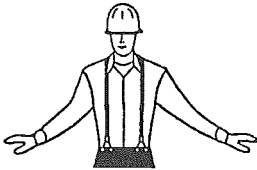
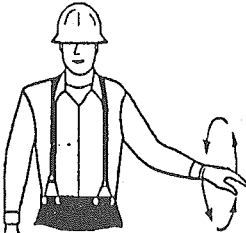
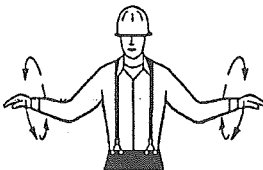
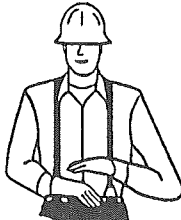
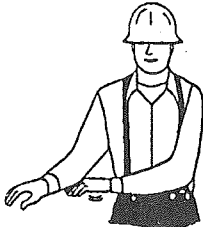

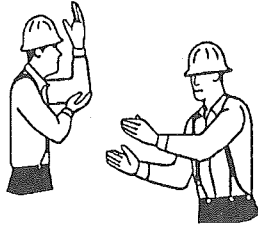
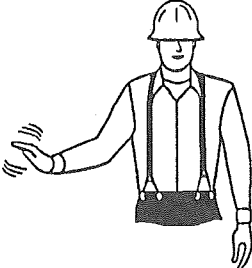
(20) Landings shall be free of root wads, limbs, tops, etc., that constitute a safety hazard.

(21) When shorter logs are yarded in the same turn with long sticks, the shorter logs shall be landed and chokers released before the long stick choker is released.

Note: See Figures No. 4-A and 4-B for Standard Hand Signals for High Lead Logging.

(22) Each yarded tree/log shall be placed in a location that does not create a hazard for an employee and an orderly manner so that the trees/logs are stable before bucking or limbing is commenced.

STANDARD HAND SIGNALS FOR HIGH LEAD LOGGING

 <p>1. Mainline ahead, normal. Raise one arm.</p>	 <p>2. Mainline ahead, fast. One arm raised, hand fluttering.</p>	 <p>3. Mainline ahead, slow. Both arms raised.</p>	 <p>4. Stop any moving line and hold.</p>
 <p>5. Slack the mainline, easy. Both hands extended at sides fluttering hands.</p>	 <p>6. Ahead on haulback, normal speed. One arm extended rotating.</p>	 <p>7. Haulback ahead, slow. Both arms extended, rotating.</p>	 <p>8. Slack the haulback. Extend hand out flat and pat back of hand with other hand.</p>
 <p>9. Slack the strawline. Hand to elbow, flexing hand.</p>	 <p>10. Ahead on strawline. Touch hand to bent elbow.</p>	 <p>and then</p> <p>11. Ahead on strawline, slow.</p>	 <p>12. Slack mainline, all off. Arm extended at side flipping wrist.</p>

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-555, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-555, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-555, filed 9/21/79.]

WAC 296-54-557 Yarding—Tractors, skidders and rough terrain log loaders (to include feller bunchers and tree shears). (1) Operators shall ensure that all persons are safely in the clear before initiating or continuing the movement of any mobile equipment. The machine shall be operated at such a distance from employees and other machines such that operation will not create a hazard for an employee.

[Title 296 WAC—p. 1168]

(2) No person shall ride on any mobile equipment, except where adequate and protected seats, or other safe facilities have been provided.

(3) While in use, tractors and skidders shall be maintained in a safe operable condition, with all guards in proper places.

(4) No person shall be under a tractor or other mobile equipment, or be placed in a hazardous position around the equipment without first making certain it cannot move or be moved by another person.

(5) Prior to working on tractor or skidder blades, arches, or other equipment, the equipment must be blocked up lowered to the ground or otherwise secured against slipping or falling.

(1999 Ed.)

(6) When making repairs to tractor or skidder equipment, such as blades, arches, etc., the engine shall be stopped. The engine may be run when necessary for making adjustments to the engine or equipment.

(7) Operators shall operate and control their machines in a safe manner and avoid operations in areas where machine stability may not be maintained.

(8) The following safe work procedures shall be adhered to:

(a) When hobo logs are picked up with a log turn, the turn shall be dropped to free the hobo.

(b) No line shall be allowed to trail behind the tractor or skidder where it may hang up and snap forward.

(c) Each machine shall be positioned during winching so the machine and winch are operated within their design limits.

(d) Grapple skidded log turns shall be evenly bunched with squared butt ends, securely grappled and safely positioned before travel commences.

(e) Before climbing or descending grades, the proper gear shall be selected to allow the engine to govern the tractor speed.

(f) On side hills, an abrupt turn uphill shall be avoided. The tractor or skidder shall be backed downhill first then turned uphill. The turn may be slacked off as necessary to permit this maneuver.

(g) The operator shall, before leaving a tractor or skidder, lower the blade to the ground and apply the parking brake.

(h) Tractor or skidder speed shall be adjusted to the circumstances prevailing. Excessive or uncontrolled speed shall be avoided.

(i) Winch lines on logging tractors or skidders shall be attached to the drum with a break-away device.

(9) When hand signals are required for giving instructions to the tractor or skidder operator, the signals as illustrated in Figure No. 5 shall be used.

(10) Brakes.

(a) Service brakes shall be sufficient to stop and hold each machine and its rated load capacity on the slopes over which it is being operated. They shall be effective whether or not the engine is running and regardless of the direction of travel.

(b) Each machine placed into initial service on or after September 8, 1995, shall also be equipped with back-up or secondary brakes that are capable of stopping the machine regardless of the direction of travel or whether the engine is running; and parking brakes that are capable of continuously holding a stopped machine stationary.

(11) Tractors and skidders shall be provided with a brake locking device that will hold the machine indefinitely on any grade on which it is being operated.

(12) Operating a tractor or skidder with defective steering or braking devices is prohibited.

(13) Arches shall be equipped with line guards.

(14) Where tractor and skidder operators or helpers, because of the nature or their work duties, are required to wear calk soled footwear, the decks and operating foot controls shall be covered with a suitable nonslip material.

(15) Glass used in windshields or in cabs shall be of "safety glass." Broken or cracked glass shall be replaced as soon as practical. Barriers shall be provided, as needed, to protect the glass from being broken by using screen, bars or other material. The protective material shall be a type that will not create a hazard by undue impairment of the operators' vision.

(16) Barriers shall be constructed of at least 1/4-inch diameter woven wire with two inch maximum openings or other material providing equivalent protection. The barrier shall be installed at least four inches from the glass to provide space to clean the glass.

(17) Enclosed-type cabs installed on mobile equipment shall have two means of exit. One may be deemed as an emergency exit and be available for use at all times, regardless of the position of the side arms or other movable parts of the machine. (An easily removable window will be acceptable as the emergency exit if it is of adequate size for a person to readily exit through.)

(18) Before the operator leaves the operator's station of a machine, it shall be secured as follows:

(a) The parking brake or brake locks shall be applied;

(b) The transmission shall be placed in the manufacturer's specified park position; and

(c) Each moving element such as, but not limited to blades, buckets, saws and shears, shall be lowered to the ground or otherwise secured.

(19) No load shall exceed the rated capacity of the pallet, trailer, or other carrier.

(20) Seat belts required by WAC 296-54-515(19) shall have buckles of the quick release type, designed to minimize the possibility of accidental release.

(21) Before a tractor or skidder is started or moved, the operator shall be certain nothing is in the way that could be set in motion by the movement of the machine thereby endangering persons.

(22) A log or turn shall not be moved until all persons are in the clear (behind the turn and on the uphill side on sloping ground).

(23) Towed equipment, such as but not limited to, skid pans, pallets, arches, and trailers, shall be attached to each machine or vehicle in such a manner as to allow a full ninety degree turn; to prevent overrunning of the towing machine or vehicle; and to assure that the operator is always in control of the towed equipment.

(24) Tractors or skidders shall not be operated within a radius of two tree heights of trees being felled unless called upon by the cutter or faller to ground lodged trees. All cutters shall be notified of the tractor or skidder entrance into the area and all felling within two tree lengths of the tractor or skidder shall be stopped.

(25) Except where electrical distribution and transmission lines have been de-energized and visibly grounded at point of work or where insulating barriers, not a part of or an attachment to the equipment or machinery, have been erected to prevent physical contact with the lines, equipment or machines shall be operated proximate to power lines only in accordance with the following:

(a) For lines rated 50 kV or below, minimum clearance between the lines and any part of the equipment or machine shall be ten feet;

(b) For lines rated over 50 kV, minimum clearance between the lines and any part of the equipment or machine shall be ten feet plus 0.4 inch for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than ten feet;

(c) In transit with no load and boom or extended equipment lowered, the equipment clearance shall be a minimum of four feet for voltages less than 50 kV, and ten feet for voltages over 50 kV up to and including 345 kV, and sixteen feet for voltages up to and including 750 kV;

(d) A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means;

(e) Any overhead wire shall be considered to be an energized line unless and until the person owning such line or the electrical utility authorities indicate it is not an energized line and it has been visibly grounded.

(26) Log piles and decks shall be located and constructed to provide working areas around them that will accommodate the safe movement of personnel and machinery.

(27) Braking systems required by subsection (10) of this section, shall be capable of stopping the equipment fully loaded as specified in the society of automotive engineers technical reports listed in subdivisions (a), (b), (c) or (d) of

this subsection and shall be installed by June 30, 1973. All rubber-tired tractors or other types of mobile equipment listed below, manufactured after the effective date of these standards, shall have braking systems and requirements specified in the applicable technical reports of the society of automotive engineers as follows:

(a) Brake systems for off-highway, rubber-tired, self-propelled scrapers shall meet or exceed the requirements outlined in SAE technical report J319b.

(b) Brake systems for off-highway, rubber-tired, front-end loaders, log stackers and dozers (skidders) shall meet or exceed the requirements outlined in SAE technical report J237.

(c) Brake systems for rubber-tired, self-propelled graders shall meet or exceed the requirements outlined in SAE technical report J236.

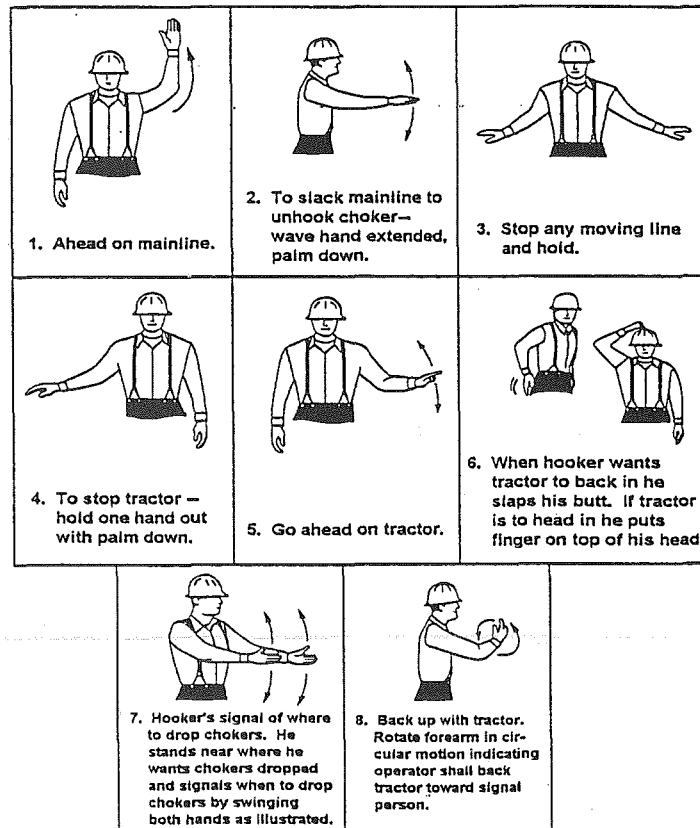
(d) Brake systems for off-highway trucks and wagons shall meet or exceed the requirements outlined in SAE technical report J166.

(28) The yarding machine or vehicle, including its load, shall be operated with safe clearance from all obstructions.

(29) The overhead covering of each cab shall be of solid material and shall extend over the entire canopy.

(30) If a hydraulic or pneumatic storage device can move the moving elements such as, but not limited to, blades, buckets, saws and shears, after the machine is shut down, the pressure or stored energy from the element shall be discharged as specified by the manufacturer.

STANDARD SIGNALS FOR TRACTOR LOGGING



[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-557, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-557, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-557, filed 9/21/79.]

WAC 296-54-559 Yarding—Helicopters and helicopter cranes. (1) Helicopters and helicopter cranes shall comply with any applicable regulations of the Federal Aviation Administration.

(2) Prior to each day's operation, a briefing shall be conducted. This briefing shall set forth the plan of operation for the pilot and ground personnel.

(3) A take-off path from the log pickup point shall be established, and shall be made known to all workers in that area before the first turn of logs is moved.

(4) The helicopter flight path to and from the drop zone shall be designated and no equipment or personnel (other than flight personnel necessary to assist landing and take-off) will occupy these areas during helicopter arrival or departure.

(5) The approach to the landing shall be clear and long enough to prevent tree tops from being pulled into the landing.

(6) The helicopter shall not pass over an area in which cutters are working at a height which would cause the rotor wash to inhibit a cutter's ability to safely control a tree or dislodge limbs.

(7) Drop zones shall be twice the nominal length of logs to be landed.

(8) The drop zone shall be no less than one hundred twenty-five feet from the loading or decking area.

(9) Separate areas shall be designated for landing logs and fueling the helicopter(s).

(10) The yarding helicopter shall be equipped with a siren to warn workers of any hazardous situation.

(11) Workers shall remain in the clear as chokers are being delivered, and under no circumstances will workers move under the helicopter that is delivering the chokers or take hold of the chokers before they have been released by the helicopter.

(12) Log pickup shall be arranged in a manner that the hook up crew will not work on slopes below felled and bucked timber.

(13) If the load must be lightened, the hook shall be placed on the ground on the uphill side of the turn before the hooker approaches to release the excess logs.

(14) Landing crew shall be in the clear before logs are dropped.

(15) One end of all the logs in the turn shall be touching the ground and lowered to an angle of not more than 45° from the horizontal before the chokers are released.

(16) Logs shall be laid on the ground and the helicopter will be completely free of the choker(s) before workers approach the logs.

(17) If the load will not release from the hook, the load and the hook shall be on the ground before workers approach to release the hook manually.

(18) Loads shall be properly slung. Tag lines shall be of a length that will not permit their being drawn up into rotors. Pressed sleeve, swaged eyes, or equivalent means shall be

used for all freely suspended loads to prevent hand splices from spinning open or cable clamps from loosening.

(19) All electrically operated cargo hooks shall have the electrical activating device so designed and installed as to prevent inadvertent operation. In addition, these cargo hooks shall be equipped with an emergency mechanical control for releasing the load. The hooks shall be tested prior to each day's operation to determine that the release functions properly, both electrically and mechanically.

(20)(a) Personal protective equipment for employees receiving the load shall consist of complete eye protection and hard hats secured by chinstraps, and high visibility vests or outer garments.

(b) Loose-fitting clothing likely to flap in the downwash, and thus be snagged on hoist line, shall not be worn.

(21) Every practical precaution shall be taken to provide for the protection of employees from flying objects in the rotor downwash. All loose gear within one hundred feet of the place of lifting of the load, depositing the load, and all other areas susceptible to rotor downwash shall be secured or removed.

(22) Good housekeeping shall be maintained in all helicopter loading and unloading areas.

(23) The helicopter operator shall be responsible for size, weight, and manner in which loads are connected to the helicopter. If, for any reason, the helicopter operator believes the lift cannot be made safely, the lift shall not be made.

(24) Employees shall not perform work under hovering craft except for that limited period of time necessary to guide, secure, hook and unhook loads. Regardless of whether the hooking or unhooking of a load takes place on the ground or other location in an elevated work position in structural members, a safe means of access and egress, to include an unprogrammed emergency escape route or routes, shall be provided for the employees hooking or unhooking loads.

(25) Static charge on the suspended load shall be dissipated with a grounding device before ground personnel touch the suspended load, or protective rubber gloves shall be worn by all ground personnel touching the suspended load.

(26) The weight of an external load shall not exceed the manufacturer's rating.

(27) Hoist wires or other gear, except for pulling lines or conductors that are allowed to "pay out" from a container or roll off a reel, shall not be attached to any fixed ground structure, or allowed to foul on any fixed structure.

(28) When visibility is reduced by dust or other conditions, ground personnel shall exercise special caution to keep clear of main and stabilizing rotors. Precautions shall also be taken by the employer to eliminate as far as practical reduced visibility.

(29) Signal systems between aircrew and ground personnel shall be understood and checked in advance of hoisting the load. This applies to either radio or hand signal systems. Hand signals shall be as shown in Figure 6.

(30) No unauthorized person shall be allowed to approach within fifty feet of the helicopter when the rotor blades are turning.

(31) Whenever approaching or leaving a helicopter with blades rotating, all employees shall remain in full view of the pilot and keep in a crouched position. Employees shall avoid

the area from the cockpit or cabin rearward unless authorized by the helicopter operator to work there.

(32) Sufficient ground personnel shall be provided, when required, for safe helicopter loading and unloading operations.

(33) There shall be constant reliable communication between the pilot, and a designated employee of the ground crew who acts as a signalperson during the period of loading and unloading. This signalperson shall be distinctly recognizable from other ground personnel.

(34) Open fires shall not be permitted in an area that could result in such fires being spread by the rotor downwash.

(35) Under no circumstances shall the refueling of any type helicopter with either aviation gasoline or Jet B (turbine) type fuel be permitted while the engines are running.

(36) Helicopters using Jet A (turbine-kerosene) type fuel may be refueled with engines running provided the following criteria is met:

(a) No unauthorized persons shall be allowed within fifty feet of the refueling operation or fueling equipment.

(b) A minimum of one thirty-pound fire extinguisher, or a combination of same, good for class A, B and C fires, shall be provided within one hundred feet on the upwind side of the refueling operation.

(c) All fueling personnel shall be thoroughly trained in the refueling operation and in the use of the available fire extinguishing equipment they may be expected to utilize.

(d) There shall be no smoking, open flames, exposed flame heaters, flare pots or open flame lights within fifty feet of the refueling area or fueling equipment. All entrances to the refueling area shall be posted with "NO SMOKING" signs.

(e) Due to the numerous causes of static electricity, it shall be considered present at all times. Prior to starting refueling operations, the fueling equipment and the helicopter shall be grounded and the fueling nozzle shall be electrically bonded to the helicopter. The use of conductive hose shall not be accepted to accomplish this bonding. All grounding and bonding connections shall be electrically and mechanically firm, to clean unpainted metal parts.

(f) To control spills, fuel shall be pumped either by hand or power. Pouring or gravity flow shall not be permitted. Self-closing nozzles or deadman controls shall be used and shall not be blocked open. Nozzles shall not be dragged along the ground.

(g) In case of a spill, the fueling operation shall be immediately stopped until such time as the person-in-charge determines that it is safe to resume the refueling operation.

(h) When ambient temperatures have been in the 100 degree F. range for an extended period of time, all refueling of helicopters with the engines running shall be suspended until such time as conditions become suitable to resume refueling with the engines running.







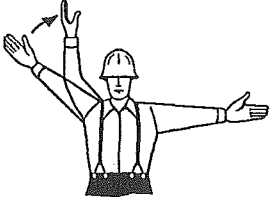

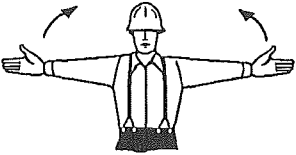
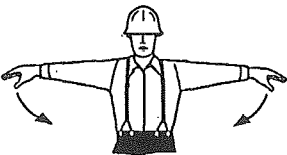
(37) Helicopters with their engines stopped being refueled with aviation gasoline or Jet B (turbine) type fuel, shall also comply with subsection (36)(a) through (g) of this section.

(38) Hook on persons in logging operations shall wear contrasting colored hard hats, with chinstraps, and high visi-

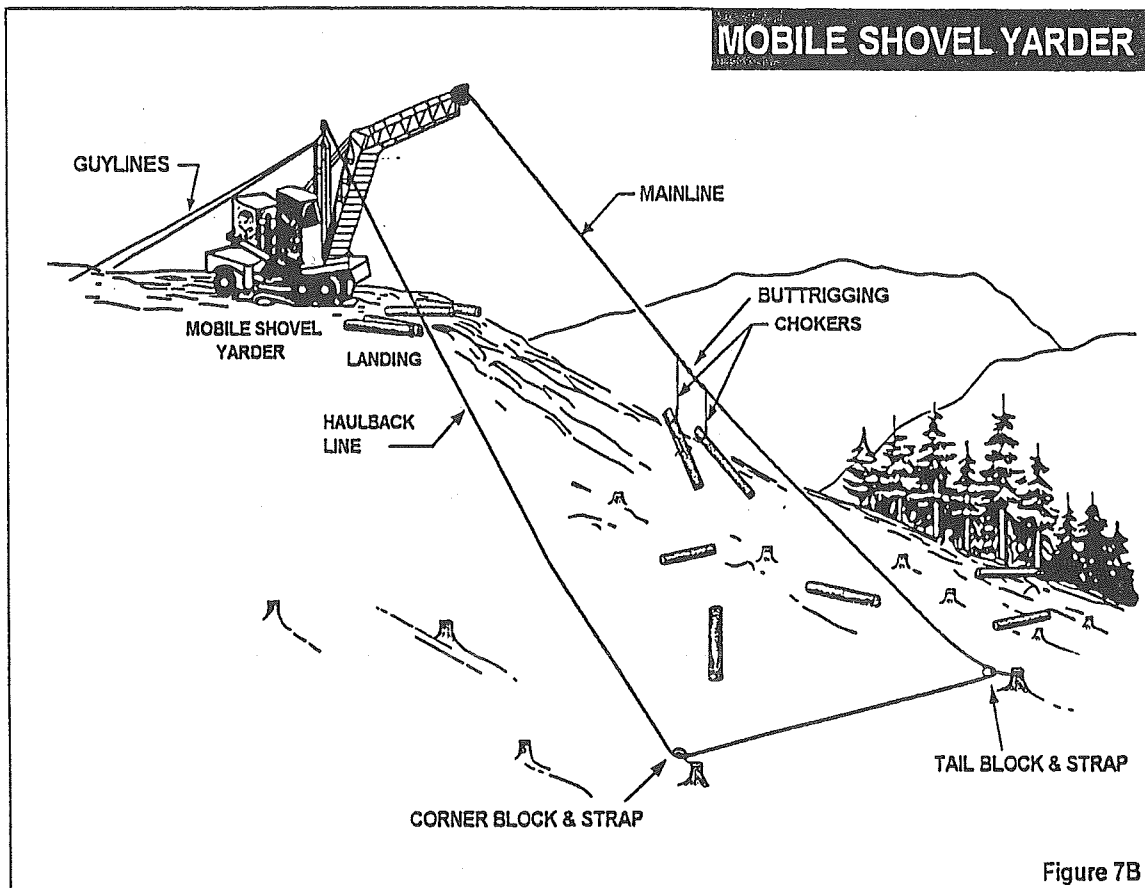
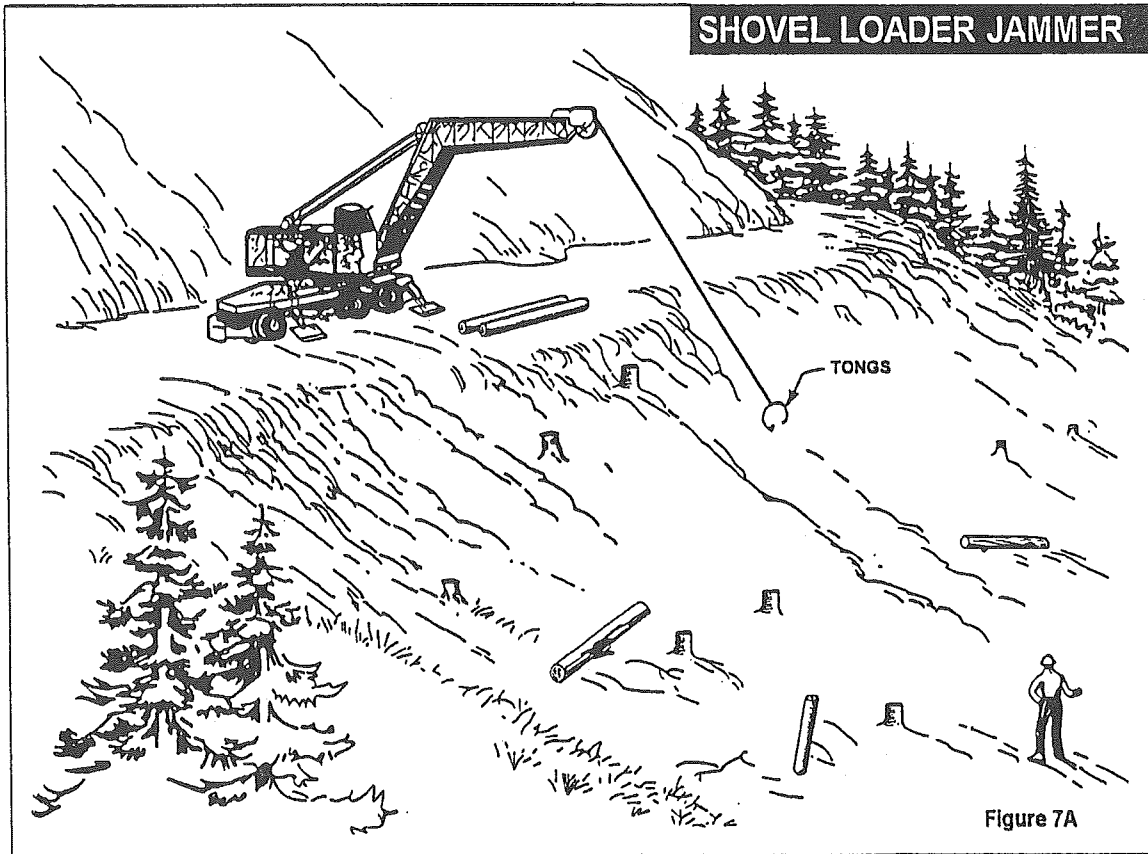
bility vests or outer garments to enable the helicopter operator to readily identify their location.

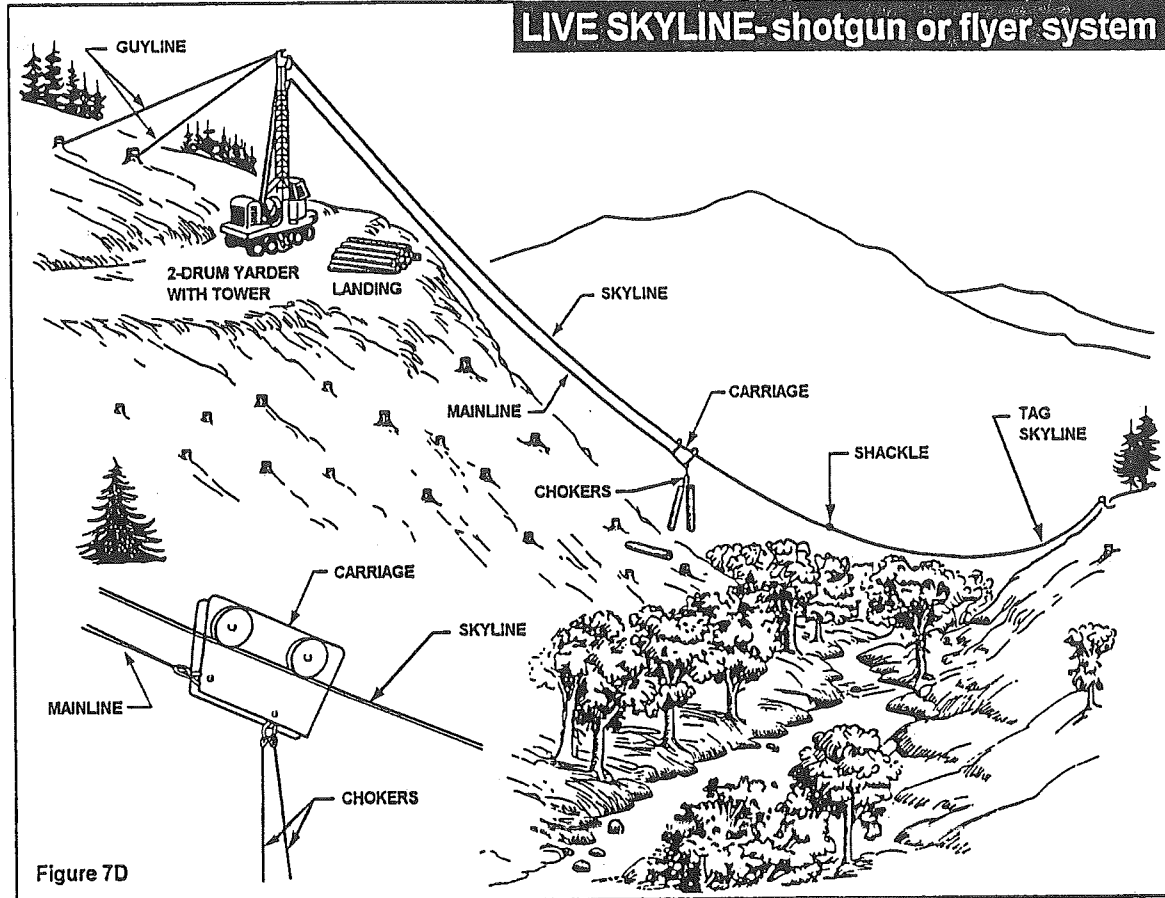
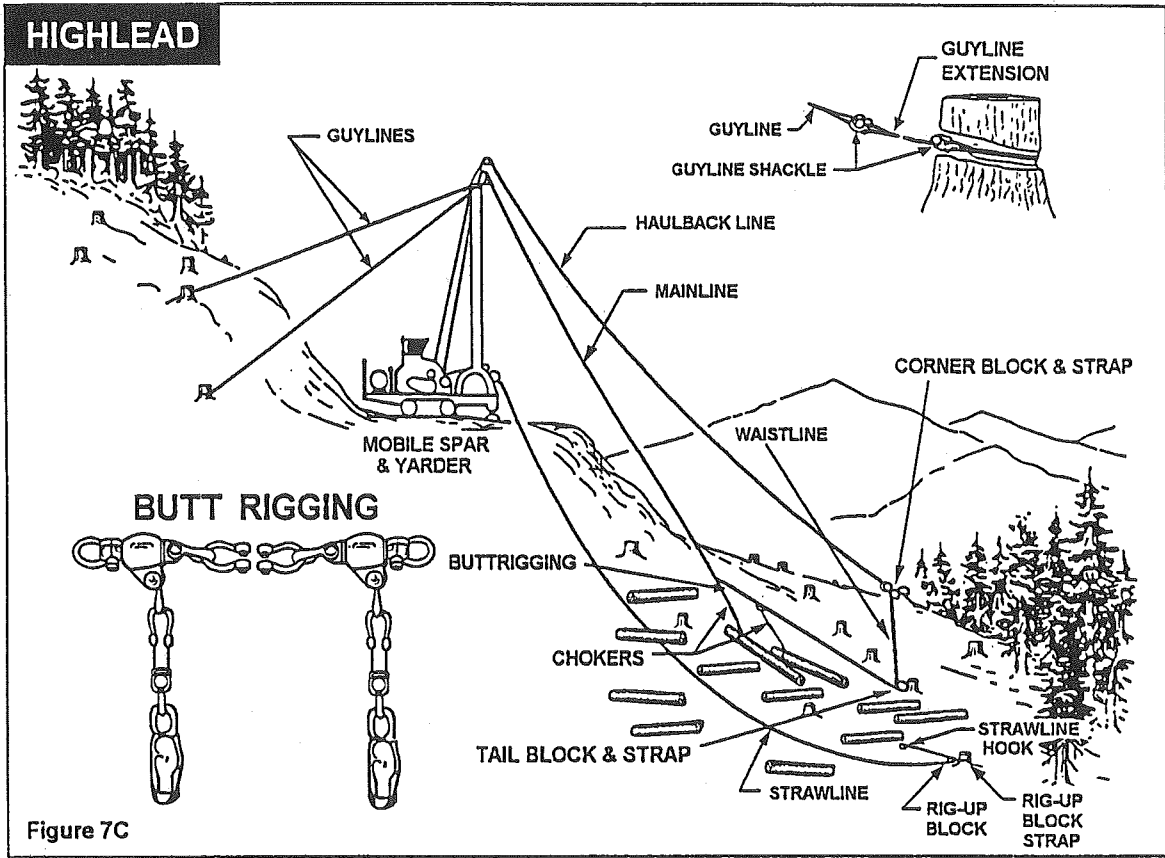
(39) Riding the load or hook of a helicopter is prohibited except in the case of an emergency with the proper safety gear.

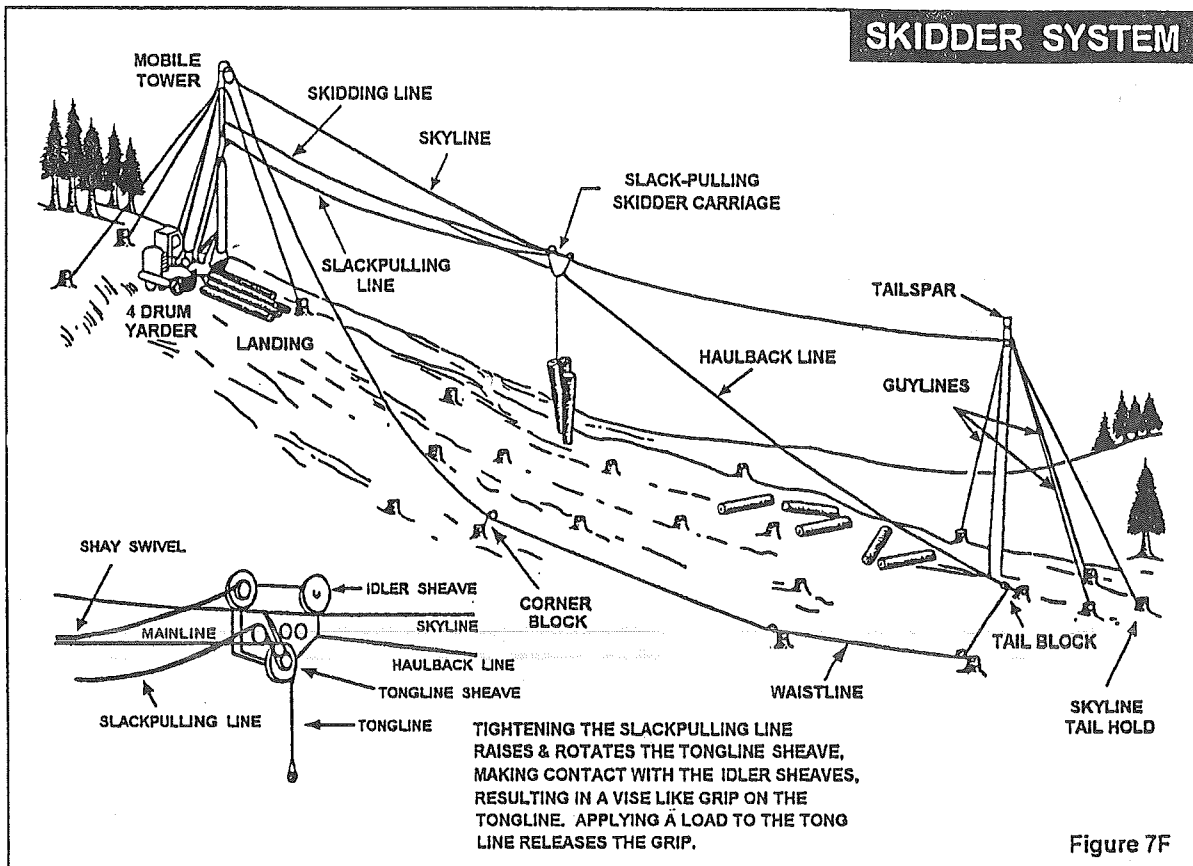
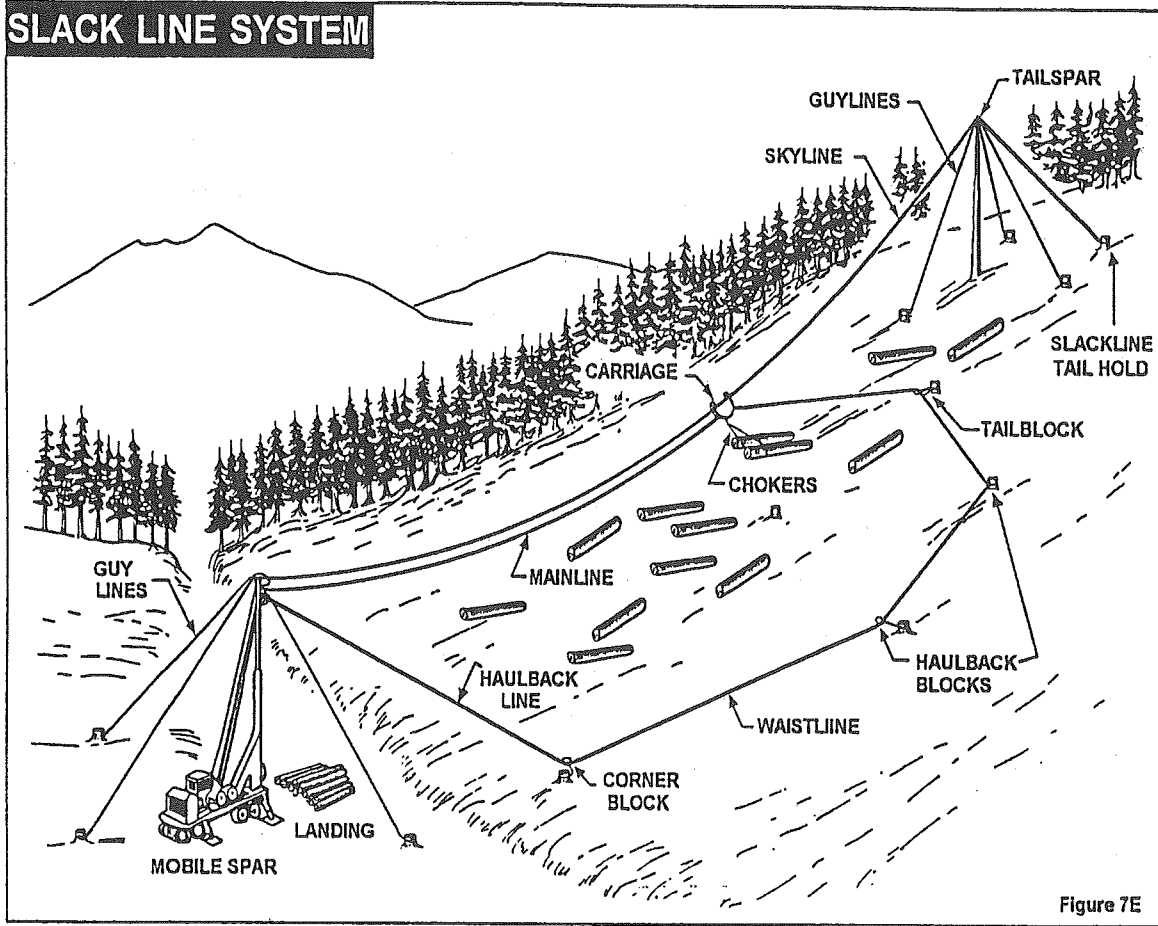
HELICOPTER HAND SIGNALS

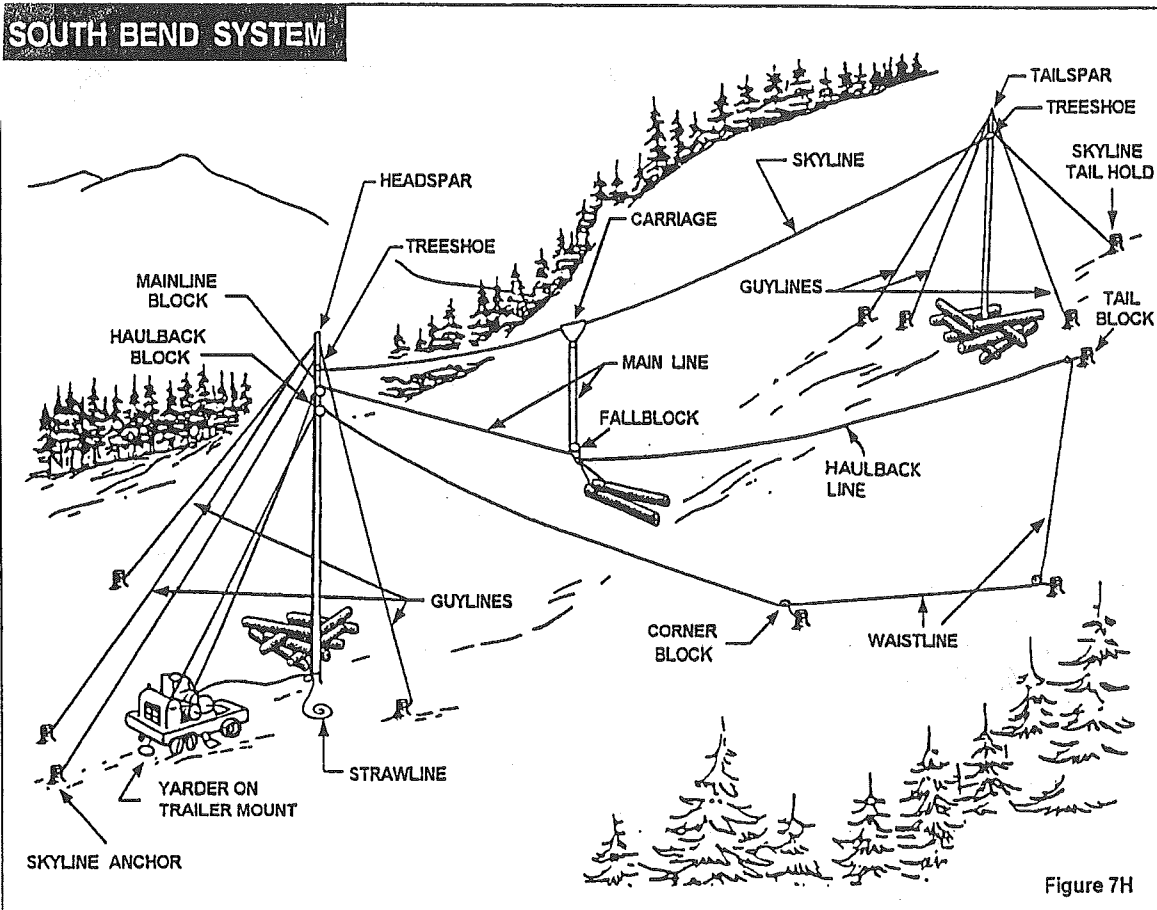
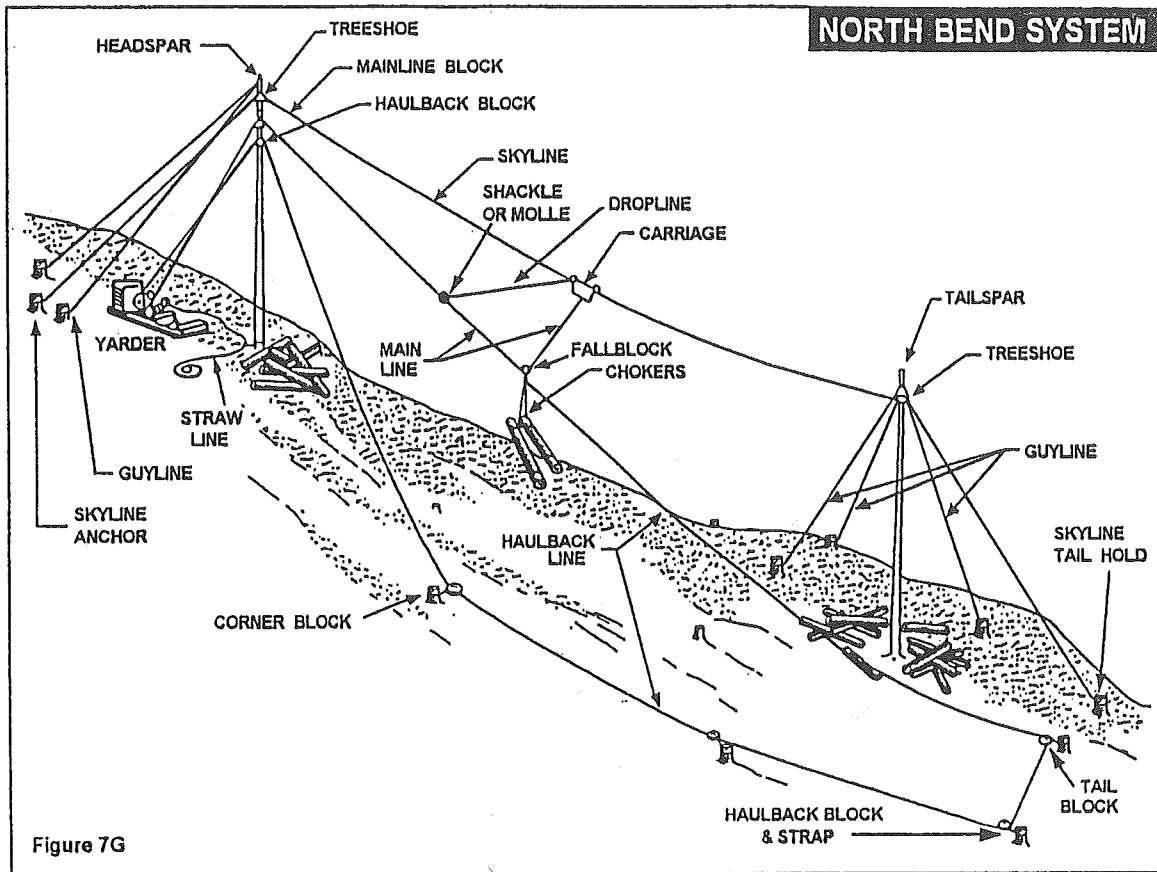
 <p>1. Takeoff. Right hand behind back; left hand pointing up.</p>	 <p>2. Land. Arms crossed in front of body and pointing downward.</p>	 <p>3. Hold-Hover. The signal "Hold" is executed by placing arms over head with clenched fists.</p>
 <p>4. Move forward. Combination of arm and hand movement in a collecting motion, pulling toward body.</p>	 <p>5. Move rearward. Hands above arm, palms out, using a shoving motion.</p>	 <p>6. Release Sling. Load. Left arm held down away from body. Right arm slashes down across body.</p>
 <p>7. Move right. Left arm extended horizontally; right arm sweeps upward to position over head.</p>	 <p>8. Move left. Right arm extended horizontally; left arm sweeps upward to position over head.</p>	
 <p>9. Move upward. Arms extended, "palms up; arms sweeping up.</p>	 <p>10. Move Downward. Arms extended, palms down; arms sweeping down.</p>	

Note: See Figures No. 7-A through 7-P, for illustrations of various types of cable logging systems.
See Figures No. 7-Q through 7-U, for illustrations of whistle signals used on various cable logging systems.



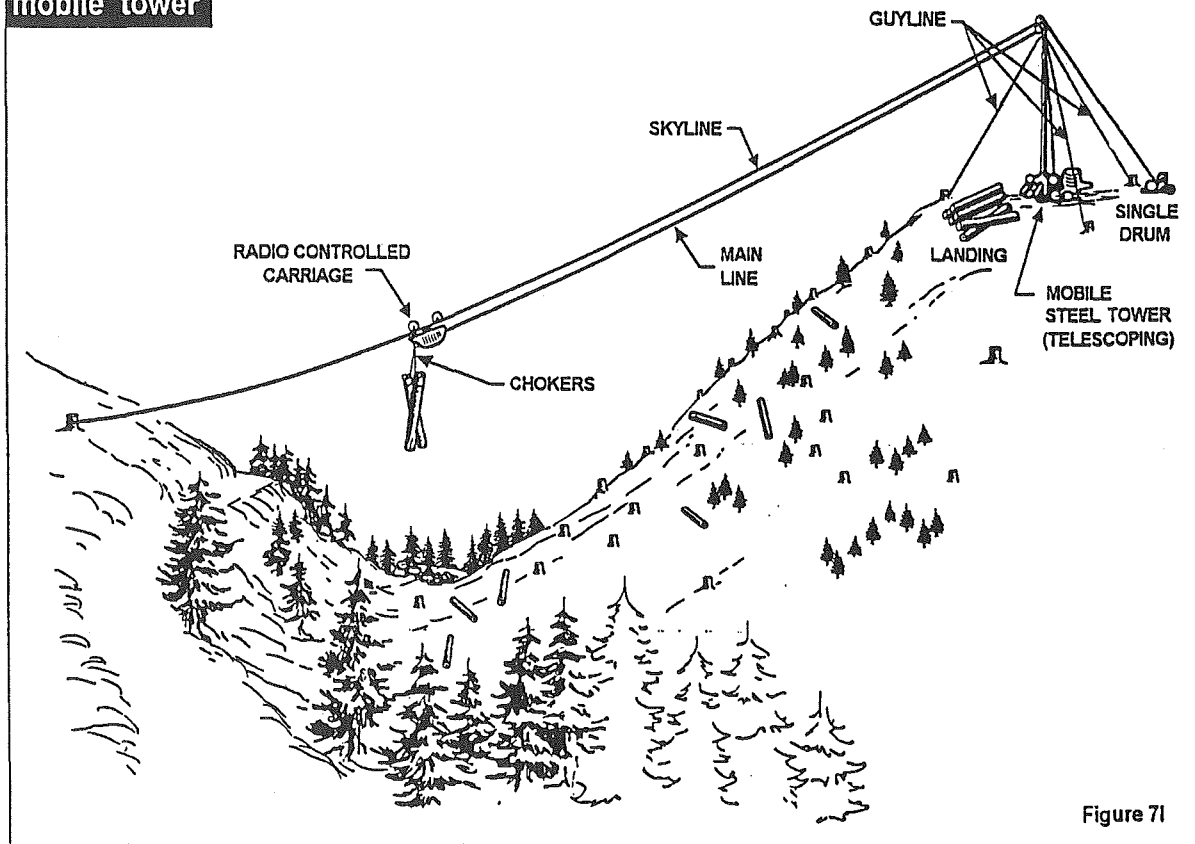




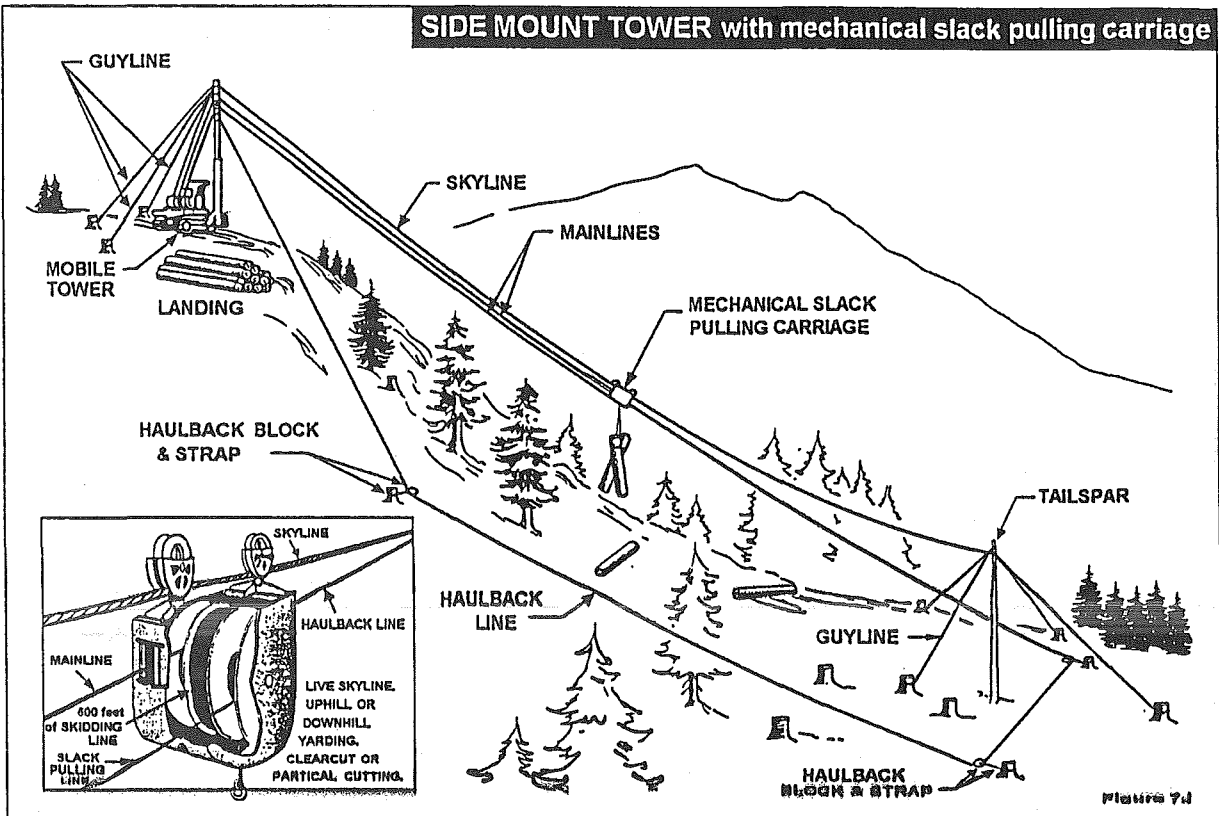


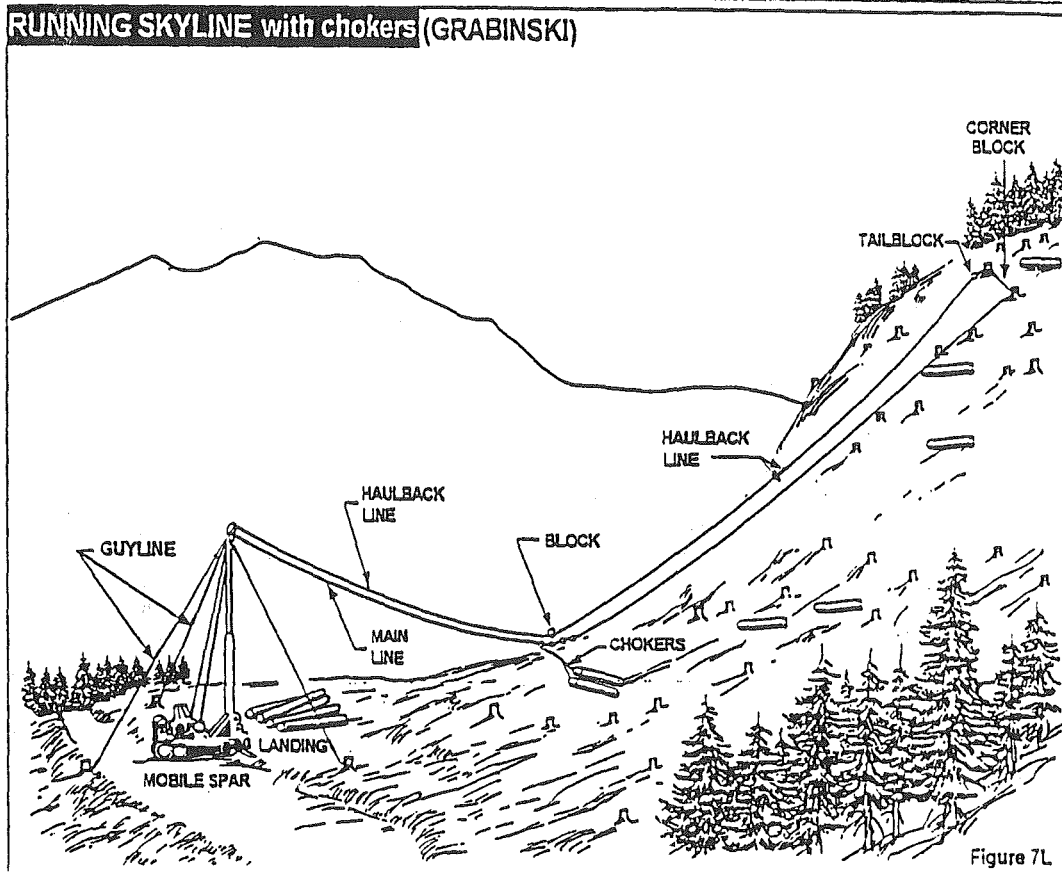
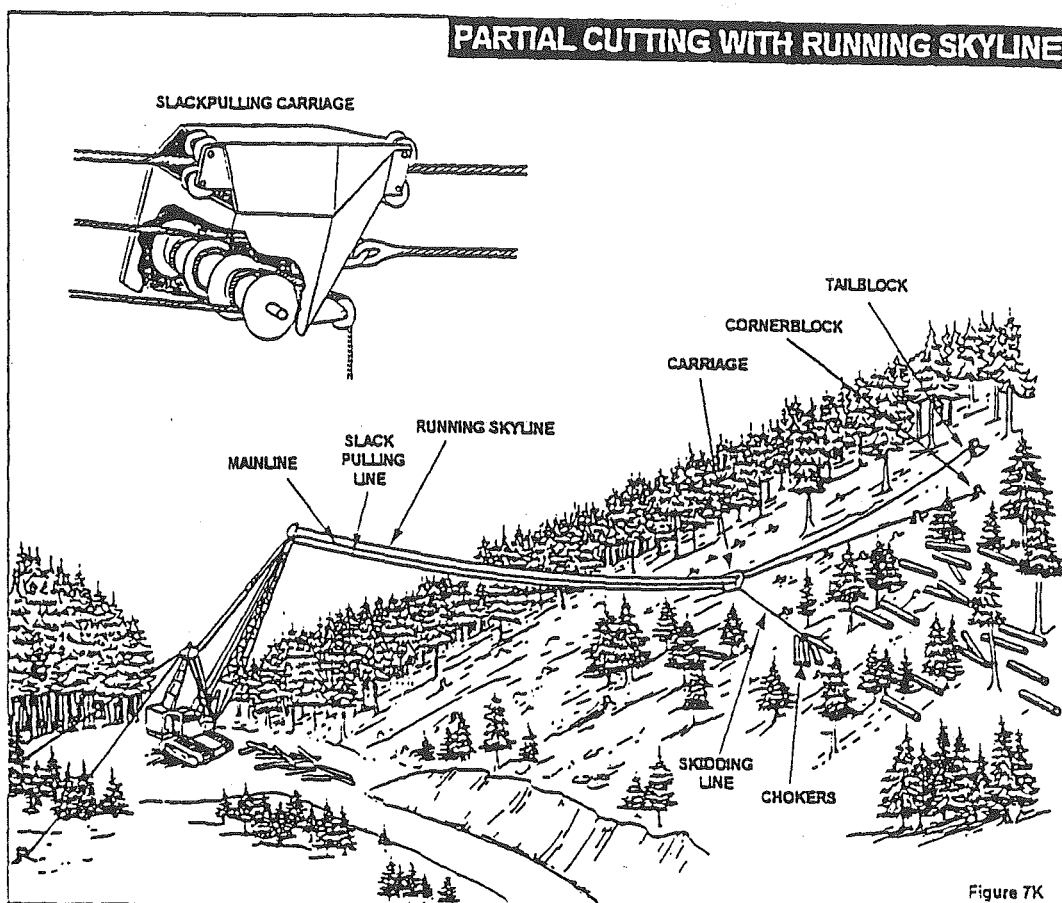
STANDING SKYLINE - RADIO CONTROLLED CARRIAGE

mobile tower



SIDE MOUNT TOWER with mechanical slack pulling carriage





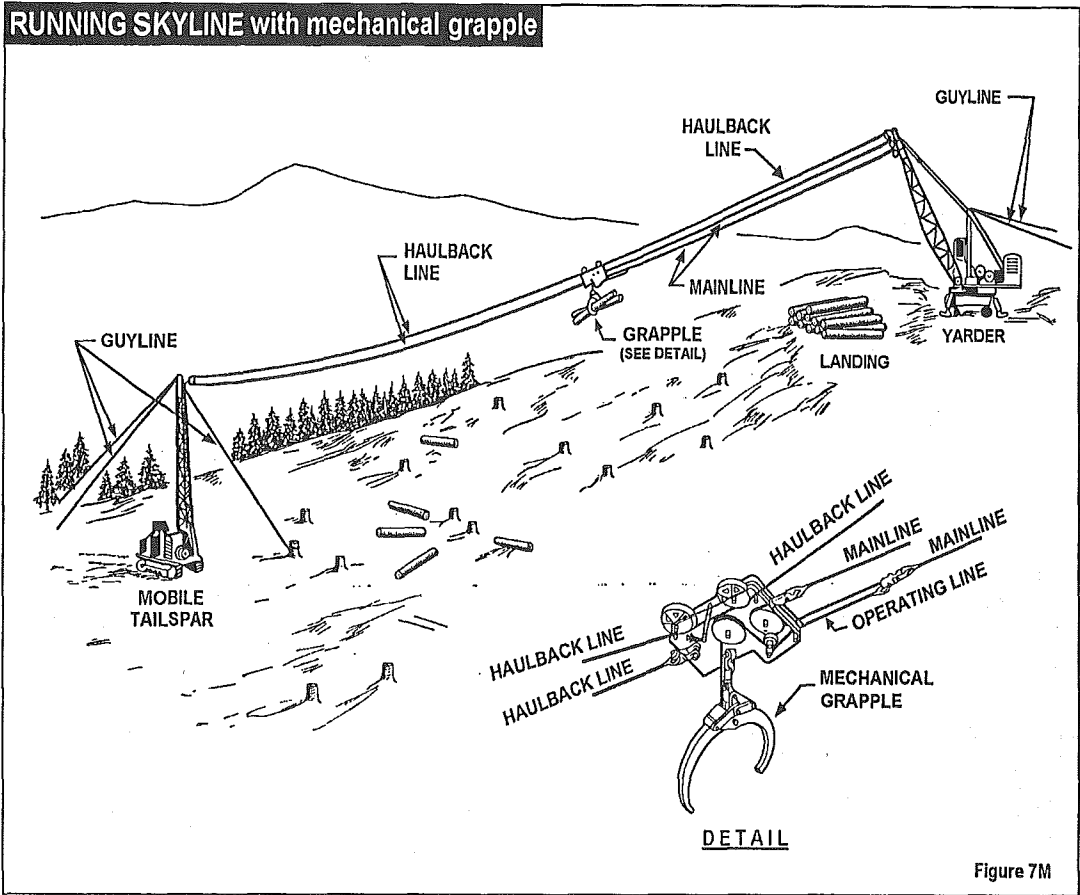


Figure 7M

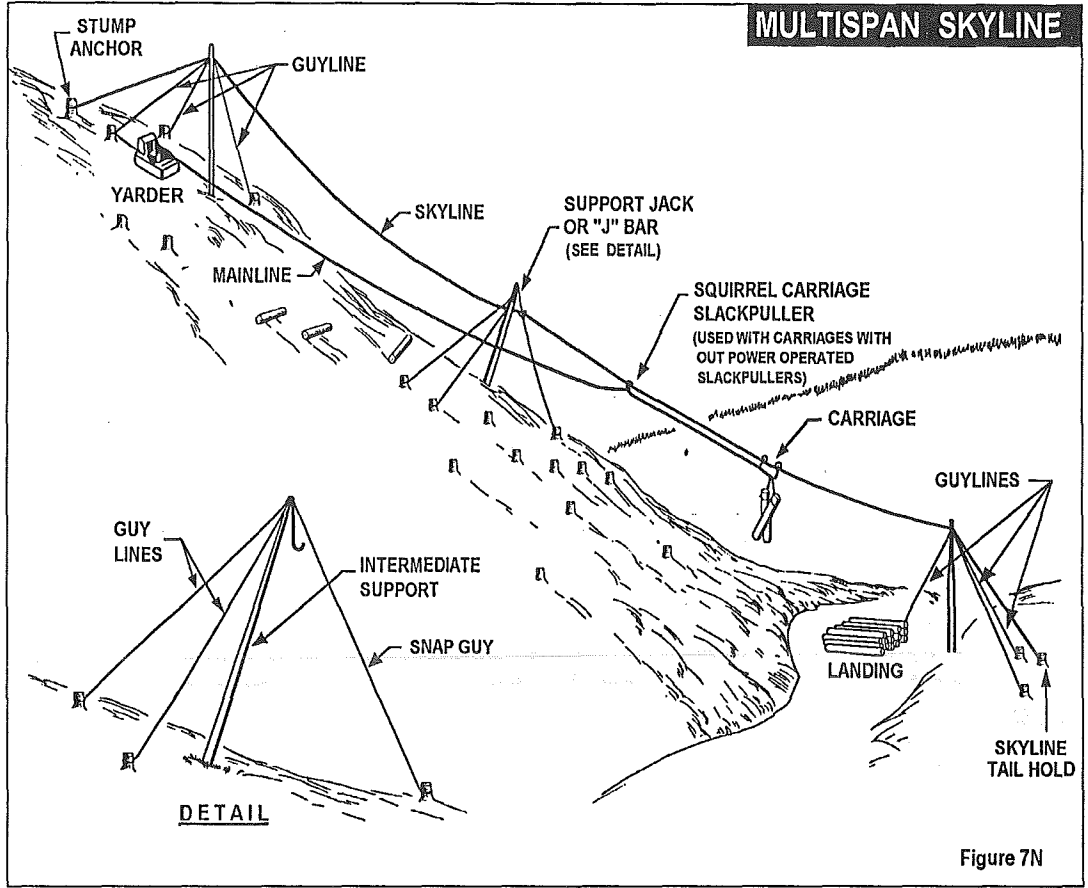
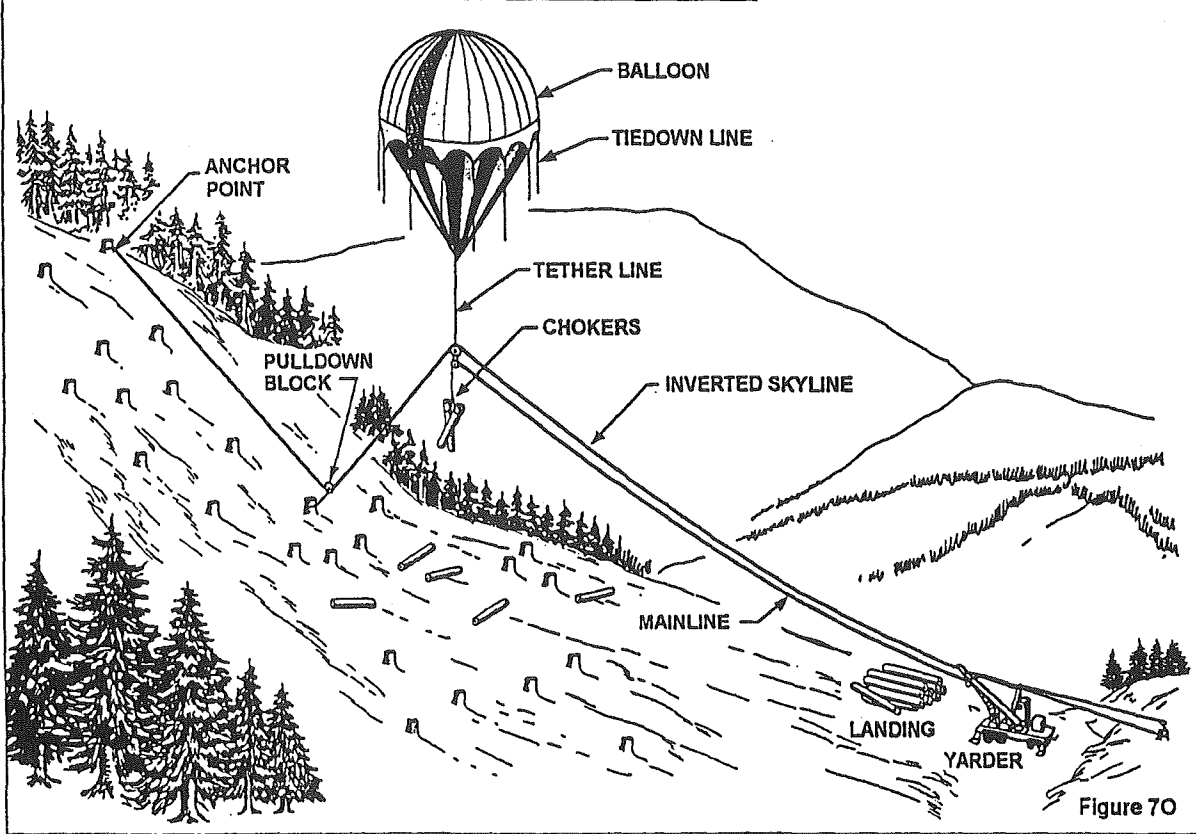
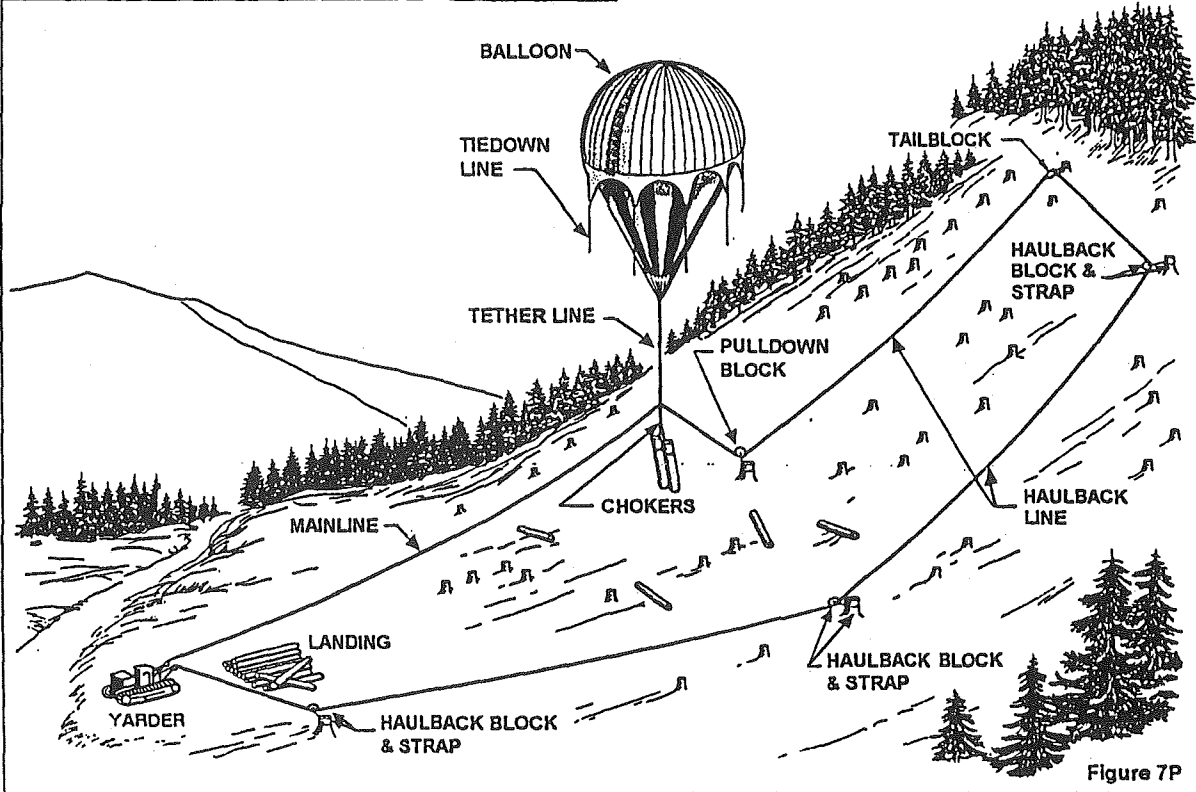


Figure 7N

BALLOON LOGGING - inverted skyline configuration



BALLOON LOGGING - haulback configuration



HIGH LEAD LOGGING WHISTLE SIGNALS

- Means longer spacing between signals.

- 1 short Stop all lines.
- 3 short-3 short Ahead slow on mainline.
- 3 short Ahead on mainline.
- 2 short Ahead on haulback.
- 2 short-2 short Ahead slow on haulback.
- 3 short-1 short Ahead on strawline.
- 3 short-1 short-3 short Ahead slow on strawline.
- 4 short or more Slack mainline.
- 2 short-4 short Slack haulback.
- 3 short-1 short-4 short Slack strawline.
- 3 short-2 short Standing tight line.
- 1 short-1 short Tight line while lines are running, or break if running tight.
- 3 short When rigging is in: Strawline back on haulback.
- 3 short / plus "X" number of shorts When rigging is in: Indicates number of sections of strawline back on rigging.
- 3 short-1 short-2 short Strawline back on rigging.
- 1 short When rigging is in: Chaser inspect and repair rigging.
- 2 short When rigging is in: No chokers back.
- 2 short-1 short / plus "X" number of shorts Number of chokers back.
- 2 short-4 short When rigging is in: Slack haulback-hold all lines until 2 short blown.
- 3 medium Hooker.
- 3 medium-4 short Hooker and that crew.
- 5 long Climber.
- 4 long Foreman.
- 1 long-1 short Start or stop work.
- 7 long-2 short Person injured, call transportation and stretcher.
- 1 long-1 short repeated Fire.
- Grabinski system
- 2 short-1 short Slack mainline and haulback together.
- 2 long Take off or put on rider block.

Figure 7-Q

SKIDDER WHISTLE SIGNALS

- Means longer spacing between signals.

- 1 short Stops moving carriage-stops or goes ahead on slack puller, as case may be, if carriage is stopped.
- 2 short Go ahead on skidding line holding carriage.
- 1 short-2 short Pick up skidding line, easy.

- 2 short-1 short Shake up carriage to clear choker.
- 2 short-2 short Ahead on receding line.
- 3 short Ahead on carriage, holding at present level, using interlock.
- 3 short-3 short Ahead easy on skidding line.
- 2 short-2 short-2 short Slack skyline, cable down.
- 2 short-2 short-2 short-1 short Pick up skyline, cable up.
- 2 short-2 short-4 short Slack receding line.
- 2 short-4 short Slack skidding line.
- 2 short-2 short-1 short Tighten all lines.
- 1 short-4 short Slack off slack puller.
- 1 short-2 short Pick up slack puller when slack.
- 2 short-2 short / plus "X" number of shorts When carriage is in: Number of chokers wanted.
- 2 short-2 short-1 long Bull choker.
- 1 short When carriage is in: Inspect butt rigging.
- 2 short-4 short / 1 short For each additional ten feet of tong line.
- 1 long / plus "X" number of shorts Number of coils of strawline wanted.
- 5 medium Tail or second rigger.
- 5 medium-4 short Tail or second rigger and that crew.
- 2 medium Skidder head rigger.
- 3 medium-4 short Hooker and that crew.
- 2 long Ahead on transfer.
- 2 long-4 short Slack transfer
- 1 short-3 short Ahead on carriage with slack puller line.
- 1 long Ahead on strawline.
- 1 long-4 short Slack strawline.
- 1 long-3 short Ahead easy on strawline.
- 5 long Climber.
- 4 long Foreman.
- 1 long-1 short Start or stop work.
- 7 long-2 short Person injured, call transportation and stretcher.
- 1 long-1 short repeated Fire.

Figure 7-R

SLACKLINE WHISTLE SIGNALS

- Means longer spacing between signals.

- 2 short-2 short-2 short-1 short First cable up when road has been changed and tail hold made fast.
- 2 short-2 short-2 short Drop skyline.
- 1 short Stop any moving line.

1 long	When logging, slack skyline.
2 short	Ahead on skyline.
1 long-2 short	Ahead easy on skyline.
3 short	Ahead on skidding line, holding haulback.
3 short-3 short	Ahead easy on skidding line with slack haulback.
4 short	Slack skidding line.
2 short-2 short / 2 short-2 short	Ahead easy on haulback with slack skidding line.
2 short-2 short	Ahead on haulback.
2 short-2 short-4 short	Slack haulback.
2 short / 3 short	Pick up skyline and skid.
2 short / 2 short-2 short	Pick up skyline and skin.
3 short-1 short	When carriage is in: Strawline back on haulback.
3 short-1 short-2 short	When carriage is in: Strawline back on carriage.
3 short-1 short	When strawline is out: Ahead on strawline.
3 short-2 short	Tight line.
3 short-1 short-4 short	Slack strawline.
3 short-1 short-3 short	Pull easy on strawline.
2 long	Ahead on transfer.
2 long-4 short	Slack transfer.
2 long-2 short-2 short	When carriage is in: Transfer back on carriage.
1 long / plus "X" number of shorts	When carriage is in: Number of coils.
2 short-2 short-1 short / plus "X" number of shorts	When carriage is in: Number of chokers.
1 short	When carriage is in: Inspect rigging, repair and send back.
2 short-2 short-4 short	When carriage is in: Slack haulback and hold all lines until 1 short is blown-then send back.
3 short-3 short	When carriage is in: Send back powder.
5 medium	Tail rigger.
5 medium-4 short	Tail rigger and that crew.
3 medium	Head hooker.
3 medium-4 short	Second hooker and that crew.
5 long	Climber.
4 long	Foreman.
1 long-1 short	Start or stop work.
7 long-2 short	Person injured, call transportation and stretcher.
1 long-1 short repeated	Fire.

Figure 7-S

RUNNING SKYLINE WHISTLE SIGNALS

- Means longer spacing between signals

1 short	Stop all moving lines
2 short	Skin carriage back
2 short-1 short	Slack haulback
2 short-2 short	Skin carriage easy
2 short-3 short	Standing tight line
1 short-2 short	Ahead on drop line
4 short	Slack drop line
1 short-4 short	Slack both mainlines
1 short-1 short	Stop drop line going up and move carriage forward
3 short	Move carriage forward
3 short-3 short	Move carriage forward easy
3 short-1 short	When strawline is out: Ahead on strawline
3 short-1 short-4 short	Slack strawline
3 short	When carriage is in: Strawline
3 short-X short	When carriage is in: Number sections
3 short-1 short-2 short	When carriage is in: Strawline back on carriage
2 short-X short	When carriage is in: Number of chokers
4 short	When carriage is in: Inspect rigging, repair and send back
1 short	When carriage is in: Hold all lines until 2 shorts, then send back
3 medium	Head hooker
3 medium-4 short	Hooker and that crew
4 long	Foreman
1 long-1 short	Start or stop work
7 long-2 short	Person injured; call transportation and stretcher
1 long-1 short (repeated)	Fire
3 short-1 long	Acknowledged by engineer to signify hazardous turn

Figure 7-T

TENSION SYSTEM SIGNALS

4	Release tension
1 short	Stop carriage and start unspooling tong line
1 short	Stop tong line
1 short	Resume unspooling tong line
1 short	Will stop any moving line or slack tong line when carriage is stopped
2 short-2 short	Go into interlock and go back
2 short-4 short	Slack haulback and let carriage down

After turn is set

2 short	Go ahead on tong line
2 short-3 short	Go ahead easy on tong line
3 short	Go into interlock and take carriage to landing
3 short-3 short	Ahead on carriage easy
1 short-2 short	Increase tension on tong line when carriage is going in
short-1 short	Decrease tension on tong line when carriage is going in

Figure 7-U

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-559, filed 10/28/96, effective 1/1/97. Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-54-559, filed 11/14/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 81-05-013 (Order 81-3), § 296-54-559, filed 2/10/81. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-559, filed 9/21/79.]

WAC 296-54-561 Log loading—General requirements. (1) Loading operators shall have a clear view of the landing and of the cars or trucks being loaded.

(2) Persons shall not ride logs, tongs, grapples or other loading devices.

(3) The use of plain spiked loading hooks without a bell is prohibited for loading logs.

(4) All limbs or knots that would project beyond the stakes or legal height shall be removed before the log is loaded on the car or truck.

(5) When the loading operator is not able to see the loading operation, signals shall be given by a designated person, who shall have a clear view of the operations and shall be visible to the operator. Hand signals used shall be as illustrated in Figure No. 7, following WAC 296-54-565.

(6) Logs shall not be swung or suspended over occupied equipment by loading machines on landings. Persons shall not stand or walk under suspended logs.

(7) No one shall ride loads while cars or trucks are being spotted or dropped, except those whose regular duties require them to do so.

(8) Cars and trucks shall not be moved until the head loader or loading machine operator is positive that all persons are in the clear.

(9) When grapples, trip tongs or similar devices are used in the loading operation, they shall be lowered to the ground whenever the machine is unattended. If the device can tip or fall over, it shall be laid on its side on the ground.

(10) While logs are being loaded, no one shall remain on the load, chain deck or behind the cab protector. Any unattached material shall be removed from the top of the cab protector before the truck is moved from the landing.

(11) To control the movement of a log truck being loaded, a positive audible means of communication shall be established between the truck driver and the loading machine operator. The established means of communication shall be familiar to all employees on the landing and shall include a danger signal to warn employees in case of an emergency. If

a movable loader is being used, the loader operator shall sound a warning signal before moving the loader. The signals so used shall be easily distinguishable from other whistle or horn signals used in the landing area.

(12) When signals are used at a landing, reload or deck to control the movement of logging trucks in accordance with subsection (11) of this section, the following signals shall be used:

1 short	Stop
1 short	Ahead
2 shorts	Back
2 shorts then 2 shorts	Wrapper
3 shorts	Check scales
1 long-repeated	Danger
1 long	Loader moving

(13) No person shall be permitted alongside or underneath trucks being loaded or on the load until communication has been established with the loading machine operator and truck driver and assurance has been received that it is safe to be there.

(14) Power saws shall not be operated on top of loaded logging trucks.

(15) Standing underneath a suspended trailer or its reach is prohibited.

(16) The outside bunklogs (bottom tier) shall be loaded tight against the stakes.

(17) Logs shall be loaded in a manner to prevent undue strain on wrappers, binders, bunk stakes and chains or straps.

Note: Logs shall be considered to be "within the stakes" when one-half the log diameter is below the top of the stakes.

(18) Logs in any tier or layer unsecured by stakes or chalk blocks shall be well saddled and have their diameter centers inside the diameter centers of the outer logs of the next lower tier or layer.

(19) Bunk and wing logs shall extend not less than twelve inches beyond the front and rear bunks or stakes. On rigid type bunks, they shall extend not less than six inches beyond the front and rear bunks or stakes.

(20) Double ended logs, above the stakes, shall not be loaded on the side of the load from which the binders or wrappers are intended to be released from.

(21) Logs shall be loaded in a manner that will not impair full and free movement of the truck and trailer.

(22) Each log not contained within the stakes shall be secured with at least two wrappers before the truck leaves the immediate landing area.

(23) Loads or logs shall not be moved or shifted while wrappers and binders are being applied or adjusted.

(24) Stable loads. Loads shall be built up or loaded in a manner to be stable without the use of wrappers. Wrappers shall be considered only as precautionary measures to ensure stability of the load.

(25) Loading equipment maintained. All loading machines and equipment shall be maintained in a safe condition. The critical parts of such equipment, such as bolts in base plates, etc., that cannot be inspected while in operation, shall be inspected at reasonable intervals by a qualified person when the machine is shutdown. If indications of failure or weakness is noted or suspected, the parts in question shall be

examined by an approved method and if found to be defective, shall be repaired or replaced before the equipment is put back into operation.

(26) Tongs pulling out. Where there is a danger of tongs or hooks pulling out of the log, straps shall be used. Tongs may be used on extra-large logs provided the logs are barked and notched to provide a secure hold.

(27) The transport vehicle shall be positioned to provide working clearance between the vehicle and the deck.

(28) Only the loading or unloading machine operator and other personnel the employer demonstrates are essential shall be in the work area during loading and unloading.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-561, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-561, filed 9/21/79.]

WAC 296-54-563 Log loading—Special requirements. (1)(a) Loading machines shall be equipped with an effective parking braking system which is not dependent on the air or hydraulic pressure which is used to stop the machine while traveling.

(b) A braking system shall be installed on the load line and boom supporting equipment which shall be capable of stopping and holding, in any position, the maximum load for which the loading machine is designed. The equipment shall be of such design as to lower the boom with power. Booms not having power down shall be dogged before workers enter the hazardous area around the boom. Workers shall not be under any boom while it is being held by the brake.

(2) A minimum distance of thirty-six-inch clearance shall be maintained between the counterweight of a loading machine and trees, logs, banks, trucks, etc., while the machine is in operation. If this clearance cannot be maintained, suitable barricades with warning signs attached, similar to a standard guardrail, shall be installed to isolate the hazardous area. "DANGER - 36-inch clearance" shall be marked in contrasting colors on sides and face of counterweight on shovels, loaders and other swing-type logging equipment.

(3) Persons shall not work under a slack puller. A warning line, of sufficient length to reach the ground at all positions, shall be hung from any slack puller.

(4) Where a backstop of a loading machine is so constructed that it could crush the operator's cab should the heel boom be pulled or pushed too far backward, positive boom stops shall be installed.

(5) All mobile fork-lift type log handling machines shall be equipped with a means or mechanism to prevent the logs from leaving or rolling off the forks, and shall be used at all times while moving logs.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-563, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-563, filed 9/21/79.]

WAC 296-54-565 Log loading—Self-loading log trucks. (1) A safe means of access and egress shall be provided to the operator's loading work station.

(2) Self-loading log truck operators shall not unload their own load unless a positive means of securing the logs has been provided when binders and wrappers are removed.



(3) New self-loading log trucks purchased and put in operation after January 1, 1980, shall be equipped with:

(a) A check valve installed on the jib boom; and

(b) A seat that is offset from the point of attachment of the boom. The seat and boom structure shall rotate concurrently.

(4) The operator of a self-loading log truck shall not heel the log over the operator's work station.

STANDARD SIGNALS FOR LOADING LOGS

 <p>1. Place log on left side of truck or car.</p>	 <p>2. Place log on right side of truck or car.</p>	 <p>3. Place log in center of load.</p>
 <p>4. Hit log into lay.</p>	 <p>5. Long log.</p>	 <p>6. Place peak log on load.</p>
 <p>7. Roll log into lay on load.</p>	 <p>8. Pick tong up in the clear.</p>	 <p>9. Load finished.</p>

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-565, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-565, filed 9/21/79.]

WAC 296-54-567 Motor truck log transportation—General requirements. (1) Prior to use, the operator shall make a complete daily inspection of the truck and trailer with particular attention to steering apparatus, lights and reflectors, brake boosters, brake hoses and connections, reaches, and hitches (couplings). The brakes shall be tested before and after movement of the vehicle. The operator shall submit a

written list of necessary repairs to a person designated by the employer.

(2) Any defective parts that would make the vehicle unsafe to operate, shall be replaced or repaired before the vehicle is placed in service.

(3) All motor vehicles operated on public roads shall comply with the rules of the regulatory body having jurisdiction. Motor vehicles used on roads not under the control of the state department of transportation, counties or cities shall be equipped with accessories necessary for a safe operation including operable head lamps and at least two tail lamps and brake lamps which shall emit a red light plainly visible from

a distance of one thousand feet to the rear and shall also have two reflectors visible at night from three hundred fifty feet when directly in front of properly adjusted motor vehicle head lamps.

(4) Truck tires worn beyond a point of safety or not meeting the safety requirements of the jurisdiction having authority as to tread wear and tire conditions, shall not be used.

(5) The driver shall do everything reasonably possible to keep the truck under control at all times and shall not operate in excess of a speed at which the driver can stop the truck in one-half the distance between the range of unobstructed vision.

(6) The area between the truck frame members, extending from the cab rearward as far as necessary to provide a safe work area, shall be covered with suitable nonslip type material. Log trucks which have logs scaled at stations shall be provided with a platform on each side extending outward from the frame members at least eighteen inches, and shall be eighteen inches long or as near this dimension as the design of the truck will permit. The treading surface of the platforms shall be of nonslip type material and the platform shall be capable of safely supporting a five hundred pound load.

(7) To protect the operator of vehicles from loads, a substantial bulkhead shall be provided behind the cab which shall extend up to the height of the cab.

(8) If logs must be scaled or branded while the loading operation is being carried on, the loading operation shall cease while the scaling or branding is being done so that the scaler or person doing the branding is not subjected to any hazards created by the loading operation.

(9) When at the dump or reload or where logs are scaled or branded on the truck, the logs shall be scaled or branded before the binders are released.

(10) All vehicles, where vision of the operator in the direction of travel is impaired by the load or vehicle, shall be moved only on a signal from a worker who shall have a clear view in the direction in which the vehicle is to be moved.

(11) Where a bridge or other roadway structure is posted with a load limit sign, log truck drivers or operators of other heavy equipment are prohibited from driving a load in excess of the posted limit over such structure.

(12) Persons shall be allowed to ride only when in the cab of the log truck.

(13) All trucks shall keep to the right side of the road except where the road is plainly and adequately posted for left side travel.

(14) A method shall be provided to assure that the trailer will remain mounted on the truck while driving on highways or logging roads.

(15) When trucks are towed on any road, the person guiding the vehicle being towed shall, by prearranged signals, govern the speed of travel. The towing of vehicles shall be done at a reasonable speed and in a prudent manner. A tow cable or chain over fifteen feet in length shall have a white flag affixed at the approximate center, however, it is recommended that a rigid tow bar be used for this purpose.

(16) All air lines, air chambers and systems shall be free of leaks and be able to maintain air pressure on constant brake application with the motor shut-off for one minute, or

air pressure does not drop more than 4 p.s.i. in one minute with the engine running at idling speed and the service brake applied.

(17) All rubber-tired motor vehicles shall be equipped with fenders. Mud flaps may be used in lieu of fenders whenever the motor vehicle is not designed for fenders.

(18) Seat belts and anchorages meeting the requirements of 49 CFR Part 571 (D.O.T. Federal Motor Vehicle Safety Standards) shall be installed and used in all motor vehicles.

(19) All trucks shall be equipped with doors with operable latches, or a safety bar or strap shall be provided in lieu of the door.

(20) All trucks shall be equipped with a means to protect the operator from inclement weather.

(21) Log trucks shall not approach a landing while there is danger from incoming logs.

(22) Log truck drivers shall stop their vehicle, dismount, check and tighten loose load wrappers and binders, either just before or immediately after leaving a private road to enter a public road. While enroute, the operator shall check and tighten the wrappers/tie downs whenever there is reason to believe that the wrappers/tie downs have loosened or the load has shifted.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-567, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040 and 49.17.050. 81-05-013 (Order 81-3), § 296-54-567, filed 2/10/81. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-567, filed 9/21/79.]

WAC 296-54-569 Motor truck log transportation— Brake requirements. (1) Motor logging trucks and trailers shall be equipped with brakes or other control methods which will safely stop and hold the maximum load on the maximum grade. When unattended trucks are parked on a grade, in addition to setting the brakes, the wheels shall be chocked or blocked.

(2) All trucks equipped with air brakes shall be also equipped with a readily visual or audible low air pressure warning device in good working order.

(3) Engine-type brakes shall be considered as auxiliary controls, not a substitute for the requirement for a service brake system.

(4) Brake drums shall be maintained free of cracks, breaks or defects. Defective brake drums, cans, shoes or air lines shall be immediately repaired or replaced.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-54-569, filed 4/10/90, effective 5/25/90. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-569, filed 9/21/79.]

WAC 296-54-571 Motor truck log transportation— Trailer hitches and safety chains. (1) All log truck and trailer combinations shall be equipped with approved hitches (couplings) which shall:

(a) Be capable of withstanding, in any direction, the potential stresses imposed;

(b) Be of a design which would not be rendered inoperative by dirt and debris and shall be locked securely and positively;

(c) Be attached to the truck frame or extension of the truck frame by means of not less than four machine bolts and

nuts (120,000 p.s.i. material or better) 3/4-inch diameter or larger, secured by lock nuts. Other means of attachment furnishing strength equal to or greater than the above may be accepted if of approved design and application; and

(d) Hitches (couplings) or parts that are broken, cracked, excessively worn, or otherwise defective hitches shall be repaired before use.

(2) Each log truck and trailer combination or log truck and independent trailer combination shall be provided with two or more safety chains or cables with a rated breaking strength of not less than the gross weight of the towed vehicle, be capable of holding the trailer in line in case of failure of the hitch assembly, and be as follows:

(a) Be permanently attached to the frame of the truck or an extension of the truck frame;

(b) Form a separate continuous connection between the truck frame or extension of the truck frame and the reach or trailer;

(c) Be attached not more than twelve inches from the eye of the reach or trailer;

(d) Be of a length short enough to prevent the trailer reach or tongue from contacting the ground in the event of disengagement from the truck;

(e) Be of a design to provide a positive connection that cannot be rendered inoperative by any condition of use or exposure.

(3) Safety chains and cables shall be replaced immediately if they contain cut, cracked, or excessively worn links, or frayed, stranded, or otherwise defective wire rope.

(4) Butt welding of safety chain links to reach truck frame, or extension of truck frame is prohibited.

(5) Cold-shuts may be used in safety chains provided they are welded shut and one size larger than the chain being used.

(6) There shall be no welding or hole drilling in frames on which the manufacturer recommends this not be done.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-571, filed 9/21/79.]

WAC 296-54-573 Motor truck log transportation—Reaches and bunks. (1) Log trailers shall be connected to tractors by reaches of a size and strength to withstand all normal imposed stresses. Spliced wooden reaches shall not be used. Proper repair of metal reaches by welding will be permitted if done by a qualified welder.

(2) Hand-holds or other facilities shall be installed on trailer tongues or trailer reaches if workers are required to manually assist in coupling them to their tractors or trucks.

(3) A positive means, other than clamp and in addition to the clamp, shall be installed on the reach of log truck trailers when the trailers are being towed without a load.

(4) Persons shall never enter the area below a suspended load of logs. At dumps where the load must remain suspended above the bunks until the truck is moved away, and when the trailer is the type with a compensating pin in the reach, a method shall be utilized which will allow the trailer to be towed away from the danger area.

(5) The reaches of unloaded trailers being towed shall be provided with and use a minimum one-inch pin near the end

or an equally effective means to prevent pulling or stripping through the tunnel.

(6) Reach locks, clamps, or tighteners shall be of the type that will securely lock the reach in the tunnel.

(7) No reach of less than the maximum size usable in the tunnel of a trailer shall be permitted.

(8) Alteration of trailer tunnel to permit reduction of reach size is prohibited.

(9) Every truck or truck and trailer engaged in the transportation of logs loaded lengthwise, shall be equipped with bunks and chock blocks or stakes.

(10) Log bunks or any part of bunk assembly bent enough to cause bunks to bind, shall be straightened. Bunks shall be sufficiently sharp to prevent logs from slipping. Trip type stakes shall be properly secured and locked in a manner which will prevent them from accidentally tripping or falling.

(11) All trucks with swivel type bunks shall have bunk locks or an equivalent system of holding the bunks in place while loading logs.

(12) The bunks or bolsters of any truck or trailer shall be either curved upward or straight. Bunks with ends lower than their centers are prohibited.

(13) Sufficient clearance between the bunk and bunk rider shall be maintained to prevent bunk binding.

(14) Trailer bunks shall be provided with a false or tilt bunk. The channel of the bunk shall be kept reasonably free of debris.

(15) Stakes and stake extensions shall be installed and maintained so that the angle between bunks and stakes (and extensions if used) shall not exceed ninety degrees when loaded.

(16) Frames, reaches, bunks and running gear of log trucks shall be maintained free of cracks, breaks and defects. If defects are found, they shall be immediately repaired or the part replaced.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-573, filed 9/21/79.]

WAC 296-54-575 Motor truck log transportation—Stakes, stake extensions and chock blocks. (1) Trucks and trailers shall be equipped with bunk stakes or chock blocks of strength and sized material to perform their intended function.

(2) Stake extensions shall not be used unless all component parts of the bunking system are of sufficient size and strength to support the added stresses involved. Stake extensions shall be secured by safety chains or other devices to prevent their accidental displacement.

(3) The linkage used to support the stakes or chocks must be of adequate size and strength to withstand the maximum imposed impact load. Molles or cold shuts are prohibited in chains or cables used for linkage.

(4) Stake chains or cables shall be equal to or better than "high test" steel chain or "plow steel" wire rope, and shall be of a size necessary to meet the requirements of a safe working load of not less than six thousand six hundred pounds. (3/8-inch alloy chain, 7/16-inch high test chain of welded link construction, and 5/8 inch improved plow steel cable in 6 x 19 and 6 x 37 construction meet this requirement.)

(5) Bunk chains containing cut, cracked, excessively worn, or otherwise defective links, shall be immediately removed from service. Molles, cold-shuts (welded or otherwise), or bolts are not permitted in bunk chains.

(6) The use of frayed, stranded, or otherwise defective wire rope for chock block cable or stake straps is prohibited.

(7) Only chain links approved for welding (and properly welded) or approved repair links which will develop a strength equivalent to the chain, are permissible for repairs or attachments to stake chains or binder chains.

(8) Chains or cables used to secure stakes or chock blocks shall be secured in a manner which will not necessitate hammering directly on them to release the stakes or blocks. Keyhole slots and similar methods of securing chains are prohibited.

(9) Deformed or defective stakes, stake securing or stake locking devices, or bunks shall be immediately repaired or removed from service.

(10) Each stake and chock which is used to trip loads shall be so constructed that the tripping mechanism is activated on the side opposite the release of the load.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-575, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-575, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-575, filed 9/21/79.]

WAC 296-54-577 Motor truck log transportation—Wrappers and binders. (1) On log trucks equipped with stakes, the following requirements shall apply:

(a) In the hauling of a one log load, one wrapper chain or cable shall be required and secured to the rear bunk. The log shall be properly blocked or secured in a manner which will prevent it from rolling or shifting. An additional wrapper secured to the front bunk is optional.

(b) In the hauling of two log loads, not less than two wrapper chains or cables shall be used to secure the load. The logs shall be properly blocked to prevent them from rolling or shifting.

(c) On loads consisting of three or four logs not over forty-four feet in length, the load shall be secured by not less than two properly spaced wrapper chains or cables. Ends of short logs not secured by such wrappers shall be secured with extra wrappers. If any log is over forty-four feet in length, the load shall be secured by not less than three properly spaced wrappers.

(d) Loads consisting of five or more logs, when the logs are all seventeen feet or less in length, shall be secured by not less than two properly spaced wrappers. Loads consisting of five or more logs, when any log is over seventeen feet in length, shall be secured by not less than three properly spaced wrappers.

(2) On log trucks equipped with chock blocks, the following requirements shall apply:

(a) In the hauling of a one log load, one wrapper chain or cable shall be required and secured to the rear bunk and the log shall be properly blocked in a manner to prevent it from rolling or shifting.

(1999 Ed.)

(b) One additional wrapper chain or cable shall be required on log trucks using chock blocks over and above the requirements in subdivisions (1)(c) and (d) of this section.

(3) In the case of short logs loaded crosswise, the following method of securing the load shall be used if the truck or trailer is not provided with solid ends of a height sufficient to prevent any log in the load from rolling off: Not less than two chock blocks shall be used at each open end of the vehicle and the load shall be held with at least two wrapper chains or cables. The wrappers shall be firmly attached to the end of the truck or trailer. Rigid standards or stakes may be used in lieu of chock blocks but each such standard or stake shall be either rigidly connected to the bed of the truck or trailer or shall be placed in a tight-fitting socket at least 12 inches in depth. Other means furnishing equivalent security may be acceptable.

(4) When two wrappers are required, they shall be applied within six feet of the front and rear bunks. When more than two wrappers are required, the front and back binder shall be applied within six feet of the front and rear bunks.

(5) To properly secure short logs, binders shall be placed near the end, not less than twelve inches from the end of the log.

(6) No log loaded on top or in outside saddles of a load shall be transported unless secured by not less than two wrapper chains or cables, one of which shall be placed near each end of such log.

(7) All wrappers and binders shall be fastened in place prior to tightening to prevent the displacement of logs on the top of the load.

(8) All wrapper chains or cables, except in the case of one log loads, shall entirely surround the load. This does not apply to gut-wrappers.

(9) Gut-wrappers, when used, shall be adjusted so as to be tightened by, but not carry the weight of the logs above them.

(10) A warning shall be given before throwing wrappers over the load and care shall be taken to avoid striking other persons with the wrapper.

(11) Wrappers and binders shall be placed and tightened around the completed load before the truck leaves the immediate loading area.

(12) While moving logs, poles, or log chunks within sorting or mill yards, that could roll or slide off the truck due to snow or ice conditions, or the logs or log chunks do not extend beyond the stakes, at least two wrappers and binders shall be used regardless of the height of the load.

(13) Wrapper chains or cables, binders, fasteners, or attachments thereof, used for any purpose as required by these standards, shall have a minimum breaking strength of not less than fifteen thousand pounds and shall be rigged so that it can be safely released.

Note: 3/8-inch hi-test steel chain, 7/16-inch improved plow steel wire rope of 6x19 or 6x37 construction, or materials having equivalent strength, when in compliance with the requirements herein contained, will be acceptable. (The diameter of the wire rope is immaterial as long as it meets the minimum breaking strength requirements.)

(14) A loaded logging truck required to have wrappers by this section, may be moved within the loading area with-

out wrappers only if such movement does not present a hazard to workers.

(15) For the purposes of this standard, applied bundle straps or banding are not acceptable as wrappers and binders.

(16) All loose ends of wrapper chains or cables shall be securely fastened so as to prevent their swinging free in a manner that will create a hazard.

(17) Binders for securing wrappers on logging trucks shall be fitted with hooks of proper size and design for the wrapper chain being used.

(18) Wrappers shall be removed from service when any of the following conditions exist:

(a) Excessively worn links on chains;

- (b) Deformed or stretched chain links;
- (c) Cracked chain links;
- (d) Frayed, stranded, knotted, or otherwise defective wire rope.

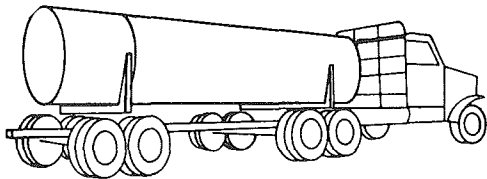
(19) Pipe extension handles (swedes) for tightening or securing binders shall be limited to not longer than thirty-six inches. Care shall be taken that a sufficient amount of the pipe extends over the binder handle.

(20) Defective binders shall be immediately removed from service.

Note: See Figures 9-A and 9-B for illustrations of placement and number of wrappers.

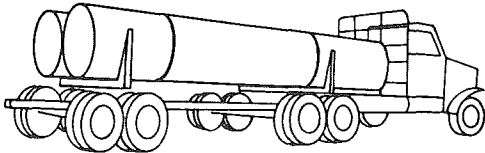
PLACEMENT AND NUMBER OF WRAPPERS

One Log Load



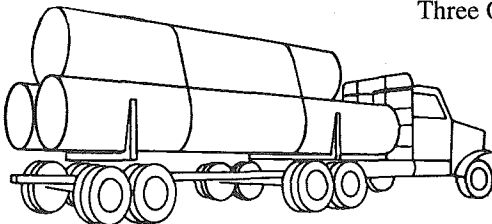
One wrapper required which shall be secured to the rear bunk. Log shall be blocked or secured in a manner to prevent it from rolling or shifting. An additional wrapper secured to the front bunk is optional.

Two Log Load



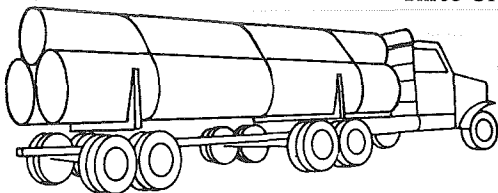
A minimum of two wrappers required. Logs shall be blocked to prevent them from rolling or shifting. If all logs are not contained by the stakes, additional wrappers required.

Three Or Four Log Load 44 Ft. Or Less

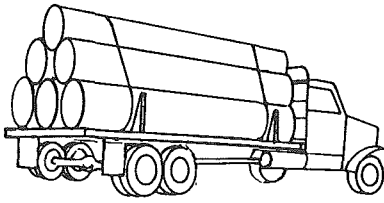


A minimum of two wrappers required. If all logs are not contained by the stakes, additional wrappers required.

Three Or Four Log Loads More Than 44 Feet

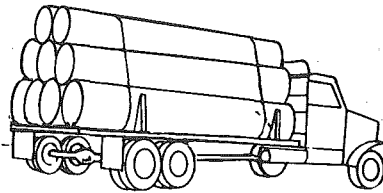


A minimum of three wrappers required. If all logs are not contained by the stakes, additional wrappers required.



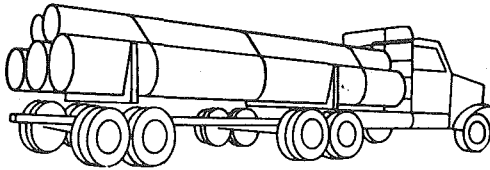
Five Or Six Log Load
All Logs 17 Feet Or Less

A minimum of two wrappers required. If all logs are not contained by the stakes, additional wrappers required.



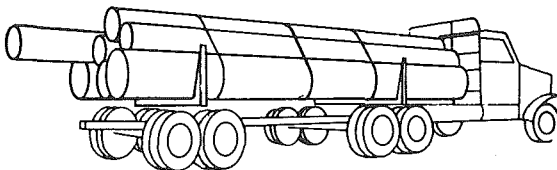
Seven Or More Log Load
All Logs 17 Feet Or Less

A minimum of two wrappers required. If all logs are not contained by the stakes, additional wrappers required.



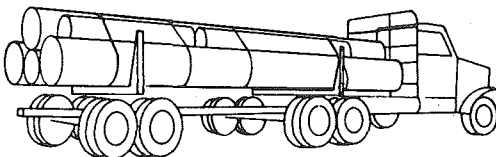
Five Or More Log Load
If Any Logs Are More Than 17 Feet

A minimum of three wrappers are required. If all logs are not contained by the stakes, additional wrappers required.



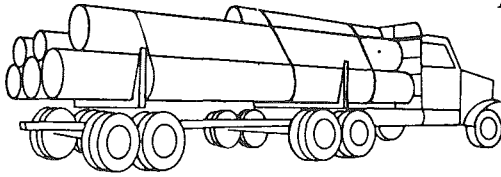
Proper Support For Logs

Not more than approximately one-third the weight of any log shall extend beyond the end of the logs or bunk supporting it.



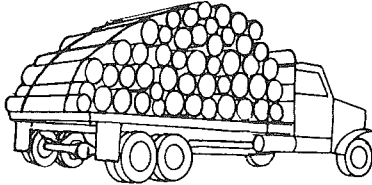
Outside Logs Or Top Logs

All outside (wing) or top logs shall be secured by a wrapper near but not within 12 inches of each end.



A Wrapper Shall Be Near Each Bunk

Each load shall be secured by having a wrapper within 6 feet of each bunk except on one log loads.



Short Logs Loaded Crosswise

A minimum of two wrappers are required and two chocks or stakes shall be used on the open end of the truck.

Note: All loads of logs on logging trucks equipped with chock blocks instead of stakes, shall have at least one additional wrapper over and above the requirements for trucks equipped with stakes, excepting on one and two log loads and trucks with short logs loaded crosswise.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-577, filed 9/21/79.]

WAC 296-54-579 Motor truck log transportation—Miscellaneous requirements. (1) No truck wheel shall have more than twenty-five percent of the lugs missing or defective.

(2) All truck wheels shall be maintained free of cracks, breaks, or defects.

(3) Windshields on all equipment shall be provided with windshield wipers in good working condition.

(4) Mule train trailers shall have a platform on the trailer tongue at least twelve inches by twenty-four inches made of nonslip material and capable of supporting at least three hundred pounds. The platform shall be of the self-cleaning type.

(5) Logs shall be loaded so that not more than approximately one-third of the weight of any log shall extend beyond the end of the logs or bunk supporting it.

(6) Trailer loading and unloading straps, links, or chains shall be fastened securely to the trailer frame and used in hoisting the trailer. The connections shall be maintained in good condition and shall not be attached to the trailer bunk. The use of molles for this purpose is prohibited.

(7) In unloading trailers from trucks, trailers shall be hoisted clear, the truck driven forward a safe distance, and the trailer lowered to within one foot of the roadway before persons approach the trailer or reach.

(8) Trailer hoisting or unloading straps shall be constructed and installed in a manner enabling the loading or unloading machine to engage the strap without manual personal contact.

(9) All motor vehicles shall be equipped with a horn that is audible above the surrounding noise level. The horn shall be sounded before operating the vehicle in reverse gear and

sounded intermittently during the entire backing operation. The horn shall be maintained in an operative condition.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-579, filed 9/21/79.]

WAC 296-54-581 Motor truck log transportation—Steered trailers. Steered trailers, not controlled from the truck cab, shall be designed, constructed, and operated as follows:

(1) A secure seat with substantial foot rest shall be provided for the operator at the rear of the bunk. Any arrangement that permits the operator to ride in front of the bunk is prohibited unless a false bunk or other adequate protection is provided for the operator.

(2) The seat for the operator shall be so arranged that he has an unobstructed exit from both sides and the rear.

(3) The bunk support shall be so constructed that the operator has a clear view ahead at all times.

(4) Adequate means of communication shall be provided between the operator and the truck driver.

(5) Eye protection and respirator shall be provided for the operator.

(6) The trailer shall be equipped with fenders or splash plates to protect the operator from mud and dust so far as possible.

(7) If used during periods of reduced visibility on roads not under the control of the state department of transportation, counties, or cities, the trailer shall be equipped with head, tail, turn and stop lights.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-581, filed 9/21/79.]

WAC 296-54-583 Stationary log truck trailer loading. (1) All loading devices shall be designed, constructed, and maintained in such a manner as to have a five to one safety factor for its rated load capacity.

(2) Loaders shall be constructed of such height and width that they can be safely used to load the maximum-sized trailers they will be expected to handle without hanging up or striking the equipment.

(3) Electric-powered trailer loading devices shall be equipped with a switch or device which will govern the upper direction of travel of the load line to a safe limit.

(4) Electric motors used for hoisting purposes shall be equipped with approved overload switches or breakers.

(5) All electrical switch controls shall not exceed twenty-four volts. All control switches shall be of the momentary contact type which require continuous manual pressure for hoist to operate.

(6) Pendant-type control switches shall be suspended by a chain or other suitable device which will prevent placing a strain on the electrical cable.

(7) Pendants shall be so installed that when retracted the control switch shall not touch the ground.

(8) All electrical equipment shall be weatherproof-type or adequately protected from the weather, and shall meet or exceed the requirements of the National Electrical Code as promulgated by the director of the department of labor and industries pursuant to RCW 19.28.060.

(9) Trailer loaders, except A-frame type or bridge crane, shall be equipped with reach guides or devices which will keep reach in proper alignment. A tag rope or other safe guidance device shall be used to guide trailers being loaded by use of an A-frame type loader.

(10) Access roads and the area around the trailer loading devices shall be kept free of standing water and debris and maintained in good repair.

(11) The maximum capacity load to be lifted shall be posted in a conspicuous location where it can be easily seen by any person operating the hoist.

(12) Trailer loading equipment shall be periodically inspected at least every thirty days and shall be maintained in good repair. A written report shall be made and signed by the person making the inspection and kept on file by the company for twelve months.

(13) A lifting test shall be conducted annually on each loading device and a written record showing the date, name of person conducting the test, amount of weight lifted and results shall be kept in the office of the employer or at the site. The test weight shall be at least one hundred twenty-five percent of the maximum rated load but not more than one hundred thirty percent of the maximum rated load.

(14) Each drum shall be designed and arranged in such a manner that the line will maintain lead and spool evenly without chafing, crossing or kinking.

(15) A braking system shall be installed which shall have the capability of safely braking and holding one and one-half times weight of the full rated load.

(16) When trailers are to be loaded after dark, sufficient lights shall be provided for a safe operation.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-583, filed 9/21/79.]

WAC 296-54-585 Log unloading, booms, and rafting grounds—Storage and sorting areas—General require-

(1999 Ed.)

ments. (1) At no time shall one person be permitted to work alone.

(2) (a) Employees working on over or along water, where the danger of drowning exists, shall be provided with and shall wear approved personal flotation devices.

(b) Employees are not considered exposed to the danger of drowning when:

(i) The water depth is known to be less than chest deep on the exposed individual;

(ii) When working behind standard height and strength guardrails;

(iii) When working inside operating cabs or stations which eliminate the possibility of accidentally falling into the water;

(iv) When wearing approved safety belts with lifeline attached so as to preclude the possibility of falling into the water.

(c) Prior to and after each use, personal flotation devices shall be inspected for defects which would reduce their designed effectiveness. Defective personal flotation devices shall not be used.

(d) To meet the approved criteria required by subdivision (a), a personal flotation device shall be approved by the United States Coast Guard as a Type I PFD, Type II PFD, Type III PFD, or Type V PFD, or their equivalent, pursuant to 46 CFR 160 (Coast Guard Lifesaving Equipment Specifications) and 33 CFR 175.23 (Coast Guard table of devices equivalent to personal flotation devices). Ski belt or inflatable type personal flotation devices are specifically prohibited.

(3) In operations where regular logging machinery, rigging, etc., is used, the applicable sections of these rules shall apply.

(4) Artificial lights shall be provided and used where work is to be done between the hours of sunset and sunrise. Such lights shall be located in a manner that will be reasonably free of glare and provide uniform distribution of illumination and avoid sharply defined shadows.

(5) On all log dumps, adequate power for the method used for unloading shall be provided. All machines used for hoisting, reloading or lowering purposes shall be of approved design and sufficient power to control or hold the maximum load imposed in mid-air.

(6) Binders shall not be released from any load until an effective safeguard is provided.

(7) All mobile log handling machines shall be equipped with a means or mechanism which will prevent the logs from accidentally leaving the forks, and shall be used.

(8) The operator of the unloading machine shall have an unobstructed view of the unloading area or shall make certain no one is in the area where the logs are to be unloaded. Rear-view mirrors shall be installed on mobile log handling equipment to assist the operator in ascertaining that the area behind the machine is clear before backing up.

(9) Unloading lines shall be so arranged that it is not necessary for the workman to attach them on the pond or dump side of the load.

(10) Life rings with a minimum of ninety feet of one-fourth-inch line with a minimum breaking strength of five hundred pounds attached, shall be provided at convenient points adjacent to water which is five feet or more in depth.

[Title 296 WAC—p. 1193]

Life rings shall be a minimum of thirty inches outside diameter and seventeen inches inside diameter and be maintained so as to retain a thirty-two pound positive buoyancy.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-585, filed 9/21/79.]

WAC 296-54-587 Water dumps. (1) All water dumps shall have brow logs except when logs are lifted from the load. If portable equipment is used, adequate stops shall be provided to prevent equipment from running off the dump.

(2) Where necessary for persons to walk alongside loads and equipment on trestles or fills, a minimum twenty-two inch wide walkway shall be provided, unless otherwise specified.

(3) All decks and plankways on log dumps must be kept in good repair and free from bark and other debris. Roadways shall not be inclined more than one inch to twelve inches across the driving surface.

(4) The use of small bridge-over logs, planking or timbers, between regular foot logs, or walkways, which will not support the weight of at least three persons are prohibited. All regular foot logs shall be barked on upper side.

(5) Electric powered hoists using hand-held cord remote controls in grounded locations, shall be actuated by circuits operating at no more than twenty-four volts. All control switches shall be of the momentary contact type which requires continuous manual pressure for the hoist to operate.

(6) Roadbeds at log dumps shall be hard packed gravel, heavy planking, or equivalent material, and shall be of sufficient width and even surface to insure safe operation of equipment.

(7) Where logs are unloaded on to rollways, sufficient space shall be provided between the top of the skids and the ground to clear the body of a person.

(8) When a brow log is used with a parbuckle system, all persons are prohibited from going between the brow log and the load of logs at any time.

(9) A positive safeguard shall be provided to prevent logs from leaving the loads on the side opposite the dump. Unloading lines, crotch lines or equally effective means shall be arranged and used in a manner to prevent any log from swinging or rolling back.

(10) All persons shall remain in the clear until all moving equipment has come to a complete stop.

(11) Logs shall not be unloaded by peaves or similar manual methods, unless means are provided and used that eliminate the danger from rolling or swinging logs.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-587, filed 9/21/79.]

WAC 296-54-589 Boom and rafting grounds. (1) Breaking of log jams by peavy method is prohibited, except in river drive or when jam occurs away from mechanical means or the dump.

(2) Wooden pike poles shall be of continuous, straight-grained No. 1 material. Defective poles, blunt or dull pikes shall not be used. Conductive pike poles shall not be used where there is a possibility of coming in contact with energized electrical conductors.

[Title 296 WAC—p. 1194]

(3) Stiff booms shall be made by fastening not less than two boom sticks together. The width of a stiff boom shall be not less than thirty-six inches measured outside to outside of the logs. The boom sticks shall be fastened together with not less than 4" x 6" cross ties, or cable lashings notched into the boom sticks may be used when stiff booms are exposed to heavy swells. Stiff booms shall be kept free of loose bark and shall be maintained in good repair.

(4) A walkway thirty-six inches wide with standard hand railing shall be provided from the shore end of stiff boom to shore.

(5) All sorting gaps shall have a substantial stiff boom on each side of gaps. Such stiff booms or walkways shall be planked over.

(6)(a) Boom sticks shall be reasonably straight with no protruding knots or loose bark. They shall be capable of supporting above the water line at either end the weight of one worker and equipment or two hundred fifty pounds.

(b) Foot logs shall be reasonably straight with no protruding knots or loose bark and shall be of sufficient size to support above the water line at either end the weight of two workers and equipment or five hundred pounds.

(7) Boom sticks which have been condemned as unsafe shall be marked by three chopped crosses ten feet from the butt end, and such sticks shall not be used as boom sticks.

(8) Gaps between boom sticks shall not exceed twenty-four inches. All wire shall be removed from boom sticks and boom chains before they are re-used or hung in rafting stalls.

(9) When permanent cable swifters are used they shall be arranged so that they are within easy reach of rafter without rolling boom sticks on which they are fastened. When cables become hazardous to use because of jagers, they shall be discarded.

(10) When floating donkeys or other power-driven machinery is used on boom, it shall be placed on a raft or float with enough buoyancy to keep the deck of such raft or float well above water. Wherever persons walk, the deck of the raft or float shall be planked over with not less than two inch planking, and kept in good repair.

(11) When doglines used in rafting, brailing or stowing logs become hazardous to use because of jagers, they shall be discarded.

(12) Storing, sorting or any boom work, other than boom boat operations, shall require a minimum of two persons.

(13) Sufficient walkways and floats shall be installed and securely anchored, to provide safe passage for workers.

(14) Walkways alongside sorting gaps shall not be less than four feet wide. Other walkways shall be not less than twenty-two inches wide.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-589, filed 9/21/79.]

WAC 296-54-591 Boats and mechanical devices on waters. (1) Prior to starting the boat motor, any spilled fuel shall be removed and vapors shall be exhausted from any area in which they may accumulate.

(2) The bilge area shall be kept clean and oil, grease, fuel, or highly combustible materials shall not be allowed to accumulate.

(1999 Ed.)

(3) Adequate ventilation equipment shall be provided and used for the bilge area to prevent the accumulation of toxic or explosive gases or vapors.

(4) Adequate ventilation equipment shall be provided and used for the cabin area on enclosed-cabin type boats to prevent an accumulation of harmful gases or vapors.

(5) Deck and cabin lighting shall be provided and used where necessary to provide safe levels of illumination aboard boats. Boats operated during the period from sunset to sunrise, or in conditions of restricted visibility, shall display navigation lights as required by the United States Coast Guard. Searchlights or floodlights shall be provided to facilitate safe navigation and to illuminate working or boarding areas adjacent to the craft.

(6) On craft used by workers wearing calked shoes, all areas where the operator or workers must stand or walk shall be made of or be covered with wood or other suitable matting or nonslip material and such covering shall be maintained in good condition.

(7) Each boat shall be provided with a fire extinguisher and life ring with at least fifty feet of one-fourth inch line attached. On log broncs, boomscoters, or other small boomboats where all occupants are required to wear life saving devices and a life ring would present a tripping hazard, the life ring may be omitted.

(8)(a) Along docks, walkways, or other fixed installations on or adjacent to open water more than five feet deep, approved life rings with at least ninety feet of one-fourth inch line attached, shall be provided. The life rings shall be spaced at intervals not to exceed two hundred feet and shall be kept in easily visible and readily accessible locations.

(b) When employees are assigned work at other casual locations where exposure to drowning exists, at least one approved life ring with at least ninety feet of line attached, shall be provided in the immediate vicinity of the work assigned.

(c) Where work is assigned over water where the vertical drop from an accidental fall would exceed fifty feet, special arrangements shall be made with and approved by the department of labor and industries prior to such assignment.

(d) Lines attached to life rings on fixed installations shall be at least ninety feet in length, at least one-fourth-inch in diameter, and have a minimum breaking strength of five hundred pounds. Similar lines attached to life rings on boats shall be at least fifty feet in length.

(e) Life rings must be United States Coast Guard approved thirty-inch size.

(f) Life rings and attached lines shall be maintained to retain at least seventy-five percent of their designed buoyancy and strength.

(9) Log broncs, boomscoters, and boomboats shall not be loaded with personnel or equipment so as to adversely affect their stability or seaworthiness.

(10) Boats shall not be operated at an excessive speed or handled recklessly.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240, 79-10-081 (Order 79-14), § 296-54-591, filed 9/21/79.]

(1999 Ed.)

WAC 296-54-593 Dry land sorting and storage. (1) Unauthorized foot and vehicle traffic shall not be permitted in the sorting or storage area.

(2) Logs shall be stored in a safe and orderly manner. Roadways and traffic lanes shall be kept clear of protruding ends of logs and debris.

(3) Dry deck log storage areas shall be kept orderly and maintained in a condition conducive to safe operation of mobile equipment. Roadways and walkways shall have a smooth hard-packed surface wide enough to permit a safe operation. Bark, mud, and other debris shall not be allowed to accumulate to the extent it constitutes a hazard to the operation.

(4) At log dumps, sorting and storage areas, an effective means shall be provided and used to control dust.

(5) Only an authorized person shall operate or ride any lift truck, log stacker, or log unloader.

(6) Signaling log unloader operators at dry deck areas by throwing bark or chips in the air is prohibited. Hand, horn signals or other safe, effective means shall be used at all times.

(7) Unnecessary talking to operator while engaged in operating controls of log stacker or log unloader is forbidden.

(8) Lift forks and arms of unloading machines shall be lowered to their lowest position, and all equipment brakes set prior to the operator leaving the machine unattended.

(9) Log unloaders or stackers shall not be moved about the premises for distances greater than absolutely necessary with the lift extended above the drivers head or with loads lifted higher than is necessary for vision.

(10) When truck drivers are out of the cab, they shall be in the clear, and in view of the log unloader before the lift forks are moved under the load and the lift is made.

(11) Where logs are offloaded onto a dry deck by means of unloading lines, a mechanism shall be used which is self-releasing. Employees shall be prohibited from ascending dry decks to release unloading lines.

(12) Persons shall not position themselves in the hazardous area near or under loads of logs being lifted, moved or suspended.

(13) Jackets or vests of fluorescent or other high visibility material shall be worn by persons working on dry land log storages. Hard hats shall be of a contrasting color or shall have high visibility tape affixed thereon.

(14) Log unloaders and log stackers designed in a manner whereby logs being handled may jeopardize the safety of the operator shall be provided with overhead protection and any other safeguards needed to afford adequate protection.

(15) Log unloaders and log stackers shall be equipped with a horn or other audible warning device. If vision is impaired or restricted to the rear, the warning device shall be sounded before operating the vehicle in reverse gear and sounded intermittently during the entire backing operation. The warning device shall be maintained in an operative condition.

(16) Each log-handling machine shall be equipped with a braking system which is capable of stopping and holding the machine with maximum load on any grade on which it may be required to work.

[Title 296 WAC—p. 1195]

(17) A limit stop, which will prevent the lift arms from over-traveling, shall be installed on electric powered log unloaders.

(18) Shear guards shall be installed on unloading machines and similar types of equipment on which the arms pivot and move alongside the operator creating a pinch point at that location.

(19) All forklift type machines shall be equipped with grapple arms and the arms shall be used whenever logs are being moved.

(20) When log trucks are loaded by the use of a log stacker and the lay of any log is higher than the stakes, the log stacker shall remain against the completed load, or other suitable protection provided, to prevent the logs from falling until at least two wrappers and binders have been applied.

(21) All binders and wrappers shall remain on the load until an approved safeguard has been provided to prevent logs from rolling off the side of the truck or trailer when binders are released. A shear log, or equivalent means, shall be provided to ensure the log truck will be stationed close enough to the wrapper rack so that a log cannot fall between the log truck and the wrapper rack when removing binders and wrappers. At least one binder shall remain secured while relocating or tightening other binders. Crotch lines, forklifts, log stackers, log unloaders, or other effective means shall be used for this purpose.

(22) An extra wrapper or metal band of equal strength shall be placed to hold the logs when it is necessary to remove a wrapper to prevent it from being fouled by the unloading machine.

(23) Machines of the type having arms which block the regular exit when in the up position, shall have an emergency exit installed.

(24) Seat provided. Riding on any part of a log handling machine except under the canopy guard is prohibited.

(25) Identification tags shall not be applied or pulled unless logs are resting in a stationary place, such as bunks, cradles, skids, or sorting tables.

(26) No person shall approach the immediate vicinity of a forklift-type log handling machine without first notifying the operator of the person's intention and receiving an acknowledgement from the operator.

(27) When forklift-type machines are used to load, unload, or handle trailers, a positive means of holding the lifting attachment to the fork shall be installed and used.

(28) When dry land log dumps use unloading methods similar to those of water dumps, the safety standards for water dumps shall apply to dry land dumps.

(29) When logs are handled between the hours of sunset and sunrise or other periods of poor visibility, illumination shall be provided consistent with chapter 296-62 WAC, general occupational health standards, pertaining to illumination.

(30) Air operated stake releases shall be in conformity with the following requirements:

(a) The air supply shall be taken from the "wet" air reservoir or from the accessory air line to a spring loaded, normally closed control valve.

(b) The control valve shall be located in the cab, positioned so that it is accessible only from the operator's position.

(c) The control valve shall be fitted with a spring loaded cover or be otherwise guarded against inadvertent operation.

(d) A separate air line shall extend from the control valve to the tractor and trailer stake release chambers. The air line shall be clearly identified or installed in such a manner as to preclude it from being mistaken for the service or emergency air line.

(31) Each deck shall be constructed and located so it is stable and provides each employee with enough room to safely move and work in the area.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-593, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-593, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-593, filed 9/21/79.]

WAC 296-54-595 Railroad operations. (1) All persons employed in any service on trains or rail operations, which are not engaged in interstate commerce, are subject to and shall be conversant with all rules and special instructions.

(2) Employees must render every assistance in their power in carrying out these rules and special instructions and must report to the proper official any violation thereof.

(3) Accidents, detention of trains or speeders, failure in supply of fuel or water, defects in track, bridges, or signals, must be properly reported to the supervisor by the quickest possible method.

(4) Any logging railroad may maintain a special set of operating rules applicable to their operation, provided that said rules are acceptable to the division of industrial safety and health, department of labor and industries.

(5) Each logging railroad operation which has more than one piece of railroad equipment in operation, must have a dispatcher on duty. All equipment must receive clearance from dispatcher.

(6) Train crew size shall be dependent upon the number of persons needed to safely operate the train under all prevailing conditions; however, when necessary to set hand brakes, two or more persons shall be assigned to set the brakes and give signals.

(7) All locomotives shall be equipped with sanding devices for both rails, front and rear, in proper working order. Clean, dry sand should be used.

(8) Locomotives shall be equipped with power brakes (air or steam) on all driving wheels. Tenders also shall have power brakes.

(9) All locomotives and speeders, operating between sunset and sunrise or other periods of reduced visibility, shall be equipped with and use head lights which shine in the direction of travel. The lights shall be of sufficient candlepower so the train can be stopped within range of the light beam. Cab lights shall be provided and maintained so the operators can see from their required positions the gauges and equipment necessary for operation.

(10) All locomotives shall be equipped with proper grab irons, hand holds, steps, and running boards.

(11) All locomotives shall be equipped with automatic couplers, suitable for low or high draw-bars.

(12) On all rolling stock, wheels which have sharp or badly worn flanges, shall be replaced. Avoid the use of flat wheels.

(13) All locomotives with tender shall have an apron of proper length and width to insure safety and which shall be roughened to insure secure footing.

(14) Handholds and footboards shall be provided on locomotive cranes, except where cab overhangs end of car.

(15) Trains and speeders shall not exceed a safe speed.

(16) A terminal test of air brakes shall be made by trainmen before leaving the terminal. Enginemen shall not proceed until they are satisfied by brake action that brakes are able to control the train.

(17) All of the cars in a train shall have their brakes in good operating condition.

(18) On railroads where joint operations of two or more firms are necessary, trains shall not be dispatched less than fifteen minutes apart. Red lights shall be displayed on the rear of such trains at night or when visibility is poor.

(19) Whenever cars are left on grades, derailleurs shall be provided. Derail signs shall be placed near derailleurs. In setting out equipment, care shall be used in seeing that proper clearance is provided.

(20) Standard pressure for mountain grades requires a pressure of ninety pounds in train pipe, one hundred ten pounds in main reservoirs (low pressure) and one hundred thirty pounds in high pressure to insure quick releasing of brakes and recharging of auxiliaries. Engineer shall see that the engine carries these pressures and that sanders, both forward and rear, are in working order. On all heavy grades the high pressure retaining valve must be used and before train is started from landing, a test of brakes must be made and piston travel adjusted, if necessary, and retaining valves put up. Engineer shall start train away from landing slowly, giving wheels a chance to roll before applying brakes and, to avoid skidding of wheels, using sand freely. Brakes should then be applied immediately and released, allowing the retaining valves to hold the train while train pipe and auxiliaries are being recharged. Train speed should be held to the required rate by setting and releasing brakes as it is necessary to control train.

(21) When it is necessary to leave loads on pass while switching a side, loads must be left close to derailer, air set and sufficient hand brakes set up, before cutting engine from train.

(22) Engineer must see car or signal person when making couplings, giving train crew ample time to align drawheads and open knuckles of coupler, especially on curves, except when using radios.

(23) Drawbars should not be aligned with the foot while cars or engines are in motion. Train crew shall not climb between cars while in motion. Engineers shall not drift too close to switches which are to be thrown. Position of switch points should always be observed after throwing switch. Switch lever should be pushed firmly into the notch before leaving the switch. No persons except trainmen, unless authorized, shall ride on engine foot-boards. No object shall be thrown from train or engine while in motion. Bell shall be rung or whistle blown, before moving locomotive.

(24) No equipment shall be pushed ahead of locomotive unless a brake tender is on head car in constant view of engineer or second brake tender in position to intercept and pass signal to engineer.

(25) In addition to air brakes, hand brakes must be provided on all cars and maintained in good working order.

(26) Hand brakes must be easily accessible to brake tenders when cars are loaded. When wheels or staff brakes are used they should be placed on the side opposite the brow log at the dump to prevent their damage when cars are unloaded. All switch throws, walkways and cleared areas for brake tenders shall be on the hand brake side.

(27) All brake hickies shall be made from three-fourths inch hexagon steel (high grade) and be twenty-four inches with a good claw on one end to fit the wheel and a knob on opposite end to prevent slipping from brakeman's hand.

(28) All railroad trucks and cars, where brakes are set by hand while in motion, shall have good footboards and toeboards on the brake end.

(29) A ten inch bunk block is recommended on all trucks to prevent logs from slipping over block.

(30) All cars other than logging trucks must have hand hold and foot steps to permit persons to get on and off easily and safely.

(31) All cars and trucks regularly operated must have automatic couplers.

(32) Locomotives and cabooses shall carry the following equipment:

1 red light (lantern type)

3 red flags

At least 3 fuses

(33) When a train stops between telephones, or where the rear of a train extends beyond yard limits, the rear of the train must be properly protected.

(34) Whistle sign board shall be placed one thousand two hundred feet from each side of highway crossings.

(35) A rail clamp shall be placed to hold cars left on a grade on main line or spurs.

(36) All cars and trucks shall be legibly numbered so that those with defects may be reported and taken out of service. Each locomotive, speeder, or other self-propelled vehicles shall be numbered, or otherwise made readily identifiable.

(37) All cars used for hauling logs shall be equipped with patent stake bunks, or bunks with chock blocks and/or chains, so constructed that block can be released from opposite end of bunk unless solid stakes are used.

(38) All main line trains of more than ten loaded cars shall have a caboose at the rear of the train.

(39) All operations having both truck roads and railroads, shall post signs at intersections same as public crossings.

Engine whistle signals. The following engine whistle signals are established as standard and are taken from the American Association of Railroads. The signals prescribed are illustrated by "o" for short sounds and "-" for long sounds. Audible whistle shall be sounded when approaching camps, junctions, grade crossings and other prescribed places in conformity with the American Association of Railroads:

One short	(o) Stop, apply brakes.
Two long	(—) Release brakes.
Three long	(— —) When running, train parted, to be repeated until answered by hand signal.
Two short	(oo) Answer to any signals not otherwise provided for.
Three short	(ooo) When train is standing back.
Four short	(oooo) Call for signals.
Two long, two short	(—oo) Approaching highway crossing at grade.
One long	(-) Approaching station, rollway, chute, crossing, junctions, and derailleurs. When standing, air leak.
Six long	(— — —) Repeated at intervals, call for section crew, train derailed.
One long, three short	(-ooo) Flagger to go back and protect rear of train.
Four long	(— —) Foreman.
Five long	(— — —) Flagger to return from any direction.
Long, short	(-o-o-o) Repeated four or more times, fire alarm.
Seven long, two short	(— — — — oo) Repeated, person hurt.
One long, one short	(-o) Repeated at intervals, closing down.
Groups of shorts repeated	(ooooooo) Danger of runaway.
Unnecessary use of whistle is prohibited.	

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-595, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-595, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-595, filed 9/21/79.]

WAC 296-54-597 Railroad maintenance—Loading or unloading. (1) Track gangs, bridge crews, etc., when working on railroads in use shall place a yellow caution flag by day and a yellow lantern by night a sufficient distance both directions from the crew to protect them against approaching equipment. The operator of said equipment shall acknowledge the signal by two short blasts of the whistle or horn and proceed with caution.

When said crews are removing or replacing a rail or are performing any other work that would make it necessary for approaching equipment to come to a stop, they shall place a red flag by day and a red lantern by night in the center of the track a sufficient distance in both directions from the crew to protect them against said equipment. The operator of approaching equipment shall acknowledge the signal by one short blast of the whistle or horn and shall come to a dead stop and remain standing until the signal is removed by the person who placed it, or until investigation proves that the track is safe for passage. If a flagger is used, the above provision need not apply.

(2) Where clearance is scant, warning signs or signals shall be posted.

(3) Switch throws should be kept well oiled and targets and signs in good legible condition.

(4) Standard clearances shall be maintained at all points on the right of way except where necessarily restricted where loading or unloading operations are performed or at water tanks, fuel tanks, etc. Warning signs shall be posted at all such locations.

(5) Whenever workers are repairing, working on or in railroad equipment, loading or unloading cars or performing other duties where there is danger of the railroad equipment being struck by other moving railroad equipment; proper means, methods or safeguards shall be used to protect such workers. A derail shall be used to prevent other rail equipment from contacting such cars or equipment or endangering the work crew. After cars are spotted, blue flags shall be placed in the center of the tracks at least fifty feet from the end car during the day and blue lights shall be installed at such locations at night. Flags, lanterns and derails shall be removed only by the person placing them unless they are to remain posted for a longer period of time, in which case one person on each oncoming shift shall be responsible to ascertain that they are in place and they shall not remove such safeguards until that person investigates to make certain all persons are in the clear. Operators of approaching equipment shall not pass or remove a flag or lantern which is properly posted. Cars or other equipment shall not be placed where it will obscure the signal from an operator controlling approaching equipment.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-597, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-597, filed 9/21/79.]

WAC 296-54-599 Truck and equipment maintenance shops. It is recognized that the usual hazards encountered in maintenance shops performing work on logging and related equipment would be very similar to those found in general repair, machine or welding shops; therefore, the rules contained in the general safety and health standards and other applicable safety standards promulgated and administered by the department of labor and industries shall apply to such places of work.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-599, filed 9/21/79.]

WAC 296-54-601 Signals and signal systems. (1) Standard hand or whistle signals as described or illustrated herein, shall be used for the movement of rigging, logs, or equipment when using a high lead, slackline, or cable skidder system for yarding. For hand signal illustrations, see Figure 4.

(2) Voice communications may be used for yarding under the following conditions:

(a) Voice communications by use of radio frequencies may be used to transmit instructions and directions to the yarder operator when using a grapple type logging system, providing no person is in a hazardous area near live rigging.

(b) Voice communication may be used to instruct the yarder operator when picking up an occasional log with the use of a choker on a grapple system, providing the grapple is on the ground prior to the setting of the choker and that no lines are moved by the operator until the person setting the choker has returned to a safe location away from any running lines. At no time shall chokers be used on the grapple system during the hours of darkness or during periods of reduced visibility to such extent that the yarder operator cannot clearly see the setting of the choker. When a number of logs are required to be yarded by using chokers instead of the grapple,

the requirements specified for high lead type of logging shall apply.

(c) Voice communications by use of radio frequencies may be used to transmit instructions and directions to the yarder operator when using a balloon system for yarding. The person operating the radio shall ascertain that all crew members are in the clear before transmitting instructions which would cause any line or turn to move. The person giving such instructions shall keep the crew members informed as to which movements will commence. The whistle shall be blown before moving any running line.

(d) The Federal Communications Commission rules require that assigned call letters be used in conjunction with voice communications.

(3) Voice communications on the same radio frequencies used to transmit skyline, highlead, slackline, or skidder whistle signals (154.57 and 154.60 MHz channels), shall be prohibited.

Note: If voice is received on 154.57 or 154.60 MHz channels, it is recommended the Assistant Director, Department of Labor and Industries, P.O. Box 44650, Olympia, Washington 98504-4650 (phone (360) 902-5428) be contacted as soon as possible to enable the department to ascertain the source of the voice transmission.

(4) If a standard signal is not listed for an unusual or new situation, a hand or whistle signal other than any listed for the type of yarding being done may be used for the specific situation only. Any special signals so developed shall be understood by all persons required to work in the area which may be affected by their use.

(5) A copy of the standard hand and whistle signals shall be posted on the yarder and at places where crews congregate. For tractor logging operations, hand signals shall be posted at places frequented by the crew members such as in crew buses, etc.

(6) Only one person in any crew shall give signals at the point where chokers are being set. Any person is authorized to give a stop signal when a person is in danger or other emergency condition is apparent.

(7) Hand signals are permitted only when the signal person is in plain sight of the machine operator and when visibility is such that the signals are discernible. Hand signals may be used at any time as an emergency stop signal.

(8) Throwing of any type of material as a signal is prohibited.

(9) The use of a jerk wire signal system for any type of yarding operation is prohibited.

(10) All persons shall be in the clear before any signal is given to move the rigging, logs, or turns, and movement of rigging, logs, or turns shall not commence until after the proper signals have been given.

(11) Machine operators shall not move any line unless the signal received is clear and distinct. If in doubt, the operator shall repeat the signal as understood and wait for confirmation.

(12) A horn or whistle which is automatically activated by the radio or electric signaling system shall be used on each yarder used for skyline, high lead, skidder or slackline system of yarding, except where hand signals are permissible. The horn or whistle shall emit a sound which will be clearly audi-

ble to all persons in the affected area. Such a horn or whistle shall also be required on combination yarding and loading machines and tree pullers. Audible signals are not necessary on grapple or other yarding systems where persons are not exposed to the movement of logs or rigging.

(13) Each unit of the signal or control system in use, shall be tested daily before operations begin. Audible signals used for test purposes shall not include signals used for the movement of lines or materials.

(14) Citizen band (CB) radios shall not be used to activate any signal, machine, or process, either automatically or by voice. This shall not prohibit the use of CB radios for communication between sides, vehicles, work units, or for emergency situations.

(15) When audible whistle signals are being used simultaneously by yarding and loading machines at a landing, signal whistle or horn tones used in connection with machine movements shall be so differentiated as to distinctively identify any intended work movement of either machine.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-601, filed 10/28/96, effective 1/1/97. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-11-057 (Order 80-15), § 296-54-601, filed 8/20/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-601, filed 9/21/79.]

WAC 296-54-603 Electric signal systems. (1) Where an electrical signal system is used, all wire and attachments shall be of the weatherproof type and all connections shall be weatherproof.

(2) Electric signal systems shall be properly installed and adjusted. They shall be protected against accidental signaling and shall be maintained in good operating condition at all times. Sufficient signal wire shall be provided to enable good voice contact between the whistle punk and rigging crew at all times.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-603, filed 9/21/79.]

WAC 296-54-605 Radio systems used for voice communication, activation of audible signals, or equipment. (1) Every employer who uses a radio signaling or control system (voice or functions) shall comply with or exceed the minimum requirements specified in this section.

(2) A valid operating permit shall be obtained by the owner from the department of labor and industries, prior to putting into use any radio signaling or control system (voice or functions) intended to be used in conjunction with any type of cable logging operation. Permits will be issued only for systems licensed for such use and using those carrier frequencies as authorized by the Federal Communications Commission. In addition, permits will be granted only when tone or function frequencies are compatible with other radio systems in use and when in compliance with all other applicable requirements contained in this safety standard.

(3) The department of labor and industries reserves the right to designate the use of radio frequencies for certain purposes or functions, for example, certain frequencies may be used for voice transmission of instruction, others for tone coded functions, or activation of signaling devices. No single tone sets shall be permitted for logging purposes. The depart-

ment may also designate which tone frequencies may be used for the activation of a signaling device or for control of equipment on certain federal communication assigned carrier frequencies.

(4) A list of tone frequencies which may be used with any Federal Communications Commission assigned carrier frequencies will be made available by the department to any interested person, firm, or corporation upon request.

(5) The department shall assign the area or areas in which a radio signaling system may be used and shall so mark on the permit. Radio signaling systems shall not be used in any area other than indicated on the permit. (See Figure 10 for map of areas.)

(6) The person or firm name on the permit shall be the same as the person or firm operating the radio signaling system except for loaner or rental sets. A person or firm using a loaner or rental set shall be responsible for the radio signal system as if they were the owner of the set. The application for a permit to use a radio signaling system shall contain the following information:

(a) Name and address of applicant.

(b) The radio frequencies of the radio signaling device in MHz.

(c) The tone frequency or frequencies of the radio signaling system used to activate a horn, whistle, or control equipment in Hz. The security gate, or pulse tone, shall be shown first.

(d) The name of the manufacturer of the radio signaling system.

(e) The serial number of the receiving unit.

(f) The state assigned area or location in which the unit will operate.

(g) Indicate type of signaling used.

(h) From whom the system was purchased or acquired, and the date of acquisition of the system.

(i) Intended use and function of system.

(7) The permit granted by the department shall be attached to the case of the receiver of the radio signaling system for which it is granted.

(8) Each radio receiver shall have its radio carrier frequency in MHz and tone frequency(s) in Hz indicated on the outside case of the receiver. The manufacturer's name and serial number shall also be permanently indicated on the outside of the case. When the duration or width of the tone frequencies performs a function, the one duration/width shall also be permanently indicated on the outside of the receiver case. Each transmitter shall be identified with its receiver. Two or more receivers in operation simultaneously on the same tone frequency shall be prohibited.

(9) It shall be the responsibility of the owner of any radio signaling system to notify the department of labor and industries, immediately, if the signal system is:

(a) Permanently retired (in what manner and date retired).

(b) Sold (submit name and address of purchaser and date sold).

(c) Removed from the state (name of state to which moved and date moved).

(d) Stolen (date).

(10) Two operable transmitters shall be carried by separate individuals at the point where chokers are being set at all times when transmitters are being used for tone signaling by persons around the live rigging in the choker setting area. Only one radio transmitter shall be required if in the possession of a signalperson who has no other duties and remains in an area where there are no hazards created by the moving rigging or logs. If the total crew consists of a yarder operator and one person in the rigging, only one transmitter is required provided a positive system is instituted and used to check on the well-being of the person in the rigging.

(11) When interference, overlap, fadeout, or blackout of radio signals is encountered, the use of the device shall be discontinued immediately. The use of the device shall not be resumed until the source of trouble has been detected and corrected.

(12) All radio signaling systems put into use for the first time after the effective date of these safety standards, shall meet or exceed the minimum performance specifications contained in WAC 296-54-607 of these safety standards, and, when altered or repaired, shall continue to meet such specifications.

(13) At least one make and model of each signaling system shall be tested and certified that it meets or exceeds the minimum requirements for performance as specified in WAC 296-54-607. A copy of such performance report shall be signed by the person or persons who tested the unit or components and shall be sent to the Department of Labor and Industries, P.O. Box 44650, Olympia, Washington 98504-4650.

(14) Radio equipment shall not be used without displaying a permit as required by this standard. The permit shall be prominently displayed on the outside case of the receiver of the unit or, for radio controlled carriages, on the transmitter in the yarder.

(15) Adjustments, repairs, or alterations of radio signaling devices shall be done only by or under the immediate supervision and responsibility of a person holding a first-class or second-class commercial radio operator's license, either radio-telephone or radio-telegraph, issued by the Federal Communications Commission. Persons who do not possess the technical ability or do not have the proper equipment to cause the signaling systems to function within required tolerances shall not attempt to repair, alter, or adjust such systems.

(16) Radio frequencies assigned to systems for which voice communications may be used to give signals to the yarder operator, shall not be the same frequencies as those assigned for whistle signals used in skyline, highlead, slackline, or cable skidder systems.

(17) When hazardous interference is created by moving a voice communication system into an area where a system is already in use on the same frequency, use of the newly-moved system shall be immediately discontinued until the problem of interference has been corrected.

(18) Before moving any unit from one assigned geographical area to another (see area map, Figure 10 following this section), a new permit shall be applied for and secured from the Department of Labor and Industries, P.O. Box 44650, Olympia, Washington 98504-4650.

Form No. 157.

5-71

STATE OF WASHINGTON
DEPARTMENT OF LABOR AND INDUSTRIES DIVISION OF SAFETY

APPLICATION FOR PERMIT
TO OPERATE RADIO SIGNAL SYSTEM IN DESIGNATED AREA

Radio Carrier Frequency..... Serial No.....
Tone Coding Frequency..... Hz..... Name of Manufacturer of Signal System.....
Firm Name..... Address..... By.....
Intended Function of Unit: Voice communication [] Whistle signal [] Control Equipment []
Area in which Unit will be Operated:..... 1 [] 2 [] 3 []
Type of Tone: Sequential [] Simultaneous [] If other specify type.....
System to be Used For: Grapple [] Skyline, Highlead, Slackline, Skidder [] Balloon []
System Purchased or Acquired From.....
Date System Purchased or Acquired: Day..... Month..... Year.....
Mail Permit to.....
Date Application Mailed to Division of Safety Day / Mo. / Year

Date Permit Issued / /
DIV. OF SAFETY USE ONLY
Day Mo. Year



Dept. of Labor & Industries
Div. of Consultation & Compliance
P.O. Box 44650
Olympia, WA. 98504-4650



APPLICATION FOR PERMIT
TO OPERATE RADIO SIGNAL SYSTEM
IN DESIGNATED AREA

Firm name Phone number
Address City State ZIP+4
Radio carrier frequency Receiver's serial no.
Tone coding frequencies
Name of manufacturer of signal system
Intended function of unit: [] Voice communication [] Whistle signal [] Control equipment [] Grapple [] Highlead, Slackline, Skidder [] Balloon
System to be used for:
Area in which unit will be operated 1 [] 2 [] 3 []
Type of tone: [] Sequential [] Simultaneous [] If other, specify type
System purchased or acquired from Date system purchased or acquired:
Mail permit to: Department Use Only
Address City State ZIP+4 Date Permit Issued

F416-087-000 app for permit 9-94

Figure No. 10

STATE OF WASHINGTON
DEPT. OF LABOR & INDUSTRIES DIV. OF SAFETY

PERMIT #

TO OPERATE MULTI-TONE RADIO SIGNAL SYSTEM
IN DESIGNATED AREA.

Model Serial

Carrier Frequency MHz

Tones Hz

AREA

Firm Name

Issued by

S. F. No. 158-12-71-25C, 38416.

Dept. of Labor & Industries
Div. of Consultation & Compliance
P.O. Box 44650
Olympia, WA. 98504-4650



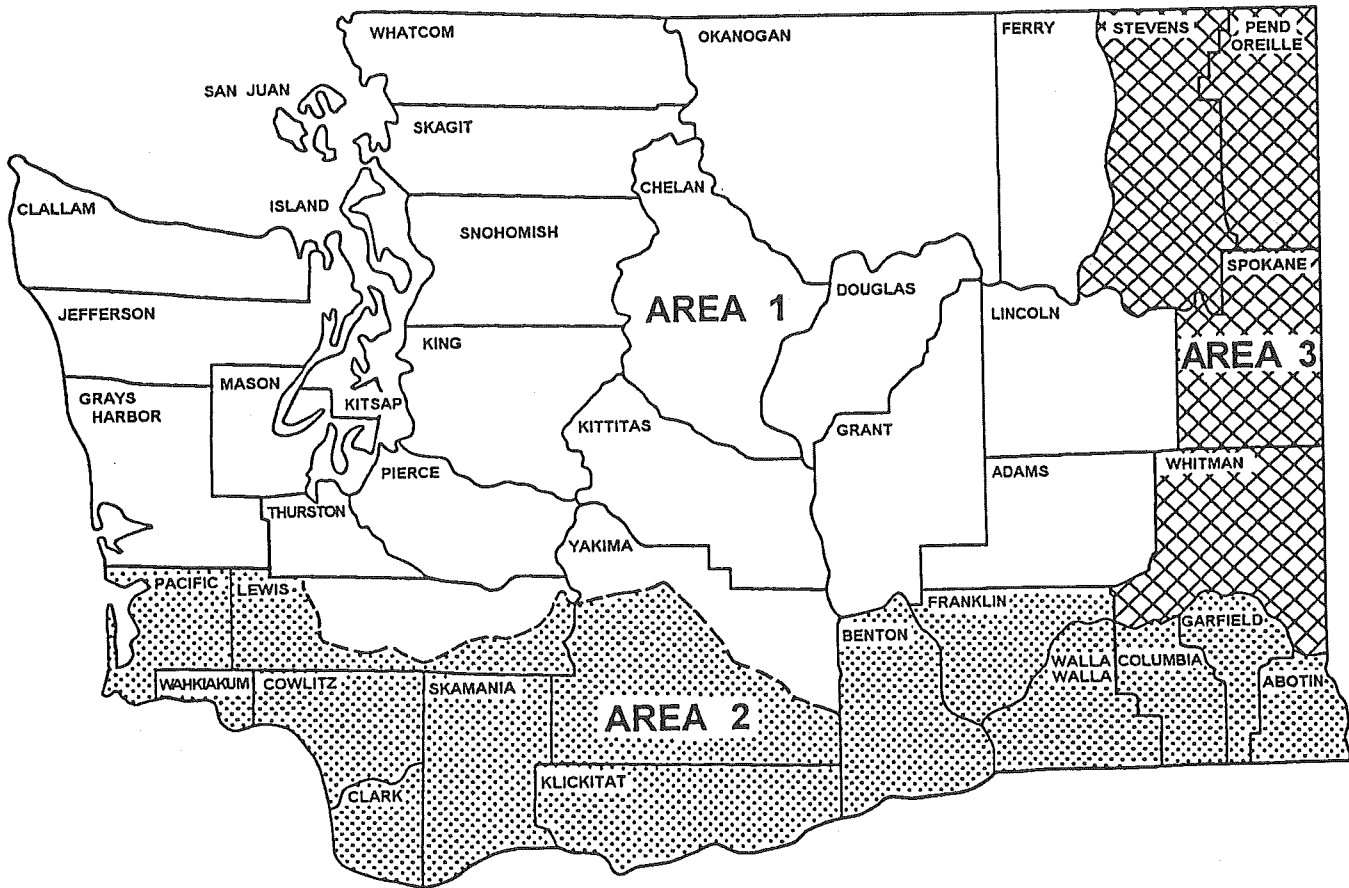
RADIO
PERMIT

TO OPERATE MULTI-TONE RADIO SIGNAL SYSTEM IN
DESIGNATED AREA.

MODEL	SERIAL
CARRIER FREQUENCY	MHz
TONES	Hz
AREA	
FIRM NAME	
ISSUED BY	

F416-086-000 RADIO PERMIT 10-88

AREAS FOR USE OF RADIO SIGNALING SYSTEMS FOR LOGGING OPERATIONS



State of Washington
 Department of Labor and Industries
 Division of Industrial Safety and Health

A permit issued by the department of labor and industries shall be attached to the outside of the receiver which shall indicate the area in which the radio signaling equipment may be used.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 96-22-013, § 296-54-605, filed 10/28/96, effective 1/1/97. Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-54-605, filed 11/14/88. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-605, filed 9/21/79.]

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

WAC 296-54-607 Radio signal systems—Specifications and test procedures. All radio-signaling systems put into use for the first time after the effective date of these rules shall meet or exceed the following requirements, specifications, tolerance, and tests and such systems, when altered or repaired, shall meet the same minimum requirements.

(1) Radio-signaling systems used to transmit whistle signals or control functions of equipment associated with skyline, highlead, slackline, or cable skidder systems of logging shall transmit and decode only by the use of authorized multi-tone frequencies. Only sequential tones may be used to trans-

mit signals or control equipment when utilizing carrier frequencies of 154.57 or 154.60 MHz.

(2) The receiver sensitivity shall be capable of attaining .6 microvolt, or greater, for 12 db SINAD ratio for VHF frequencies and .7 microvolt, or greater, for UHF frequencies. Effective January 1, 1984, all radio systems receiver sensitivity shall be capable of attaining .4 microvolt, or greater, for 12 db SINAD ratio for VHF frequencies and .5 microvolt, or greater, for UHF frequencies. When interference is a factor, the receiver may be desensitized in the furtherance of safety by a person qualified in accordance with WAC 296-54-605(15).

(3) The receiver spurious attenuation shall be at least 40 db when measured by the 20 db quieting method. On all new radio systems put into service after the effective date of these standards, the receiver spurious attenuation shall be at least 60 db when measured by the 20 db quieting method. Effective January 1, 1984, all new radio signal systems shall be required to have receiver spurious attenuation of at least 70 db when measured by the 20 db quieting method and shall have image response attenuation of 60 db when measured by the 20 db quieting method. Effective January 1, 1989, all radio signal systems shall be required to have receiver spurious attenuation of at least 70 db when measured by the 20 db

quieting method and image response attenuation of 60 db when measured by the 20 db quieting method.

Note: Spurious response attenuation is a measure of the receiver's ability to discriminate between a desired signal to which it is resonant and an undesired signal at any other frequency to which it is also responsive.

(4) The receiver selectivity shall be more than 40 db plus or minus 30 KHz. All new radio signal systems put into service after the effective date of these standards, the receiver selectivity shall be at least 60 db plus or minus 30 KHz. Effective January 1, 1984, all new radio signal systems purchased and used shall have receiver selectivity of at least 80 db plus or minus 30 KHz. Effective January 1, 1989, all radio signal systems shall have receiver selectivity of at least 80 db plus or minus 30 KHz, when measured by the E.*I.A. SINAD method.

(5) The receiver-decoder tone frequency stability shall not exceed .006 (.6%) above or below the assigned tone frequency.

(6) The drift of a transmitter-encoder tone shall not exceed .006 (.6%) above or below the assigned tone frequency.

(7) Parts of the radio-signaling system affected by moisture, which may be subjected to the entrance of moisture during use, shall be weatherproofed. Transmitters shall be tested within fifteen minutes after being subjected to the following conditions and shall have the ability to continue functioning properly. The transmitter and receiver shall be placed in a humidity chamber for eight hours where the humidity has been maintained at not less than ninety percent and where a 40°C. temperature has been maintained.

(8) Radio-signaling system units shall operate within tolerances specified at any temperature within the range of -30°C. to +60°C.

(9) Switches of transmitters used to send whistle signals or activate equipment associated with high lead, slackline, or cable skidder systems of logging shall be designed in such a manner whereby two buttons, motions or a combination of

these shall be required simultaneously to cause activation of the system. Arrangement of the activating switches shall be such that the operator can transmit signals easily but cannot easily activate a control or command function accidentally.

(10) All receivers intended to be mounted on or in the yarder or similar equipment, and all portable transmitters, shall continue to maintain specified mechanical and electrical performance during and after being subjected to vibration of the magnitude and amplitude as follows:

The equipment shall be vibrated with simple harmonic motion having an amplitude of 0.015" (total excursion 0.03") with the frequency varied uniformly between 10 and 30 Hz and an amplitude of 0.0075" (total excursion 0.015") with the frequency varied uniformly between 30 and 60 Hz. The entire cycle of frequencies for each group (i.e., 10 to 30 cycles and 30 to 60 cycles) shall be accomplished in five minutes and repeated three times. The above motion shall be applied for a total period of thirty minutes in each direction, namely, the directions parallel to both axes of the base and perpendicular to the plane of the base.

(11) All portable transmitters shall continue to maintain specified mechanical and electrical performance after being subjected to a shock test as follows:

The equipment shall be dropped once on each of five surfaces from a height of four feet onto a smooth concrete floor.

(12) Transmitters operating on carrier frequencies of 154.57 MHz and on 154.60 MHz shall be limited on maximum power output not to exceed 500 mW measured at the antenna terminals.

(13) To minimize the possibility of interference with other signaling systems, the input power of transmitters operating in the 450 MHz range should be limited to only the amount needed to transmit to the receiver of the system effectively.

[Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-10-081 (Order 79-14), § 296-54-607, filed 9/21/79.]

WAC 296-54-99002 Appendix I—Figure 2—High lead yarding system.

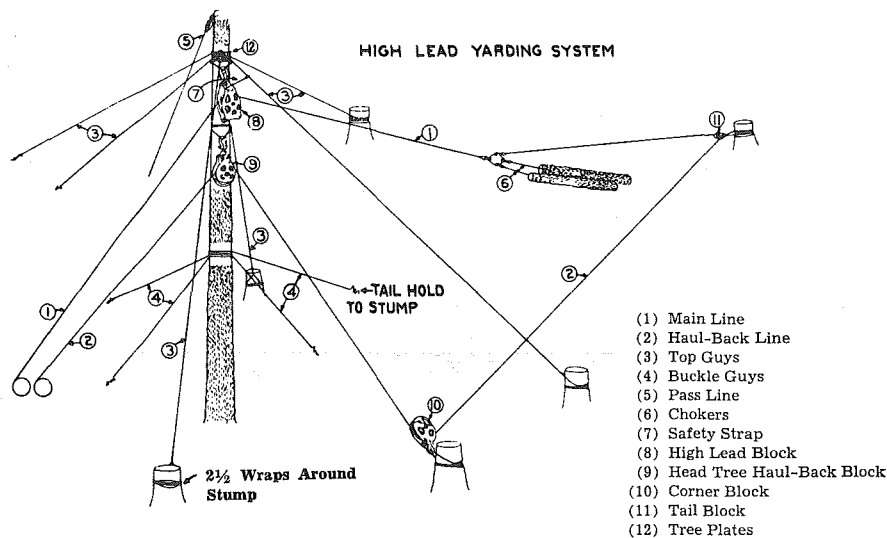


Figure 2.

Order 72-14, Figure 2 (codified as WAC 296-54-99002), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99003 Appendix I—Figure 3—North Bend yarding system.

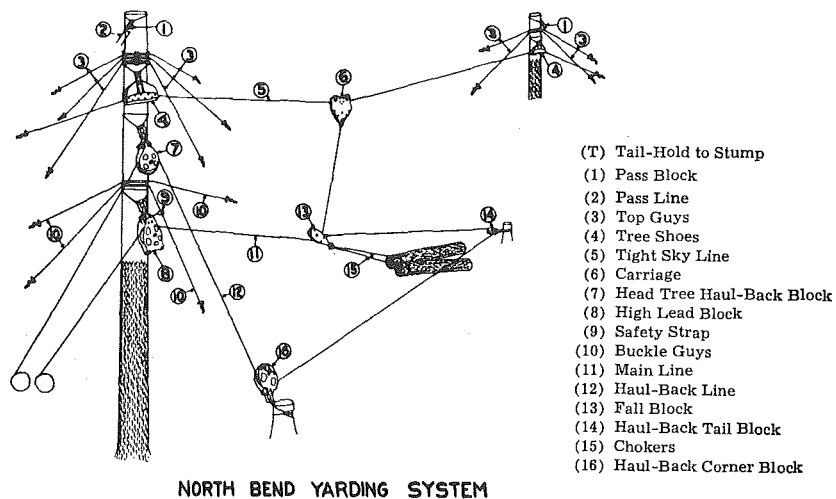


Figure 3.

[Order 72-14, Figure 3 (codified as WAC 296-54-99003), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99004 Appendix I—Figure 4—Slack skyline yarding system.

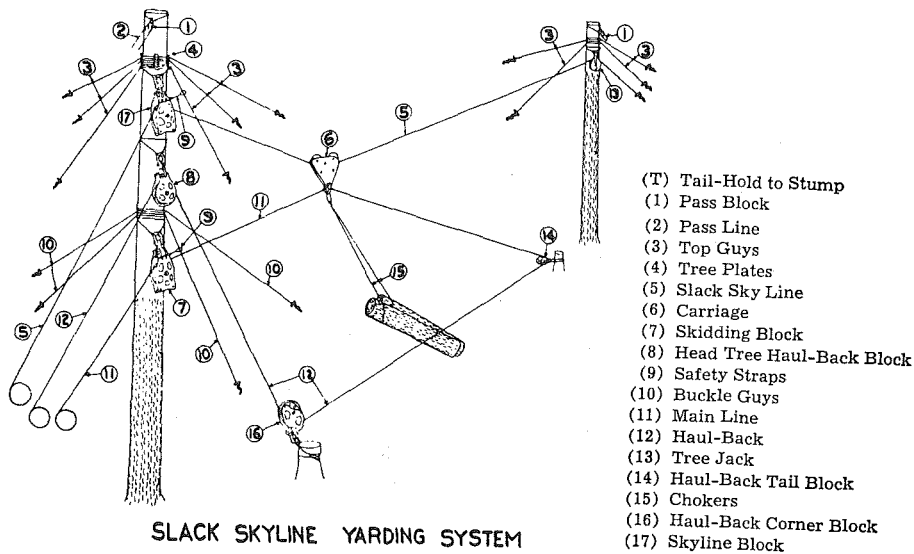


Figure 4.

[Order 72-14, Figure 4 (codified as WAC 296-54-99004), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99007 Appendix I—Figure 7—Heel boom loading.

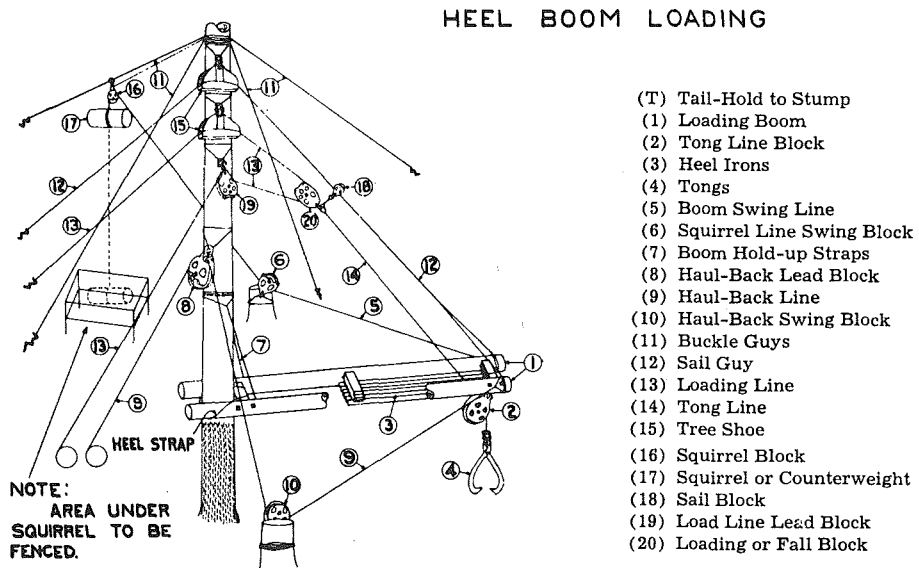


Figure 7.

[Order 72-14, Figure 7 (codified as WAC 296-54-99007), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99008 Appendix I—Figure 8—Guyline loading.

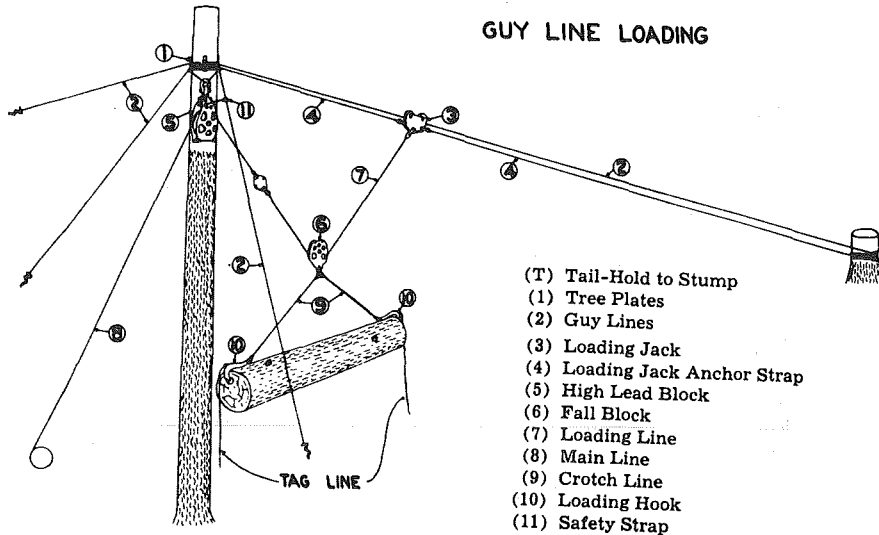


Figure 8.

[Order 72-14, Figure 8 (codified as WAC 296-54-99008), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99009 Appendix I—Figure 9—Hayrack boom loading.

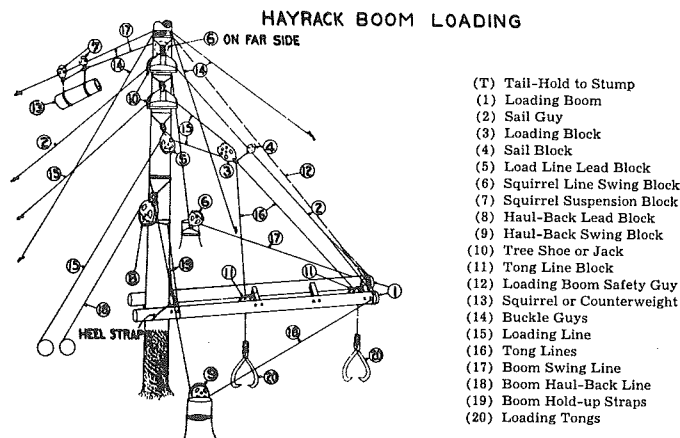


Figure 9.

[Order 72-14, Figure 9 (codified as WAC 296-54-99009), filed 7/31/72, effective 9/1/72.]

WAC 296-54-99010 Appendix I—Figure 10—Spreader bar loading.

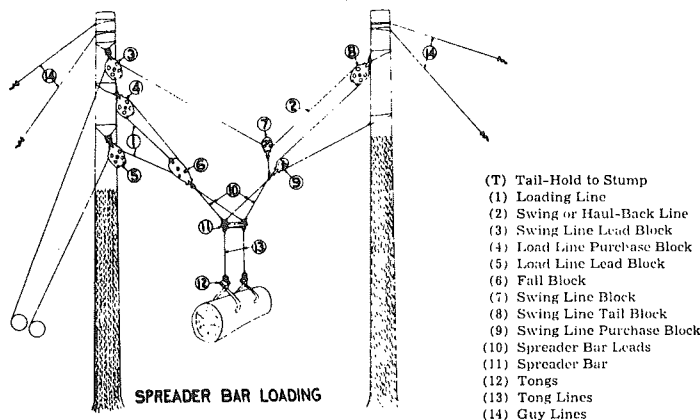


Figure 10.

[Order 72-14, Figure 10 (codified as WAC 296-54-99010), filed 7/31/72, effective 9/1/72.]

Chapter 296-56 WAC

SAFETY STANDARDS—LONGSHORE, STEVEDORE AND RELATED WATERFRONT OPERATIONS

WAC

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- 296-56-60027 Audible warning system.
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296-56-99002	Form—Appendix A—Standard signals for longshore crane signals.
296-56-99003	Form—Appendix B—Standard signals for longshore crane signals.

DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER

296-56-001	through 296-56-400. [Filed 3/23/60.] Superseded by safety standards for longshore, stevedore and related waterfront operations, filed 9/24/65. See WAC 296-56-401 et seq.
296-56-401	Scope and application. [Order 74-14, § 296-56-401, filed 4/22/74; Order 69-3, § 296-56-401, filed 5/26/69, effective 7/1/69; Rules (part), filed 9/24/65; Rule (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-405	Practical application. [Order 74-14, § 296-56-405, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-410	Introduction. [Order 74-14, § 296-56-410, filed 4/22/74; Introduction, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-412	Variance and procedure. [Order 74-14, § 296-56-412, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-415	Definitions. [Order 74-14, § 296-56-415, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-420	Education and first-aid standards. [Order 76-7, § 296-56-420, filed 3/1/76; Order 74-14, § 296-56-420, filed 4/22/74; Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-430	Management's responsibility. [Order 74-14, § 296-56-430, filed 4/22/74; Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-432	Employee's responsibility. [Order 74-14, § 296-56-432, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-435	Accident prevention program. [Order 74-14, § 296-56-435, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-436	General safety requirements. [Order 76-7, § 296-56-436, filed 3/1/76; Order 74-14, § 296-56-436, filed

	4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44605	Signals. [Order 74-14, § 296-56-44605, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43801	Eye protection. [Order 74-14, § 296-56-43801, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44607	Signalman for power units. [Order 74-14, § 296-56-44607, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43803	Respiratory protection. [Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-56-43803, filed 11/30/83; Order 74-14, § 296-56-43803, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44609	Radio communication. [Order 74-14, § 296-56-44609, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43805	Protective clothing. [Order 74-14, § 296-56-43805, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44611	Obstructions. [Order 74-14, § 296-56-44611, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43807	Foot protection. [Order 74-14, § 296-56-43807, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44613	Crane clearance. [Order 74-14, § 296-56-44613, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43809	Head protection. [Order 74-14, § 296-56-43809, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44615	Qualifications of machinery operators. [Order 74-14, § 296-56-44615, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43811	Required clothing, caps, etc. [Order 74-14, § 296-56-43811, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-44617	Radio controls. [Order 74-14, § 296-56-44617, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-43813	Protection from falling. [Order 74-14, § 296-56-43813, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-450	Posting claim procedure. [§ II, Rule 2.010, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
296-56-43815	Personal flotation devices. [Order 76-7, § 296-56-43815, filed 3/1/76.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-455	Inspection of stevedore equipment or gear—Scope and application. [Order 74-14, § 296-56-455, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-440	Minimum safety requirements for docks and dock facilities. [Order 74-14, § 296-56-440, filed 4/22/74; Order 69-3, § 296-56-440, filed 5/26/69, effective 7/1/69; § I, Rules 1.010-1.030, filed 9/24/65; Rule (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45501	General requirements. [Order 74-14, § 296-56-45501, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-442	Crane and spout certification, application. [Order 74-14, § 296-56-442, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45503	Fiber rope and fiber rope slings. [Order 76-7, § 296-56-45503, filed 3/1/76; Order 74-14, § 296-56-45503, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44201	Qualifications of persons making inspections, issuance of certificates, posting certificates, etc. [Order 74-14, § 296-56-44201, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45505	Wire rope and wire rope slings. [Order 74-14, § 296-56-45505, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44203	Unit proof load test and inspection. [Order 74-14, § 296-56-44203, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45507	Chains and chain slings. [Order 74-14, § 296-56-45507, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44205	Examination and inspection of cranes and derricks. [Order 74-14, § 296-56-44205, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45509	Shackles. [Order 74-14, § 296-56-45509, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44207	Equipment and information to be installed or posted on cranes or derricks. [Order 74-14, § 296-56-44207, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45511	Hooks other than hand hooks. [Order 74-14, § 296-56-45511, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44209	Cargo spouts, suckers and similar types of equipment. [Order 74-14, § 296-56-44209, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45513	Cargo boards and other type pallet boards. [Order 74-14, § 296-56-45513, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-445	Radio controlled cranes. [Order 69-3, § 296-56-445, filed 5/26/69, effective 7/1/69.] Repealed by Order 74-14, filed 4/22/74.		296-56-45515	Chutes, gravity conveyors and rollers. [Order 74-14, § 296-56-45515, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-446	Cranes and crane operations—Scope and application. [Order 74-14, § 296-56-446, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-45517	Disposition of defective material or gear. [Order 74-14, § 296-56-45517, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-44601	Operators. [Order 74-14, § 296-56-44601, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-460	Minimum requirements for first aid—First-aid training. [§ III, Rule 3.010, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
296-56-44603	Signalmen. [Order 74-14, § 296-56-44603, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.		296-56-46001	Keep clear of lines. [Order 74-14, § 296-56-460 (codified as WAC 296-56-46001), filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
			296-56-461	Greasing power units. [Order 74-14, § 296-56-461, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.

296-56-462	Use of tools. [Order 76-7, § 296-56-462, filed 3/1/76; Order 74-14, § 296-56-462, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	
296-56-465	Jacob's ladders. [Order 74-14, § 296-56-465, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-47531	Safety while moving cars. [Order 74-14, § 296-56-47531, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-467	Secure storage. [Order 74-14, § 296-56-467, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-480	Mobile vehicles—Scope and application. [Order 74-14, § 296-56-480, filed 4/22/74; Order § V, Rules 5.010-5.280 filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-470	Hard hats—General safety standards. [Order 69-3, § 296-56-470, and Appendix A (Forms), filed 5/26/69, effective 7/1/69; § III, Rules 4.010-4.230, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74. See WAC 296-56-990 through 296-56-99006.	296-56-48001	Traffic lanes. [Order 74-14, § 296-56-48001, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-475	Standard gauge railroad operations—Scope and application. [Order 74-14, § 296-56-475, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-48003	Duties of operator. [Order 74-14, § 296-56-48003, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47501	Warning flags or light. [Order 74-14, § 296-56-47501, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-48005	Vehicle equipment and maintenance. [Order 74-14, § 296-56-48005, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47503	Signals unobscured. [Order 74-14, § 296-56-47503, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-490	Lift jitneys. [Order 74-14, § 296-56-490, filed 4/22/74; § VI, Rules 6.010-6.100, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47504	Derails. [Order 74-14, § 296-56-47504, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-495	Changing and charging storage batteries. [Order 74-14, § 296-56-495, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47505	Signals displayed by each maintenance crew. [Order 74-14, § 296-56-47505, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-500	Handling of cargo—Scope and application. [Order 74-14, § 296-56-500, filed 4/22/74; § VII, Rules 7.010-7.110, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47507	Warning device. [Order 74-14, § 296-56-47507, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50001	Nonuse of defective slings. [Order 74-14, § 296-56-50001, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47509	Audible warning system. [Order 74-14, § 296-56-47509, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50003	Landing loads. [Order 74-14, § 296-56-50003, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47511	Passageway across railroad tracks required. [Order 74-14, § 296-56-47511, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50005	Secure hoisted cargo. [Order 74-14, § 296-56-50005, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47513	Cars to be immobilized. [Order 74-14, § 296-56-47513, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50007	Hoisting material by bands or fasteners. [Order 76-7, § 296-56-50007, filed 3/1/76; Order 74-14, § 296-56-50007, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47515	Working in railroad cars. [Order 74-14, § 296-56-47515, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50009	Slings for handling pulp. [Order 74-14, § 296-56-50009, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47517	Safety observer on railroad switching. [Order 74-14, § 296-56-47517, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50010	Containerized cargo secured by bands or wire. [Order 74-14, § 296-56-50010, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47519	Warning at road crossing. [Order 74-14, § 296-56-47519, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50011	Securing glass cases. [Order 74-14, § 296-56-50011, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47521	Preparation of cars for moving. [Order 74-14, § 296-56-47521, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50013	Hoisting bulk cargo. [Order 76-7, § 296-56-50013, filed 3/1/76; Order 74-14, § 296-56-50013, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47523	Flying switches. [Order 74-14, § 296-56-47523, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50015	Hand and eye protection on wire rope. [Order 74-14, § 296-56-50015, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47525	Car opening devices. [Order 74-14, § 296-56-47525, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50017	Car plates. [Order 74-14, § 296-56-50017, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47527	Safe car floors. [Order 74-14, § 296-56-47527, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.	296-56-50019	Dockboards (bridge plates). [Order 74-14, § 296-56-50019, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-56-47529	Clearance from railroad tracks. [Order 74-14, § 296-56-47529, filed 4/22/74.] Repealed by 85-01-022 (Order	296-56-50021	Trucks and railroad cars. [Order 74-14, § 296-56-50021, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24),

- filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-50023 Hazardous cargo. [Order 74-14, § 296-56-50023, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-50025 Recouping broken cargo. [Order 74-14, § 296-56-50025, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-50027 Containerized cargo. [Order 74-14, § 296-56-50027, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-510 Handling explosives or hazardous materials. [Order 74-14, § 296-56-510, filed 4/22/74; § VIII, Rules 8.010-8.070, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-520 Log handling on docks. [Order 74-14, § 296-56-520, filed 4/22/74; § IX, Rules 9.010-9.090, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-530 Cranes and crane operations. [§ X, Rules 10.010—10.060, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
- 296-56-535 Petroleum docks. [Order 74-14, § 296-56-535, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-53501 Boat marinas. [Order 74-14, § 296-56-53501, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-53503 Canneries and cold storage docks. [Order 74-14, § 296-56-53503, filed 4/22/74.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-540 Application for waiver or variances. [Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
- 296-56-550 Practical application. [Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
- 296-56-560 Excerpts from Revised Code of Washington. [Order 74-14, § 296-56-560, filed 4/22/74; Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by 85-01-022 (Order 84-24), filed 12/11/84. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-570 Glossary. [Glossary, filed 9/24/65; Rules (part), filed 3/23/60.] Repealed by Order 74-14, filed 4/22/74.
- 296-56-590 Standard signals for longshore crane operations. Decodified. [See WAC 296-56-990 through 296-56-99006, filed 5/26/69, effective 7/1/69.]
- 296-56-60059 First-aid and lifesaving facilities. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60059, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60059, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60060 First-aid training and certification. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60060, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60060, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60062 First-aid kit. [Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60062, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60062, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60062, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60065 First-aid station. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60065, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60065, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60067 First-aid room. [Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60067, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60067, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60069 Personnel. [Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-56-60069, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60069, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60069, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60069, filed 12/11/84.] Repealed by 99-02-024, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040.
- 296-56-60137 Waiver and variance. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60137, filed 12/11/84. Repealed by 85-10-004 (Order 85-09), filed 4/19/85. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-60182 Waiver and variance. [Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60182, filed 12/11/84.] Repealed by 85-10-004 (Order 85-09), filed 4/19/85. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-990 Form—Appendix A—Certificate of competency. [Order 74-14, Appendix A (codified as WAC 296-56-990), filed 4/22/74; Form, filed 5/26/69, effective 7/1/69.] Repealed by 86-03-064 (Order 86-02), filed 1/17/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-99001 Form—Appendix B—Notice of deficiencies found on certification examination. [Order 74-14, Appendix B (codified as WAC 296-56-99001), filed 4/22/74; Order 69-3, filed 5/26/69, effective 7/1/69.] Repealed by 86-03-064 (Order 86-02), filed 1/17/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-99004 Form—Appendix E—Certificate of unit test and/or examination of crane, derrick, or other material handling device. [Order 74-14, Appendix E (codified as WAC 296-56-99004), filed 4/22/74; Form, filed 5/26/69, effective 7/1/69.] Repealed by 86-03-064 (Order 86-02), filed 1/17/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-99005 Form—Appendix F—Standard procedure—Testing and examination cranes, derricks, or material handling devices longshore, stevedore, and related waterfront operations. [Order 74-14, Appendix F (codified as WAC 296-56-99005), filed 4/22/74.] Repealed by 86-03-064 (Order 86-02), filed 1/17/86. Statutory Authority: RCW 49.17.040 and 49.17.050.
- 296-56-99006 Form—Appendix G—Standard procedure—Testing and inspection cargo spouts, suckers and similar equipment longshore, stevedore and related waterfront operations. [Order 74-14, Appendix G (codified as WAC 296-56-99006), filed 4/22/74.] Repealed by 86-03-064 (Order 86-02), filed 1/17/86. Statutory Authority: RCW 49.17.040 and 49.17.050.

PART A—GENERAL

WAC 296-56-600 Marine terminals.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-600, filed 12/11/84.]

WAC 296-56-60001 Scope and applicability. (1) The rules included in this chapter apply throughout the state of Washington, to any and all waterfront operations under the jurisdiction of the department of labor and industries.

(2) These minimum requirements are promulgated in order to augment the general safety and health standards, and any other safety and health standards promulgated by the department of labor and industries which are applicable to all places of employment under the jurisdiction of the department of labor and industries. The rules of this chapter, and the rules of chapters 296-24 and 296-62 WAC are applicable to all longshore, stevedore and related waterfront operations: Provided, That such rules shall not be applicable to those

operations under the exclusive safety jurisdiction of the federal government.

(3) The provisions of this chapter shall prevail in the event of a conflict with, or duplication of, provisions contained in chapters 296-24 and 296-62 WAC. Specific standards which are applicable include, but are not limited to:

(a) Electrical—Chapter 296-24 WAC Part L.

(b) Toxic and hazardous substances are regulated by chapter 296-62 WAC. Where references to this chapter are given they are for informational purposes only. Where specific requirements of this chapter conflict with the provisions of chapter 296-62 WAC this chapter prevails. Chapter 296-62 WAC does not apply when a substance or cargo is contained within a manufacturer's original, sealed, intact means of packaging or containment complying with the department of transportation or International Maritime Organization requirements.

(c) Hearing conservation—Chapter 296-62 WAC Part K.

(d) Standards for commercial diving operations—Chapter 296-37 WAC.

(e) Safety requirements for scaffolding—Chapter 296-24 WAC Part J-1.

(f) Safe practices of abrasive blasting operations—Chapter 296-24 WAC Part H-2.

(g) Access to employee exposure and medical records—Chapter 296-62 WAC Part B.

(h) Respiratory protection—Chapter 296-62 WAC Part E.

(i) Safety standards for grain handling facilities—Chapter 296-99 WAC.

(j) Hazard communication purpose—Chapter 296-62 WAC Part C.

(k) Asbestos—Chapters 296-62 Part I-1 and 296-65 WAC.

(l) Permit - required confined spaces and confined space—Chapter 296-62 WAC Part M.

(m) Servicing multi-piece and single-piece rim wheels—Chapter 296-24 WAC Part D.

(n) First-aid requirements—Chapter 296-24 WAC Part A-1.

(o) Employee emergency plans and fire prevention plans—Chapter 296-24 WAC Part G-1.

(4) The provisions of this chapter do not apply to the following:

(a) Fully automated bulk coal handling facilities contiguous to electrical power generating plants.

(b) Facilities subject to the regulations of the office of pipeline safety regulation of the materials transportation bureau, department of transportation, to the extent such regulations apply.

(5) WAC 296-62-074 shall apply to the exposure of every employee to cadmium in every employment and place of employment covered by chapter 296-56 WAC in lieu of any different standard on exposures to cadmium that would otherwise be applicable by virtue of those sections.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60001, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60001, filed 1/18/95, effective 3/1/95; 93-07-044 (Order 93-01), § 296-56-60001, filed 3/13/93, effective 4/27/93. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060.

92-22-067 (Order 92-06), § 296-56-60001, filed 10/30/92, effective 12/8/92. Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-56-60001, filed 11/22/91, effective 12/24/91; 89-11-035 (Order 89-03), § 296-56-60001, filed 5/15/89, effective 6/30/89; 88-14-108 (Order 88-11), § 296-56-60001, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60001, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60001, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60001, filed 12/11/84.]

WAC 296-56-60003 Variance and procedure. Conditions may exist under which certain state standards will not have practical application. In these cases, the director of the department of labor and industries has made provisions for the issuance of variances. The director or his/her authorized representative may, pursuant to this section, RCW 49.17.080 and 49.17.090, and WAC 296-350-200 through 296-350-270, upon receipt of application and after investigation by the department, permit a variation from the requirements of this chapter. Any variance is limited to the particular case and application. It shall remain posted during the time which it is in effect. Variance application forms may be obtained from the department.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60003, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60003, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60003, filed 12/11/84.]

WAC 296-56-60005 Definitions. "Apron" means that open portion of a marine terminal immediately adjacent to a vessel berth and used in the direct transfer of cargo between the terminal and vessel.

"Assistant director for the division of WISHA services" means the assistant director of WISHA services, department of labor and industries or his/her authorized representative.

"Authorized," in reference to an employee's assignment, means selected by the employer for that purpose.

"Cargo door" (transit shed door) means a door designed to permit transfer of cargo to and from a marine terminal structure.

"Cargo packaging" means any method of containment for shipment, including cases, cartons, crates and sacks, but excluding large units such as intermodal containers, vans or similar devices.

"Confined space" means a space that:

- Is large enough and so configured that an employee can bodily enter and perform assigned work; and
- Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry); and

- Is not designed for continuous employee occupancy.

"Conveyor" means a device designed exclusively for transporting bulk materials, packages or objects in a predetermined path and having fixed or selective points of loading or discharge.

"Danger zone" means any place in or about a machine or piece of equipment where an employee may be struck by or caught between moving parts, caught between moving and stationary objects or parts of the machine, caught between the material and a moving part of the machine, burned by hot surfaces or exposed to electric shock. Examples of danger zones

are nip and shear points, shear lines, drive mechanisms, and areas beneath counterweights.

"Designated person" means a person who possesses specialized abilities in a specific area and is assigned by the employer to perform a specific task in that area.

"Dock" means a wharf or pier forming all or part of a waterfront facility, including marginal or quayside berthing facilities; not to be confused with "loading dock" as at a transit shed or container freight station, or with the body of water between piers or wharves.

"Dock facilities" includes all piers, wharves, sheds, aprons, dolphins, cranes, or other gear or equipment owned or controlled by the dock or facility owner, where cargo or materials are loaded, moved or handled to or from a vessel.

"Dockboard" (bridge plate or car plate) means a device utilized to span the gap between railroad cars, or between railroad cars or highway vehicles and the loading dock or platform. A car plate may be fixed, adjustable, portable, powered, or unpowered.

"Enclosed space" means an indoor space, other than a confined space, that may contain or accumulate a hazardous atmosphere due to inadequate natural ventilation. Examples of enclosed spaces are trailers, railcars, and storage rooms.

"Examination," as applied to material handling devices required to be certified by this chapter, means a comprehensive survey consisting of the criteria outlined in WAC 296-56-60093 through 296-56-60097. The examination is supplemented by a unit proof test in the case of annual survey.

"Flammable atmosphere" means an atmosphere containing more than ten percent of the lower flammable limit (LEL) of a flammable or combustible vapor or dust mixed with air. Such atmospheres are usually toxic as well as flammable.

"Front-end attachments."

- As applied to power-operated industrial trucks, means the various devices, such as roll clamps, rotating and side-shifting carriages, magnets, rams, crane arms or booms, load stabilizers, scoops, buckets, and dumping bins, attached to the load end for handling lifts as single or multiple units.

- As applied to cranes, means various attachments applied to the basic machine for the performance of functions such as lifting, clamshell or magnet services.

"Fumigant" is a substance or mixture of substances, used to kill pests or prevent infestation, which is a gas or is rapidly or progressively transformed to the gaseous state even though some nongaseous or particulate matter may remain and be dispersed in the treatment space.

"Hazardous cargo, material, substance or atmosphere" means:

- Any substance listed in chapter 296-62 WAC;
- Any material in the hazardous materials table and hazardous materials communications regulations of the Department of Transportation, 49 CFR Part 172;
- Any article not properly described by a name in the hazardous materials table and hazardous materials communications regulations of the Department of Transportation, 49 CFR Part 172, but which is properly classified under the definition of those categories of dangerous articles given in 49 CFR Part 173;

- Atmospheres having concentrations of airborne chemicals in excess of permissible exposure limits as defined in chapter 296-62 WAC; or

- Any atmosphere with an oxygen content of less than nineteen and one-half percent by volume.

"House falls" means spans and supporting members, winches, blocks, and standing and running rigging forming part of a marine terminal and used with a vessel's cargo gear to load or unload by means of married falls.

"Inspection," as applied to material handling devices required to be certified by this chapter, includes a complete visual examination of all visible parts of the device.

"Intermodal container" means a reusable cargo container of rigid construction and rectangular configuration intended to contain one or more articles of cargo or bulk commodities for transportation by water and one or more other transport modes without intermediate cargo handling. The term includes completely enclosed units, open top units, fractional height units, units incorporating liquid or gas tanks and other variations fitting into the container system, demountable or with attached wheels. It does not include cylinders, drums, crates, cases, cartons, packages, sacks, unitized loads or any other form of packaging.

"Loose gear" means removable or replaceable components of equipment or devices which may be used with or as a part of assembled material handling units for purposes such as making connections, changing line direction and multiplying mechanical advantage. Examples include shackles and snatch blocks.

"Marina" means a small harbor or boat basin providing dockage, supplies, and services for small craft.

"Marine terminal" means wharves, bulkheads, quays, piers, docks and other berthing locations and adjacent storage or contiguous areas and structures associated with the primary movement of cargo or materials from vessel to shore or shore to vessel. It includes structures which are devoted to receiving, handling, holding, consolidation, loading or delivery of waterborne shipments and passengers, and areas devoted to the maintenance of the terminal or equipment. The term does not include production or manufacturing areas having their own docking facilities and located at a marine terminal nor storage facilities directly associated with those production or manufacturing areas.

"Permit-required confined space (permit space)" means a confined space that has one or more of the following characteristics:

- Contains or has a potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- Contains any other recognized serious safety or health hazard.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60005, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-56-60005, filed 1/18/95, effective 3/1/95. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60005, filed 10/30/92, effective 12/8/92.

Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60005, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60005, filed 12/11/84.]

WAC 296-56-60006 Personnel. (1) Qualifications of machinery operators.

(a) Only those employees determined by the employer to be competent by reason of training or experience, who understand the signs, notices, and operating instructions and are familiar with the signal code in use shall be permitted to operate a crane, winch, or other power-operated cargo handling apparatus, or any power-operated vehicle, or give signals to the operator of any hoisting apparatus. Employees being trained and supervised by a designated individual may operate such machinery and give signals to operators during training.

(b) No employee known to have defective uncorrected eyesight or hearing, or to be suffering from heart disease, epilepsy, or similar ailments which may suddenly incapacitate the employee shall be permitted to operate a crane, winch, other power-operated cargo handling apparatus, or a power-operated vehicle.

(c) Persons who have recovered from a heart attack shall be exempted from the provisions of (b) of this subsection, as it pertains to their heart condition, provided:

(i) A medical release is obtained from their attending medical doctor.

(ii) The release shall state that the operation of a crane, winch, power-operated cargo handling apparatus, or power-operated vehicle, will not present a hazard to themselves or others.

(iii) An examination by a medical doctor, and renewal of the work release certification is required annually.

(2) Supervisory accident prevention proficiency.

(a) Immediate supervisors of cargo-handling operations of more than five persons shall satisfactorily complete a course in accident prevention. Employees newly assigned to supervisory duties shall be required to meet the provisions of this subsection (2)(a) within ninety days of such assignment.

(b) The course shall consist of instruction suited to the particular operations involved.

(c) No minor under eighteen years of age shall be employed in occupations involving the operation of any power-operated hoisting apparatus or assisting in such operations by performing work such as hooking on or landing drafts, rigging gear, etc.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60006, filed 12/30/98, effective 3/30/99.]

WAC 296-56-60007 Housekeeping. (1) Active work areas shall be kept free of equipment and materials not in use, and clear of debris, projecting nails, strapping and other sharp objects not necessary for the work in progress.

(2) Hatch beams, covers, and pontoons placed in terminal working areas shall be stowed in stable piles with beams secured against tipping or falling. Alternatively, beams may be laid on their sides. When beams and pontoons are stowed in tiers more than one high, dunnage or other suitable material shall be used under and between tiers.

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(3) Cargo and material shall not obstruct access to vessels, cranes, vehicles, or buildings. Means of access and egress within buildings shall be unobstructed.

(4) The employer shall eliminate, to the extent possible, conditions causing slippery working or walking surfaces in immediate work areas used by employees.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60007, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60007, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60007, filed 12/11/84.]

WAC 296-56-60009 Accident prevention program.

(1) An accident prevention program, which provides equitable management-employee participation, shall be established in all establishments, industrial plants, or operations.

(2) It shall be the responsibility of the employer to initiate and maintain the accident prevention program necessary to comply with this section. The division of WISHA services may be contacted for assistance in initiating and maintaining an effective accident prevention program.

(3) All accident prevention programs shall be tailored to the needs of the particular operation.

(4) Employer and employee representatives, as elected, delegated or appointed, shall attend and actively take part in frequent and regular safety committee meetings.

(5) Accident prevention programs shall provide for employer-employee safety meetings and frequent and regular safety inspections of job sites, materials, equipment, and operating procedures.

(6) A record of safety activities, such as inspections and meetings, shall be maintained by the employer for a period covering the previous twelve months and shall be made available, upon request, to noncompliance personnel of the department of labor and industries.

(7) Employees shall individually comply with all safety rules and cooperate with management in carrying out the accident prevention program.

(8) To make effective the preceding statement and promote on-the-job accident prevention, committees shall be established in each port. These committees shall consist of an equal number of port or stevedore company and longshoremen representatives at the job level with the industry or company safety supervisor serving as secretary and coordinator. Some functions of the committee are to maintain the interest of the workers in accident prevention by providing for their actual participation in the program, to direct their attention to the real causes of accidents, and to provide a means for making practical use of their intimate knowledge of working conditions and practices.

(9) It is intended that this program will produce mutually practical and effective recommendations regarding correction of accident-producing circumstances and conditions.

Note: For first aid requirements, see chapter 296-24 WAC Part A-1.

Note: For emergency plan and fire prevention plan requirements, see chapter 296-24 WAC Part G-1.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60009, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60009, filed 1/18/95, effective 3/1/95. Statutory Authority:

(1999 Ed.)

RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60009, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60009, filed 12/11/84.]

PART B—WATERFRONT OPERATIONS

WAC 296-56-60011 Slinging. (1) Drafts shall be safely slung before being hoisted. Loose dunnage or debris hanging or protruding from loads shall be removed.

(2) Bales of cotton, wool, cork, wood pulp, gunny bags, or similar articles shall be hoisted only by straps strong enough to support the weight of the bale. At least two hooks, each in a separate strap, shall be used.

(3) Unitized loads bound by bands or straps shall only be hoisted by the banding or strapping if the banding or strapping is suitable for hoisting and is strong enough to support the weight of the load.

(4) Additional means of hoisting shall be employed to ensure safe lifting of unitized loads having damaged banding or strapping.

(5) Case hooks shall be used only with cases designed to be hoisted by these hooks.

(6) Loads requiring continuous manual guidance during handling shall be guided by guide ropes (tag lines) that are long enough to control the load.

(7) Intermodal containers shall be handled in accordance with WAC 296-56-60103.

(8) The employer shall require employees to stay clear of the area beneath overhead drafts or descending lifting gear.

(9) Employees shall not be permitted to ride the hook or the load.

(10) Cargo handling bridles, such as pallet bridles, which are to remain attached to the hoisting gear while hoisting successive drafts, shall be attached by shackles, or other positive means shall be taken to prevent them from becoming accidentally disengaged from the cargo hook.

(11) Drafts of lumber, pipe, dunnage and other pieces, the top layer of which is not bound by the sling, shall be slung in such a manner as to prevent sliders. Double slings shall be used on unstrapped dunnage, except, when due to the size of hatch or deep tank openings, it is impractical to use them.

(12) Hand loaded buckets, tubs, bins and baskets used in handling bulk cargo shall not be loaded above their rim.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60011, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60011, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60011, filed 12/11/84.]

WAC 296-56-60013 Stacking of cargo and pallets.

Cargo, pallets, and other material stored in tiers shall be stacked in such a manner as to provide stability against sliding and collapse.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60013, filed 12/11/84.]

WAC 296-56-60015 Coopering. Repair and reconditioning of damaged or leaking cargo packaging (coopering) shall be performed so as not to endanger employees.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60015, filed 12/11/84.]

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WAC 296-56-60017 Line handling. (1) In order to provide safe access for handling lines while mooring and unmooring vessels, cargo or material shall not be stowed or vehicles placed where they obstruct the work surface.

(2) When stringpiece or apron width is insufficient for safe footing, grab lines on rails shall be installed on the sides of permanent structures. ("Stringpiece" means a narrow walkway between the water edge of a berth and a shed or other structure.)

(3) Areas around bitts or cleats where workers perform their duties as line handlers shall be lighted as required by this chapter. There shall be a nonslip surface around each bitt or cleat.

(4) Walkways on which mooring hausers must be moved may have the handrail omitted on the line handling side provided a six inch by six inch toeboard is installed.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60017, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60017, filed 12/11/84.]

WAC 296-56-60019 Standard gauge railroad operations. WAC 296-56-60019 through 296-56-60041 apply to standard gauge railroad operations.

(1) Work shall be performed in railcars only if floors of the railcars are in visibly safe condition for the work activity being conducted and the equipment being used.

(2) A route shall be established to allow employees to pass to and from places of employment without passing under, over or through railcars, or between cars less than ten feet (3 m) apart on the same track.

(3) The employer shall direct that no employees remain in railcars after work is concluded. No employee shall remain in a railcar after work is concluded.

(4) Railcars shall be chocked or otherwise prevented from moving:

(a) While dockboards or carplates are in position; or

(b) While employees are working within, on or under the railcars or near the tracks at the ends of the cars.

(5) When employees are working in, on, or under a railcar, positive means shall be taken to protect them from exposure to impact from moving railcars.

(6) Work being carried on, in, or under cars which subjects employees to the hazard of moving railroad equipment shall be protected by flags and derails set a minimum of fifty feet from one or both ends of the worksite. Where the spur track switch is less than fifty feet from the work location, the switch padlocked in the open position may take the place of the derail. The blue flag shall be placed at that point.

(7) Before cars are moved, unsecured and over-hanging stakes, wire straps, banding, and similar objects shall be removed or placed so as not to create hazards.

(8) The employer shall institute all necessary controls during railcar movement to safeguard personnel. If winches or capstans are employed for movement, employees shall stand clear of the hauling rope and shall not stand between the rope and the cars.

(9) Before being opened fully, doors shall be opened slightly to ensure that the load has not shifted during transit. Special precautions shall be taken if the doors being opened are visibly damaged.

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(10) If power industrial trucks are used to open freight car doors, the trucks or the railcar doors shall be equipped with door opening attachments. Employees shall stand clear of the railcar doors while they are being opened and closed.

(11) Only railcar door openers or power trucks equipped with door opening attachments shall be used to open jammed doors.

(12) Employees shall not remain in or on gondolas or flat cars when drafts that create overhead, caught-in, caught-between or struck-by hazards are being landed in or on the railcar. End gates, if raised, shall be secured.

(13) Operators of railcar dumps shall have an unrestricted view of dumping operations and shall have emergency means of stopping movement.

(14) Recessed railroad switches shall be enclosed to provide a level surface.

(15) Warning signs shall be posted where doorways open onto tracks, at blind corners and at similar places where vision may be restricted.

(16) Warning signs shall be posted if insufficient clearance for personnel exists between railcars and structures.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60019, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60019, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60019, filed 12/11/84.]

WAC 296-56-60021 Signals displayed by each maintenance crew. Each maintenance crew shall display and remove its own set of blue signals.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60021, filed 12/11/84.]

WAC 296-56-60023 Warning flags or lights. A blue flag, bright colored flag or blue light shall be displayed at one or both ends of an engine, car or train to indicate that workers are under or about the railway equipment. When such warning devices are displayed, the equipment shall not be coupled to or moved. On a dead end spur, a blue light or flag may be displayed adjacent to the switch opening while cars are being loaded or unloaded.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60023, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60023, filed 12/11/84.]

WAC 296-56-60025 Signals unobscured. Equipment which could obscure signals shall not be placed on the track.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60025, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60025, filed 12/11/84.]

WAC 296-56-60027 Audible warning system. A clearly audible warning system shall be employed when cars are being moved in areas where workers may be in the vicinity of the tracks. When the audible warning signal might not be heard above the surrounding noises, a person shall be delegated and stationed close enough to the track crew to warn them, by contact, of the oncoming equipment.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60027, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60027, filed 12/11/84.]

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WAC 296-56-60029 Safety observer on railroad switching. When persons are required to work between railway cars, underneath railway cars or in areas where switching is done, there shall be a person charged with the responsibility to warn of an approaching switch of the railway car or cars, unless other reasonable and practical safeguards are provided.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60029, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60029, filed 12/11/84.]

WAC 296-56-60031 Warning at road crossing. An audible whistle, horn or bell shall be sounded by the locomotive engineer to give adequate warning prior to switching across any road crossing. Whenever cars are pushed with a locomotive, a signalman shall be located at the crossing to give signals in conjunction with other warnings by the engineer.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60031, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60031, filed 12/11/84.]

WAC 296-56-60033 Flying switches. Flying switches shall not be used when switching railroad equipment in congested areas or across roadways or walkways.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60033, filed 12/11/84.]

WAC 296-56-60035 Clearance from railroad tracks. Materials shall not be stacked or piled closer than eight and one-half feet from the center line of the railroad tracks.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60035, filed 12/11/84.]

WAC 296-56-60037 Car plates. Whenever workers are required to move cargo into or out of a railway car, a railway car plate shall be used which shall meet the following specifications:

(1) All car plates shall be strong enough to carry maximum loads with a safety factor of three.

(2) All car plates shall be provided with positive stops to prevent shifting of plates. One set of these stops shall be adjustable to allow for different spaces between car door and platform.

(3) Car plates shall be so shaped that edges will always bear on the floor of car and platform to prevent "teetering" or rocking.

(4) All car plates shall have skid resistant surfaces.

(5) All car plates shall be provided with toe or guard plates at the sides with a minimum height of four inches.

(6) All car plates must bear no less than six inches back from edge of platform.

(7) Maximum capacity of car plates shall be marked in a conspicuous place.

(8) Car plates shall be provided with an appropriate fixture to enable the plates to be lifted and moved by fork trucks.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60037, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60037, filed 12/11/84.]

WAC 296-56-60039 Dockboards (bridge plates). (1) Portable and powered dockboards shall be strong enough to carry the load imposed.

(2) Portable dockboards shall be secured in position, either by being anchored or equipped with devices which will prevent slipping.

(3) Powered dockboards shall be designed and constructed in accordance with commercial standards CS202-56 (1956) *Industrial Lifts and Hinged Loading Ramps* published by the United States Department of Commerce.

(4) Handholds or other effective means, shall be provided on portable dockboards to permit safe handling.

(5) Positive protection shall be provided to prevent railroad cars from being moved while dockboards or bridge plates are in position.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60039, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60039, filed 12/11/84.]

WAC 296-56-60041 Log handling. (1) The employer shall ensure that structures (bunks) used to contain logs have rounded corners and rounded structural parts to avoid sling damage.

(2) Two or more binders or equivalently safe means of containment shall remain on logging trucks and railcars to secure logs during movement of the truck or car within the terminal. During unloading, logs shall be prevented from moving while binders are being removed.

(3) Logs shall be hoisted by two slings or by other gear designed for safe hoisting.

(4) Logs placed adjacent to vehicle curbs on the dock shall not be over one tier high unless placed in bunks or so stacked as not to roll or otherwise creating a hazard to employees.

(5) Before logs are slung up from the dock, they shall be stably supported to prevent spreading and to allow passage of slings beneath the load. When bunks or similar retaining devices are used, no log shall be higher than the stanchions or retaining members of the device.

(6) A draft of logs for hoisting aboard ship shall not vary in length more than twenty percent.

(7) Audible alarms.

(a) All bidirectional machines, shall be equipped with a horn, distinguishable from the surrounding noise level, which shall be operated as needed when the machine is moving in either direction. The horn shall be maintained in operable condition.

(b) Automatic back-up alarms shall be installed on bidirectional equipment used to handle logs or containers and shall be maintained in operable condition.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60041, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60041, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60041, filed 12/11/84.]

WAC 296-56-60043 Movement of barges and railcars. Barges and railcars shall not be moved by cargo runners (running rigging) from vessel cargo booms, cranes or other equipment not suitable for the purpose.

(1999 Ed.)

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60043, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60043, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60043, filed 12/11/84.]

WAC 296-56-60045 Communication. (1) Radio. When practical and safe, crane operators shall be provided with a radio or telephone to be in contact with the signalman or crane chaser in those cases where a signalman or crane chaser is required.

(2) Interference. Cargo handling operations shall not be carried on when noise-producing maintenance, construction or repair work interferes with communication of warnings or instructions.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-56-60045, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60045, filed 12/11/84.]

WAC 296-56-60047 Open fires. Open fires and fires in drums or similar containers are prohibited.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60047, filed 12/11/84.]

PART C—HAZARDOUS ATMOSPHERES AND MATERIALS

WAC 296-56-60049 Hazardous cargo. (1) Before cargo handling operations begin, the employer shall ascertain whether any hazardous cargo is to be handled and shall determine the nature of the hazard. The employer shall inform employees of the nature of any hazard and any special precautions to be taken to prevent employee exposure, and shall instruct employees to notify the employer of any leaks or spills.

(2) All hazardous cargo shall be slung and secured so that neither the draft nor individual packages can fall as a result of tipping the draft or slackening of the supporting gear.

(3) If hazardous cargo is spilled or if its packaging leaks, employees shall be removed from the affected area until the employer has ascertained the specific hazards, provided any equipment, clothing, ventilation and fire protection equipment necessary to eliminate or protect against the hazard. Cleanup employees shall be instructed as to the safe method of cleaning up and disposing of the spill, and handling and disposing of leaking containers. Actual cleanup or disposal work shall be conducted under the supervision of a designated person.

(4) The Department of Transportation and the United States Coast Guard impose requirements related to handling, storing and transportation of hazardous cargo (see 33 CFR Part 126, 46 CFR, 49 CFR).

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60049, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60049, filed 12/11/84.]

WAC 296-56-60051 Handling explosives or hazardous materials. (1) All workers handling explosive or other hazardous material which is properly labeled pursuant to the Washington State Labeling Code, chapters 296-62 and 296-

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64 WAC, promulgated by the department of labor and industries; or the Explosive Act, chapter 70.74 RCW and chapter 296-52 WAC; or the Federal and Washington State Food, Drug and Cosmetic Acts; the Federal Insecticide, Fungicide and Rodenticide Act, the Washington Pesticide Act, chapter 17.21 RCW; the Federal Hazardous Substances Labeling Act; or the Interstate Commerce Commission and Foreign Commerce regulations; or explosives or other dangerous cargo which is reasonably known by the employers to be mislabeled or to be lacking a required label, shall be thoroughly informed by the employer of the explosive or hazardous nature of the cargo.

(2) In all shipping operations including, but not limited to, handling, storage, and preparation, compliance with the standards of the Interstate Commerce Commission, the United States Coast Guard, or the safety rules developed by the Institute of Makers of Explosives shall be deemed proper and safe methods of operation.

(3) Handling of breakage. If breakage should occur while handling explosives or other hazardous materials, the foreman shall order the work in the immediate area to cease until the hazard has been removed. It shall be the responsibility of the employer to use a safe method of handling such breakage and placing it in a remote, safe location.

(4) No smoking. All workers supervising or engaged in the handling, hoisting, stowing of explosives, combustible oxidizing materials or flammable materials shall smoke only in designated areas. No person shall smoke within one hundred feet of any location where such materials are handled or stored.

(5) Loading chute. In chuting packaged explosives, care must be exercised to ensure that one package is taken from the mat before starting another. Each package shall be completely removed from the mat before another is placed on the chute.

(6) Specifications for chutes. In the loading of explosive merchandise in package form where chutes are used, the chutes shall be constructed only of wood. All fastenings shall be of wooden pins, dowelings, or pegs. Metal fastenings may be used, provided they are countersunk.

(7) Mattress landing buffer. The bottoms of the chutes shall be provided with a stuffed mattress not less than four inches thick and of sufficient width and length to allow for safe landing of packages.

(8) Drafts of hazardous or explosive cargo shall be so slung and secured that neither the draft nor individual packages can fall as a result of tipping the draft or slackening the supporting gear.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60051, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60051, filed 12/11/84.]

WAC 296-56-60053 Hazardous atmospheres and substances. (1) Purpose and scope. This section covers areas where a hazardous atmosphere or substance may exist, except where one or more of the following sections apply: WAC 296-56-60049 Hazardous cargo; WAC 296-56-60051 Handling explosives or hazardous materials; WAC 296-56-60055 Carbon monoxide; WAC 296-56-60057 Fumigants, pesticides, insecticides and hazardous preservatives; WAC 296-

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56-60107 Terminal facilities handling menhaden and similar species of fish; WAC 296-56-60235 Welding, cutting and heating (hot work); and WAC 296-56-60237 Spray painting.

(2) Determination of hazard.

(a) Whenever a room, building, vehicle, railcar or other space contains or has contained a hazardous atmosphere, a designated and appropriately equipped person shall test the atmosphere before entry to determine whether a hazardous atmosphere exists.

(b) Records of results of any tests required by this section shall be maintained for at least thirty days.

(3) Testing during ventilation. When mechanical ventilation is used to maintain a safe atmosphere, tests shall be made by a designated person to ensure that the atmosphere is not hazardous.

(4) Entry into hazardous atmospheres. Only designated persons shall enter hazardous atmospheres. The following provisions shall apply:

(a) Persons entering a space containing a hazardous atmosphere shall be protected by respiratory and emergency protective equipment meeting the requirements of WAC 296-62-071 through 296-62-07121;

(b) Persons entering a space containing a hazardous atmosphere shall be instructed in the nature of the hazard, precautions to be taken, and the use of protective and emergency equipment. Standby observers, similarly equipped and instructed, shall continuously monitor the activity of employees within such space; and

(c) Except for emergency or rescue operations, employees shall not enter into any atmosphere which has been identified as flammable or oxygen deficient (less than nineteen and one-half percent oxygen). Persons who may be required to enter flammable or oxygen deficient atmospheres in emergency operations shall be instructed in the dangers attendant to those atmospheres and instructed in the use of self-contained breathing apparatus, which shall be utilized.

(d) To prevent inadvertent employee entry into spaces that have been identified as having hazardous, flammable or oxygen deficient atmospheres, appropriate warning signs or equivalent means shall be posted at all means of access to those spaces.

(5) When the packaging of asbestos cargo leaks, spillage shall be cleaned up by designated employees protected from the harmful effects of asbestos as required by WAC 296-62-07517 and chapter 296-65 WAC.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60053, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60053, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60053, filed 12/11/84.]

WAC 296-56-60055 Carbon monoxide. (1) Exposure limits. The carbon monoxide content of the atmosphere in a room, building, vehicle, railcar or any enclosed space shall be maintained below fifty parts per million (0.005%) as an eight-hour time-weighted average. Employees shall be removed from the enclosed space if the carbon monoxide concentration exceeds one hundred parts per million (0.01%).

(2) Testing. Tests to determine carbon monoxide concentration shall be made whenever necessary to ensure that

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employee exposure does not exceed the limits specified in subsection (1) of this section.

(3) Instrumentation. Tests for carbon monoxide concentration shall be made by designated persons using gas detector tube units certified by NIOSH under 30 CFR Part 11 or other measuring instruments whose accuracy is as great or greater.

(4) Records. A record of the date, time, location and result of carbon monoxide tests shall be available for at least thirty days.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60055, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60055, filed 12/11/84.]

WAC 296-56-60057 Fumigants, pesticides, insecticides and hazardous preservatives. (1) Whenever cargo in a space is or has been stowed, handled, or treated with a fumigant, pesticide, insecticide, or hazardous preservative, a determination shall be made as to whether a hazardous atmosphere is present in the space. Only employees protected as required in subsection (5) of this section shall enter the space if it is hazardous.

(2) Tests to determine the atmospheric concentration of chemicals used to treat cargo shall be:

- (a) Appropriate for the hazard involved;
- (b) Conducted by designated persons; and
- (c) Performed at the intervals necessary to ensure that employee exposure does not exceed the permissible exposure limit for the chemical involved, see chapter 296-62 WAC.

(3) Results of any tests shall be available for at least thirty days.

(4) Chemicals shall only be applied to cargoes by designated persons.

(5) Only designated persons shall enter hazardous atmospheres. Whenever a hazardous atmosphere is entered the following provisions apply.

(a) Persons entering a space containing a hazardous atmosphere shall be protected by respiratory and emergency protective equipment meeting the requirements of part G of this standard; and

(b) Persons entering a space containing a hazardous atmosphere shall be instructed in the nature of the hazard, precautions to be taken, and the use of protective and emergency equipment. Standby observers, similarly equipped and instructed, shall continuously monitor the activity of employees within such a space.

(6) Signs shall be clearly posted where fumigants, pesticides or hazardous preservatives have created a hazardous atmosphere. These signs shall note the danger, identify specific chemical hazards, and give appropriate information and precautions, including instructions for the emergency treatment of employees affected by any chemical in use.

(7) In the case of containerized shipments of fumigated tobacco, the contents of the container shall be aerated by opening the container doors for a period of forty-eight hours after the completion of fumigation and prior to loading. When tobacco is within shipping cases having polyethylene or similar bag liners, the aeration period shall be seventy-two hours. The employer shall obtain a written warranty from the

fumigation facility stating that the appropriate aeration period has been met.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60057, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60057, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60057, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60057, filed 12/11/84.]

PART E—CARGO HANDLING GEAR AND EQUIPMENT

WAC 296-56-60071 House falls. (1) Span beams shall be secured to prevent accidental dislodgement.

(2) A safe means of access shall be provided for employees working with house fall blocks.

(3) Designated employees shall inspect chains, links, shackles, swivels, blocks and other loose gear used in house fall operations before each day's use. Defective gear shall not be used.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60071, filed 12/11/84.]

WAC 296-56-60073 Miscellaneous auxiliary gear. (1) Routine inspection.

(a) At the completion of each use, loose gear such as slings, chains, bridles, blocks, and hooks shall be so placed as to avoid damage to the gear. Loose gear shall be inspected and any defects corrected before re-use.

(b) All loose gear shall be inspected by the employer or his/her authorized representative before each use and, when necessary, at intervals during its use, to ensure that it is safe. Any gear which is found upon inspection to be unsafe shall not be used until it is made safe.

(c) Defective gear shall not be used. Distorted hooks, shackles, or similar gear shall be discarded.

(d) Chains or other gear which have been lengthened, altered, or repaired by welding shall be properly heat treated, and before again being put into use, shall be tested and reexamined in the manner set forth in WAC 296-56-60097 and 296-56-60098.

(2) The employer shall maintain a record of the dates and results of the tests with each unit of gear concerned clearly identified. The records shall be available for examination by division of consultation and compliance personnel and the employee safety committee.

(3) Wire rope and wire rope slings.

(a) The employer shall ascertain and adhere to the manufacturer's recommended ratings for wire rope and wire rope slings and shall have such ratings available at the terminal. When the manufacturer is unable to supply such ratings, the employer shall use the tables for wire rope and wire rope slings found in American National Safety Standard for Slings, ANSI/ASME B30.9-1984. A design safety factor of at least five shall be maintained for the common sizes of running wire used as falls, in purchases or in such uses as light load slings. Wire rope with a safety factor of less than five may be used only:

(i) In specialized equipment, such as cranes designed to be used with lesser wire rope safety factors;

- (ii) In accordance with design factors in standing rigging applications; or
- (iii) For heavy lifts or other purposes for which a safety factor of five is impractical and for which the employer can demonstrate that equivalent safety is ensured.
- (b) Wire rope or wire rope slings exhibiting any of the following conditions shall not be used:
 - (i) Ten randomly distributed broken wires in one rope lay or three or more broken wires in one strand in one rope lay;
 - (ii) Kinking, crushing, bird caging, or other damage resulting in distortion of the wire rope structure;
 - (iii) Evidence of heat damage;
 - (iv) Excessive wear, corrosion, deformation or other defect in the wire or attachments, including cracks in attachments;
 - (v) Any indication of strand or wire slippage in end attachments; or
 - (vi) More than one broken wire in the close vicinity of a socket or swaged fitting.
- (c) Four by twenty-nine (4 x 29) wire rope shall not be used in any running rigging.
- (d) Protruding ends of strands in splices on slings and bridles shall be covered or blunted. Coverings shall be removable so that splices can be examined. Means used to cover or blunt ends shall not damage the wire.
- (e) Where wire rope clips are used to form eyes, the employer shall adhere to the manufacturer's recommendations, which shall be available at the terminal. If "U" bolt clips are used and the manufacturer's recommendations are not available, Table C-1 shall be used to determine the number and spacing of clips. "U" bolts shall be applied with the "U" section in contact with the dead end of the rope.

Table C-1— Number and Spacing of U-Bolt Wire Rope Clips

Improved plow steel, rope diameter	Minimum number of clips		Minimum spacing
	Drop forged	Other material	
inches/(cm)			inches/(cm)
1/2 or less (1.3)	3	4	3 (7.6)
5/8 (1.6)	3	4	3 3/4 (9.5)
3/4 (1.9)	4	5	4 1/2 (11.4)
7/8 (2.2)	4	5	5 1/4 (13.3)
1 (2.5)	5	7	6 (15.2)
1 1/8 (2.7)	6	7	6 3/4 (17.1)
1 1/4 (3.2)	6	8	7 1/2 (18.1)
1 3/8 (3.5)	7	8	8 1/4 (21.0)
1 1/2 (3.8)	7	9	9 (22.9)

- (f) Wire rope shall not be secured by knots.
- (g) Eyes in wire rope bridles, slings, bull wires, or in single parts used for hoisting shall not be formed by wire rope clips or knots.
- (h) Eye splices in wire ropes shall have at least three tucks with a whole strand of the rope and two tucks with one-half of the wire cut from each strand. Other forms of splices or connections which are demonstrated to be equally safe may be used.

(i) Except for eye splices in the ends of wires and for endless rope slings, each wire rope used in hoisting or lowering, or in bulling cargo, shall consist of one continuous piece without knot or splice.

(4) Natural fiber rope.

(a) The employer shall ascertain the manufacturer's ratings for the specific natural fiber rope used and have such ratings available at the terminal. The manufacturer's ratings shall be adhered to and a minimum design safety factor of five maintained.

(b) Eye splices shall consist of at least three full tucks. Short splices shall consist of at least six full tucks, three on each side of the center line.

(5) Synthetic rope.

(a) The employer shall adhere to the manufacturer's ratings and use recommendations for the specific synthetic fiber rope used and shall have such ratings available at the terminal.

(b) Unless otherwise recommended by the manufacturer, when synthetic fiber ropes are substituted for manila ropes of less than three inches (7.62 cm) circumference, the substitute shall be of equal size. Where substituted for manila rope of three inches or more in circumference, the size of the synthetic rope shall be determined from the formula:

$$C = \sqrt{.6(C_s^2) + 4(C_m^2)}$$

Where C= the required circumference of the synthetic rope in inches, C_s= the circumference to the nearest one-quarter inch of a synthetic rope having a breaking strength not less than that of the size manila rope that would be required by subsection (4) of this section, and C_m= the circumference of manila rope in inches which would be required by subsection (4) of this section. In making such substitution, it shall be ascertained that the inherent characteristics of the synthetic fiber are suitable for hoisting.

(6) Removal of natural and synthetic rope from service. Natural or synthetic rope having any of the following defects shall be removed from service:

- (a) Abnormal wear;
 - (b) Powdered fiber between strands;
 - (c) Sufficient cut or broken fibers to affect the capacity of the rope;
 - (d) Variations in the size or roundness of strands;
 - (e) Discolorations other than stains not associated with rope damage;
 - (f) Rotting; or
 - (g) Distortion or other damage to attached hardware.
- (7) Thimbles. Properly fitting thimbles shall be used where any rope is secured permanently to a ring, shackle or attachment, where practical.

(8) Synthetic web slings.

(a) Slings and nets or other combinations of more than one piece of synthetic webbing assembled and used as a single unit (synthetic web slings) shall not be used to hoist loads in excess of the sling's rated capacity.

(b) Synthetic web slings shall be removed from service if they exhibit any of the following defects:

- (i) Acid or caustic burns;
- (ii) Melting or charring of any part of the sling surface;
- (iii) Snags, punctures, tears or cuts;

- (iv) Broken or worn stitches;
- (v) Distortion or damage to fittings; or
- (vi) Display of visible warning threads or markers designed to indicate excessive wear or damage.

(c) Defective synthetic web slings removed from service shall not be returned to service unless repaired by a sling manufacturer or similar entity. Each repaired sling shall be proof tested by the repairer to twice the slings' rated capacity prior to its return to service. The employer shall retain a certificate of the proof test and make it available for examination.

(d) Synthetic web slings provided by the employer shall only be used in accordance with the manufacturer's recommendations, which shall be made available upon request.

(e) Fittings shall have a breaking strength at least equal to that of the sling to which they are attached and shall be free of sharp edges.

(9) Chains and chain slings used for hoisting.

(a) The employer shall adhere to the manufacturer's recommended ratings for safe working loads for the sizes of the wrought iron and alloy steel chains and chain slings used and shall have such ratings available. When the manufacturer is unable to provide such ratings, the employer shall use the tables for chains and chain slings found in American National Safety Standard for Slings, ANSI B30.9-1971.

(b) Proof coil steel chain, also known as common or hardware chain, and other chain not recommended by the manufacturer for slinging or hoisting shall not be used for slinging or hoisting.

(c)(i) Sling chains, including end fastenings, shall be inspected for visible defects before each day's use and as often as necessary during use to ensure integrity of the sling.

(ii) Thorough inspections of chains in use shall be made quarterly to detect wear, defective welds, deformation, increase in length or stretch. The month of inspection shall be indicated on each chain by color of paint on a link or by other effective means.

(iii) Chains shall be removed from service when maximum allowable wear, as indicated in Table C-2, is reached at any point of link.

(iv) Chain slings shall be removed from service when stretch has increased the length of a measured section by more than five percent; when a link is bent, twisted or otherwise damaged; or when a link has a raised scarf or defective weld.

(v) Only designated persons shall inspect chains used for slinging and hoisting.

Table C-2 — Maximum Allowable Wear at Any Point of Link

Chain size		Maximum allowable wear	
Inches		Inches	(cm)
1/4 (9/32)	(0.6)	3/64	(0.1)
3/8	(1.0)	5/64	(0.2)
1/2	(1.3)	7/64	(0.3)
5/8	(1.6)	9/64	(0.4)
3/4	(1.9)	5/32	(0.4)
7/8	(2.2)	11/64	(0.4)
1	(2.5)	3/16	(0.5)
1 1/8	(2.9)	7/32	(0.6)

Chain size		Maximum allowable wear	
Inches		Inches	(cm)
1 1/4	(3.2)	1/4	(0.6)
1 3/8	(3.5)	9/32	(0.7)
1 1/2	(3.8)	5/16	(0.8)
1 3/4	(4.4)	1 1/32	(0.9)

(d) Chains shall only be repaired under qualified supervision. Links or portions of chain defective under any of the criteria of WAC 296-56-60073 (9)(c) shall be replaced with properly dimensioned links or connections of material similar to that of the original chain. Before repaired chains are returned to service, they shall be tested to the proof test load recommended by the manufacturer for the original chain. Tests shall be performed by the manufacturer or shall be certified by an agency accredited for the purpose under WAC 296-56-60093. Test certificates shall be available at the terminal.

(e) Wrought iron chains in constant use shall be annealed or normalized at intervals not exceeding six months. Heat treatment certificates shall be available at the terminal. Alloy chains shall not be annealed.

(f) Kinked or knotted chains shall not be used for lifting. Chains shall not be shortened by bolting, wiring or knotting. Makeshift links or fasteners such as wire, bolts or rods shall not be used.

(g) Hooks, rings, links and attachments affixed to sling chains shall have rated capacities at least equal to that of the chains to which they are attached.

(h) Chain slings shall bear identification of size, grade and rated capacity.

(10) Shackles.

(a) If available, the manufacturer's recommended safe working loads for shackles shall not be exceeded. In the absence of manufacturer's recommendations, Table C-3 shall apply.

(b) Screw pin shackles used aloft in house fall or other gear, except in cargo hook assemblies, shall have their pins moused or otherwise effectively secured.

Table C-3 — Safe Working Loads for Shackles

Material size		Pin diameter		Safe working load in 2,000 lb tons
Inches		Inches	(cm)	
1/2	(1.3)	5/8	(1.6)	1.4
5/8	(1.6)	3/4	(1.9)	2.2
3/4	(1.9)	7/8	(2.2)	3.2
7/8	(2.2)	1	(2.5)	4.3
1	(2.5)	1 1/8	(2.9)	5.6
1 1/8	(2.9)	1 1/4	(3.2)	6.7
1 1/4	(3.2)	1 3/8	(3.5)	8.2
1 3/8	(3.5)	1 1/2	(3.8)	10.0
1 1/2	(3.8)	1 3/4	(4.4)	11.9
1 3/4	(4.4)	2	(5.0)	16.2
2	(5.0)	2 1/4	(5.7)	21.2

(c) Tables G-2 through G-5 shall be used to determine the safe working loads of various sizes and classifications of improved plow steel wire rope slings with various types of terminals. For sizes, classifications and grades not included in these tables the safe working load recommended by the

manufacturer for specific, identifiable products shall be followed, however, a safety factor of not less than five shall be maintained.

**TABLE G-1
MANTLA ROPE**
(In pounds or tons of 2000 pounds)

Circumferences	Diameter in inches	Single Leg	60 Degrees	45 Degrees	30 Degrees
		Lbs.	Lbs.	Lbs.	Lbs.
3/4	1/4	120	204	170	120
1	5/16	200	346	282	200
1 1/8	3/8	270	467	380	270
1 1/4	7/16	350	605	493	350
1 3/8	15/32	450	775	635	450
1 1/2	1/2	530	915	798	530
1 3/4	9/16	690	1190	973	690
2	5/8	880	1520	1240	880
2 1/4	3/4	1080	1870	1520	1080
2 1/2	13/16	1300	2250	1830	1300
2 3/4	7/8	1540	2660	2170	1540
3	1	1800	3120	2540	1800
		Tons	Tons	Tons	Tons
3 1/4	1-1/16	1.0	1.7	1.4	1.0
3 1/2	1-1/8	1.2	2.1	1.7	1.2
3 3/4	1-1/4	1.35	2.3	1.9	1.35
4	1-5/16	1.5	2.6	2.1	1.5
4 1/2	1-1/2	1.8	3.1	2.5	1.8
5	1-3/8	2.25	3.9	3.2	2.25
5 1/2	1-3/4	2.6	4.5	3.7	2.6
6	2	3.1	5.4	4.4	3.1
6 1/2	2-1/8	3.6	6.2	5.1	3.6

In making such a substitution it should be ascertained that the inherent characteristics of the synthetic fiber are suitable for the intended service of the rope.

TABLE G-2 RATED CAPACITIES FOR IMPROVED PLOW STEEL, INDEPENDENT WIRE ROPE CORE, WIRE ROPE AND WIRE SLINGS
(IN TONS OF 2,000 POUNDS)

Rope Diameter Inches	Single Leg					
	Vertical			Choker		
	A	B	C	A	B	C
6 x 19 Classification						
1/4"	.59	.56	.53	.44	.42	.40
3/8"	1.3	1.2	1.1	.98	.93	.86
1/2"	2.3	2.2	2.0	1.7	1.6	1.5
5/8"	3.6	3.4	3.0	2.7	2.5	2.2
3/4"	5.1	4.9	4.2	3.8	3.6	3.1
7/8"	6.9	6.6	5.5	5.2	4.9	4.1
1"	9.0	8.5	7.2	6.7	6.4	5.4
1-1/8"	11	10	9.0	8.5	7.8	6.8
6 x 37 Classification						
1-1/4"	13	12	10	9.9	9.2	7.9
1-3/8"	16	15	13	12	11	9.6
1-1/2"	19	17	15	14	13	11
1-3/4"	26	24	20	19	18	15
2"	33	30	26	25	23	20
2-1/4"	41	38	33	31	29	25

(A) — Socket or Swaged Terminal attachment.
(B) — Mechanical Sleeve attachment.
(C) — Hand Tucked Splice attachment.

TABLE G-3 RATED CAPACITIES FOR IMPROVED PLOW STEEL, INDEPENDENT WIRE ROPE CORE, WIRE ROPE SLINGS
(IN TONS OF 2,000 POUNDS)

Rope dia. inches	Two-leg bridle or basket hitch											
	Vertical			60 degree			45 degree			30 degree		
	A	B	C	A	B	C	A	B	C	A	B	C
6 x 19 Classification												
1/4"	1.2	1.1	1.0	1.0	.97	.92	.83	.79	.75	.59	.56	.53
3/8"	2.6	2.5	2.3	2.3	2.1	2.0	1.8	1.8	1.6	1.3	1.2	1.1
1/2"	4.6	4.4	3.9	4.0	3.8	3.4	3.2	3.1	2.8	2.3	2.2	2.0
5/8"	7.2	6.8	6.0	6.2	5.9	5.2	5.1	4.8	4.2	3.6	3.4	3.0
3/4"	10	9.7	8.4	8.9	8.4	7.3	7.2	6.9	5.9	5.1	4.9	4.2
7/8"	14	13	11	12	11	9.6	9.8	9.3	7.8	6.9	6.6	5.5
1"	18	17	14	15	15	12	13	12	10	9.0	8.5	7.2
1-1/8"	23	21	18	19	18	16	16	15	13	11	10	9.0
6 x 37 Classification												
1-1/4"	26	24	21	23	21	18	19	17	15	13	12	10
1-3/8"	32	29	25	28	25	22	22	21	18	16	15	13
1-1/2"	38	35	30	33	30	26	27	25	21	19	17	15
1-3/4"	51	47	41	44	41	35	36	33	29	26	24	20
2"	66	61	53	57	53	46	47	43	37	33	30	26
2-1/4"	83	76	66	72	66	57	58	54	47	41	38	33




(A) -- Socket or Swaged Terminal Attachment.
(B) -- Mechanical Sleeve Attachment.
(C) -- Hand Tucked Splice Attachment.

TABLE G-4 RATED CAPACITIES FOR IMPROVED PLOW STEEL, FIBER CORE, WIRE ROPE AND WIRE ROPE SLINGS
(In Tons of 2,000 pounds)

Rope dia. Inches	Single leg					
	Vertical			Choker		
	A	B	C	A	B	C
6 x 19 Classification						
1/4"	.55	.51	.49	.41	.38	.37
3/8"	1.2	1.1	1.1	.91	.85	.80
1/2"	2.1	2.0	1.8	1.6	1.5	1.4
5/8"	3.3	3.1	2.8	2.5	2.3	2.1
3/4"	4.8	4.4	3.9	3.6	3.3	2.9
7/8"	6.4	5.9	5.1	4.8	4.5	3.9
1"	8.4	7.7	6.7	6.3	5.8	5.0
1-1/8"	10	9.5	8.4	7.9	7.1	6.3
6 x 37 Classification						
1-1/4"	12	11	9.8	9.2	8.3	7.4
1-3/8"	15	13	12	11	10	8.9
1-1/2"	17	16	14	13	12	10
1-3/4"	24	21	19	18	16	14
2"	31	28	25	23	21	18





(A) — Socket or Swaged Terminal attachment.
(B) — Mechanical Sleeve attachment.
(C) — Hand Tucked Splice attachment.

TABLE G-5 RATED CAPACITIES FOR IMPROVED PLOW STEEL, FIBER CORE, WIRE ROPE SLINGS (In Tons of 2,000 Pounds)

Two-leg bridle or basket hitch												
Rope dia. Inches	Vertical			60 Degree 			45 Degree 			30 degree 		
	A	B	C	A	B	C	A	B	C	A	B	C
6 x 19 Classification												
1/4	1.1	1.0	.99	.95	.88	.85	.77	.72	.70	.55	.51	.49
3/8	2.4	2.2	2.1	2.1	1.9	1.8	1.7	1.6	1.5	1.2	1.1	1.1
1/2	4.3	3.9	3.7	3.7	3.4	3.2	3.0	2.8	2.6	2.1	2.0	1.8
5/8	6.7	6.2	5.6	5.8	5.3	4.8	4.7	4.4	4.0	3.3	3.1	2.8
3/4	9.5	8.8	7.8	8.2	7.6	6.8	6.7	6.2	5.5	4.8	4.4	3.9
7/8	13	12	10	11	10	8.9	9.1	8.4	7.3	6.4	5.9	5.1
1	17	15	13	14	13	11	12	11	9.4	8.4	7.7	6.7
1-1/2	21	19	17	18	16	14	15	13	12	10	9.5	8.4
6 x 37 Classification												
1-1/4	25	22	20	21	19	17	17	16	14	12	11	9.8
1-3/8	30	27	24	26	23	20	21	19	17	15	13	12
1-1/2	35	32	28	30	27	24	25	22	20	17	16	14
1-3/4	48	43	38	41	37	33	34	30	27	24	21	19
2	62	55	49	53	48	43	43	39	35	31	28	25

(A) -- Socket or Swaged Terminal attachment.
 (B) -- Mechanical Sleeve attachment.
 (C) -- Hand Tucked Splice attachment.

TABLE G-6 ALLOY STEEL CHAIN (In Tons of 2,000 Pounds)

Nominal size chain stock Inch.	Single leg 	60 degree 	45 degree 	30 degree 
1/4	1.62	2.82	2.27	1.62
3/8	3.30	5.70	4.65	3.30
1/2	5.62	9.75	7.90	5.62
5/8	8.25	14.25	11.65	8.25
3/4	11.5	19.9	16.2	11.5
7/8	14.3	24.9	20.3	14.3
1	19.3	33.5	27.3	19.3
1-1/8	22.2	38.5	31.5	22.2
1-1/4	28.7	49.7	40.5	28.7
1-3/8	33.5	58.0	47.0	33.5
1-1/2	39.7	68.5	56.0	39.7
1-5/8	42.5	73.5	59.5	42.5
1-3/4	47.0	81.5	62.0	47.0

(11) Hooks other than hand hooks.

(a) The manufacturer's recommendations shall be followed in determining the safe working loads of the various sizes and types of specific and identifiable hooks. All hooks for which no applicable manufacturer's recommendations are available shall be tested to twice the intended safe working load before they are initially put into use. The employer shall maintain a record of the dates and results of such tests.

(b) Loads shall be applied to the throat of the hook since loading the point may overstress, bend, or spring the hook.

(c) Hooks shall be inspected once a month to see that they have not been bent by overloading. Bent or sprung hooks shall not be used.

(d) Crane hooks. Magnetic particle or other suitable crack detecting inspection shall be performed at least once each year. When testing by x-ray, the pertinent provisions of the Nuclear Regulatory Commission's standards for protec-

tion against radiation, relating to protection against occupational radiation exposure, shall apply.

(e) Any activity which involves the use of radioactive materials or x-rays, whether or not under license from the Nuclear Regulatory Commission, shall be performed by competent persons specially trained in the proper and safe operation of such equipment. In the case of materials used under commission license, only persons actually licensed, or competent persons under direction and supervision of the licensee, shall perform such work.

(f) Teeth of case hooks shall not be split, cracked, or deformed.

(g) Jaws of patent clamp type plate hooks shall be kept in safe condition so that they will grip plates securely.

(12) Pallets.

(a) Pallets shall be made and maintained to safely support and carry loads being handled. Fastenings of reusable pallets used for hoisting shall be bolts and nuts, drive screws (helically threaded nails), annular threaded nails or fastenings of equivalent holding strength.

(b) Damaged pallets shall be stored in designated areas and identified.

(c) Reusable wing or lip-type pallets shall be hoisted by bar bridles or other suitable gear and shall have an overhanging wing or lip of at least three inches (76.2 mm). They shall not be hoisted by wire slings alone.

(d) Loaded pallets that do not meet the requirements of this paragraph shall be hoisted only after being placed on pallets meeting such requirements or shall be handled by other means providing equivalent protection.

(e) Bridles for handling flush end or box-type pallets shall be designed to prevent disengagement from the pallet under load.

(f) Pallets shall be stacked or placed to prevent falling, collapsing or otherwise causing a hazard under standard operating conditions.

(g) Disposable pallets intended only for one use shall not be re-used for hoisting.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60073, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-56-60073, filed 1/18/95, effective 3/1/95. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60073, filed 10/30/92, effective 12/8/92. Statutory Authority: Chapter 49.17 RCW, 91-11-070 (Order 91-01), § 296-56-60073, filed 5/20/91, effective 6/20/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60073, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60073, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60073, filed 12/11/84.]

WAC 296-56-60075 Cargo boards and other type pallet boards. (1) "Cargo board" means the typical wing or lip-type stevedore board hoisted to or from vessels by means of a bar bridle. "Other pallet boards" includes all other platforms used to hold cargo for the purpose of transporting it from place to place.

(2) All pallets and cargo boards shall be of such material and construction as to safely support and carry loads being handled.

(3) All cargo boards shall be sheathed (decked) top and bottom with the top sheathing being of two-inch lumber and extending at least six inches beyond the end stringers.

(4) The outer sheathing boards or boards adjacent thereto on cargo boards shall be fastened to the stringers by bolts and nuts. Other sheathing shall be fastened by bolts and nuts, drive screws (helically threaded nails), annular threaded nails, or fastenings of equivalent strength.

(5) Pallet boards, other than cargo boards, may be hoisted if safe means are provided for the type of board used.

(6) Loaded cargo or pallet boards which do not meet the requirements of this section shall be reboarded or placed on cargo boards meeting the requirements of this section before being hoisted, only if the weight of the load can be safely distributed on the cargo board.

(7) Cargo boards which are not loaded and secured so that the load will not tip or fall shall not be hoisted.

(8) Bridles used to handle flush-end or box-type pallets shall be of such a design as to prevent them from becoming disengaged from the pallet under load.

Note: In areas where a two lip cargo board is being used, that practice shall continue. The department of labor and industries recommends the use of the two lip cargo board.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60075, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60075, filed 12/11/84.]

WAC 296-56-60077 Powered industrial trucks. (1) Applicability. This section applies to every type of powered industrial truck used for material or equipment handling within a marine terminal. It does not apply to over-the-road vehicles.

(2) General.

(a) Modifications, such as adding counterweights, that might affect the vehicle's capacity or safety shall not be performed without either the manufacturer's prior written approval or the written approval of a professional engineer experienced with the equipment who has consulted with the manufacturer, if available. Capacity, operation and maintenance instruction plates, tags or decals shall be changed to conform to the equipment as modified.

(b) Unauthorized personnel shall not ride on powered industrial trucks. A safe place to ride shall be provided when riding is authorized.

(c) When a powered industrial truck is left unattended, load-engaging means shall be fully lowered, controls neutralized and brakes set. Unless the truck is in view and within twenty-five feet (7.6 m) of the operator, power shall be shut off. Wheels shall be blocked or curbed if the truck is on an incline.

(d) Powered industrial trucks shall not be operated inside highway vehicles or railcars having damage which could affect operational safety.

(e) Powered industrial trucks shall be marked with their rated capacities, which shall be visible to the operator.

(f) Only stable and safely arranged loads within the rated capacity of the truck shall be handled.

(g) Drivers shall ascend and descend grades slowly.

(h) Drivers shall slow down and sound the horn at cross-aisles and other locations where visibility is obstructed.

(i) If the load obstructs the forward view drivers shall travel with the load trailing.

(j) Steering knobs shall not be used unless the truck is equipped with power steering.

(k) When powered industrial trucks use cargo lifting devices that have a means of engagement hidden from the operator, a means shall be provided to enable the operator to determine that the cargo has been engaged.

(l) When cargo is being towed on pipe trucks or similar equipment, a safe means shall be provided to protect the driver from sliding loads.

(3) Maintenance.

(a) Only designated persons shall perform maintenance and repair.

(b) Batteries on all powered trucks shall be disconnected during repairs to the primary electrical system unless power is necessary for testing and repair. On trucks equipped with systems capable of storing residual energy, that energy shall be safely discharged before work on the primary electrical system begins.

(c) Replacement parts whose function might affect operational safety shall be equivalent in strength and performance capability to the original parts which they replace.

(d) Braking systems or other mechanisms used for braking shall be operable and in safe condition.

(e) Powered industrial trucks shall be maintained in safe working order. Safety devices shall not be removed or made inoperative except as otherwise provided in this section. Trucks with a fuel system leak or any other safety defect shall not be operated.

(f) Those repairs to the fuel and ignition systems of industrial trucks which involve fire hazards shall be conducted only in locations designated as safe for such repairs.

(4) Approved trucks.

(a) "Approved power-operated industrial truck" means one listed or approved for the intended use by a nationally recognized testing laboratory.

(b) Approved trucks acquired and used after February 15, 1972, shall bear a label or other identification indicating testing laboratory approval.

(c) When the atmosphere in an area is hazardous and the provisions of United States Coast Guard regulations at 33 CFR 126.15(e) do not apply, only power-operated industrial trucks approved for such locations shall be used.

(5) Duties of operator.

(A) A power-driven vehicle operator's special duties are:

(i) To operate the vehicle in a safe manner.

(ii) To test brakes, steering gear, lights, horns, or other warning devices, clutches, etc., before starting work.

(iii) To have the vehicle at all times under control so that it can be brought to an emergency stop in the clear space in front of the vehicle.

(iv) To back down any incline of two percent or more when traveling with a load on the fork lift jitney.

(b) Unobstructed view. When traveling, power-propelled vehicles shall at all times be operated in a manner giving the operator a reasonably unobstructed view in the direction of travel. Where this is impractical, the operator shall be directed in travel, by a person designated to do so.

(c) Employee riding safety. Operators and authorized passengers shall not be permitted to ride with legs or arms extending outside any vehicle nor shall they be permitted to

ride while standing unless the vehicle is designed to be operated from a standing position.

(d) Moving vehicles. Vehicles shall be controlled manually while being pushed or towed except when a tow bar is used. Special precautions shall be taken when pushing vehicles where view is obstructed. Vehicles shall not be pushed with blades of a forklift.

(e) Moving highway trailers. In all cargo operations involving the use of highway trailers, trailers shall be moved in such a manner that the moving trailer is completely under control at all times. Special caution shall be exercised when such trailers are moving on inclines. Trailers shall be loaded in a manner which will prevent the cargo from shifting, and the load in the trailer shall be evenly distributed so as not to cause the trailer to tip to one side.

(f) Prohibited forms of riding. Riding on tongue or handles of trailers or forks of power-propelled vehicles is prohibited.

(g) Regular seats for riders. No one except the operator shall ride on power-driven vehicles unless regular seats are provided to accommodate passengers.

(h) Jumping on or off moving vehicles. Employees shall not jump on or off moving vehicles.

(i) Reporting defects. If a power-driven vehicle is at any time found to be in any way unsafe, the operator shall report same immediately to the person in charge and such vehicle shall not be used for production work until it has been made safe.

(6) Vehicle equipment and maintenance.

(a) Horns and lights. All power-propelled vehicles shall be provided with horns or other warning devices.

(b) Power-propelled vehicles used for night work, when required to travel away from an illuminated work area shall be equipped with a light or lights directed in the direction of travel in order to safely travel about the area.

(c) Guards on operator's platform. Every power truck operated from an end platform or standing position shall be equipped with a substantial guard securely attached to the platform or frame of the vehicle in such a manner as to protect the operator from falling objects and so designed that the operator can easily mount or dismount from the operating station.

(d) Seat cushions. All vehicles having a driver's seat shall be provided with resilient seat cushions fixed in place.

(e) Securing of counterbalances. Counterbalances of all power-driven vehicles shall be positively secured to prevent accidental dislodging, but may be a removable type which may be removed, if desired, prior to hoisting the vehicle.

(f) Exhaust pipes and mufflers. Exhaust pipes and mufflers of internal combustion engines, where workers are exposed to contact shall be isolated or insulated. Exhaust pipes shall be constructed to discharge not less than seventy-two inches above the floor on jitneys and eighty-four inches on forklifts or less than twenty inches from the floor.

(g) Ventilation where internal combustion vehicles are used. Internal combustion engines may be used only in areas where adequate ventilation is provided.

(h) Concentration levels of carbon monoxide gas created by powered industrial truck operations shall not exceed the levels specified in WAC 296-56-60055.

(i) When disputes arise concerning degree of concentration, methods of sampling to ascertain the conditions should be referred to a qualified industrial hygienist.

(j) Cargo truck couplings. Couplings installed on cargo trucks (four-wheelers) shall be of a type which will prevent accidental disengaging.

(k) Operating levers. Operating levers on power-driven vehicles shall be so placed as not to project toward the operator's body.

(l) Front axle assembly. The front axle assembly on all trailers shall be securely fastened to the truck bed.

(m) Air line hook-up. Tractors hauling heavy duty highway trailers shall have an air line brake hook-up.

(n) Floor mats. On power-driven vehicles where the operator stands on a platform, resilient foot mats shall be securely attached.

(o) Cleaning vehicles. All power-propelled vehicles shall be cleaned at frequent intervals to remove any accumulation of dust and grease that may present a hazard.

(7) Forklift trucks.

(a) Overhead guards.

(i) When operators are exposed to overhead falling hazards, forklift trucks shall be equipped with securely attached overhead guards. Guards shall be constructed to protect the operator from falling boxes, cartons, packages, or similar objects.

(ii) Overhead guards shall not obstruct the operator's view, and openings in the top of the guard shall not exceed six inches (15.2 cm) in one of the two directions, width or length. Larger openings are permitted if no opening allows the smallest unit of cargo being handled to fall through the guard.

(iii) Overhead guards shall be built so that failure of the vehicle's mast tilting mechanism will not displace the guard.

(iv) An overhead guard, otherwise required by this paragraph, may be removed only when it would prevent a truck from entering a work space and if the operator is not exposed to low overhead obstructions in the work space.

(v) Overhead guards shall be large enough to extend over the operator during all truck operations, including forward tilt.

(b) Supplies to ship's rail. Cargo or supplies shall not be hoisted to or from ship's rail with a forklift. This does not apply to ramp or side port loading.

(c) Position of forks. When standing, lift forklift forks shall be lowered to floor. When moving, lift forklift forks shall be kept as low as possible.

(d) Forklift use in gangplank moving. Not less than two forklifts shall be used to place or remove gangplanks unless fork width prevents tipping and manufacturer's rated lifting capacity of the forklift is not exceeded.

(e) Forklift seat covers. Seats on forklifts shall be provided with a removable waterproof cover when they are exposed to the weather.

(f) Raised equipment to be blocked. Workers shall not work below the raised bed of a dump truck, raised buckets of front end loaders, raised blades of tractors or in similar positions without blocking the equipment in a manner that will prevent it from falling. When working under equipment sus-

pended by use of jacks, safety stands or blocking shall be used in conjunction with the jack.

(g) Maximum speed. The maximum speed for forklifts on all docks shall not exceed eight miles per hour. The speed limit shall be prominently posted on such docks.

(h) Load backrest extensions. Where necessary to protect the operator, forklift trucks shall be fitted with a vertical load backrest extension to prevent the load from hitting the mast when the mast is positioned at maximum backward tilt. For this purpose, a "load backrest extension" means a device extending vertically from the fork carriage frame to prevent raised loads from falling backward.

(i) Forks. Forks, fork extensions and other attachments shall be secured so that they cannot be accidentally dislodged, and shall be used only in accordance with the manufacturer's recommendations.

(j) Counterweights. Counterweights shall be so affixed that they cannot be accidentally dislodged.

(k) Capacities and weights.

(i) Forklift truck rated capacities, with and without removable counterweights, shall not be exceeded. Rated capacities shall be marked on the vehicle and shall be visible to the operator. The vehicle weight, with and without counterweight, shall be similarly marked.

(ii) If loads are lifted by two or more trucks working in unison, the total weight of the load shall not exceed the combined rated lifting capacity of all trucks involved.

(l) Lifting of employees. Employees may be elevated by forklift trucks only when a platform is secured to the lifting carriage or forks. The platform shall meet the following requirements:

(i) The platform shall have a railing complying with WAC 296-56-60123(3).

(ii) The platform shall have toeboards complying with WAC 296-56-60123(4), if tools or other objects could fall on employees below.

(iii) When the truck has controls which are elevated with the lifting carriage, means shall be provided for employees on the platform to shut off power to the vehicle.

(iv) Employees on the platform shall be protected from exposure to moving truck parts.

(v) The platform floor shall be skid resistant.

(vi) A truck operator shall be at the truck's controls when employees are elevated unless the truck's controls are elevated with the lifting carriage.

(vii) While employees are elevated, the truck may be moved only to make minor placement adjustments.

(8) Bulk cargo-moving vehicles.

(a) Where a seated operator may come into contact with projecting overhead members, crawler-type bulk-cargo-moving vehicles that are rider operated shall be equipped with operator guards.

(b) Guards and their attachment points shall be so designed as to be able to withstand, without excessive deflection, a load applied horizontally at the operator's shoulder level equal to the drawbar pull of the machine.

(c) After July 26, 1999, bulk cargo-moving vehicles shall be equipped with rollover protection of such design and construction as to prevent the possibility of the operator being crushed because of a rollover or upset.

(9) Straddle trucks.

(a) Accessibility. Straddle trucks shall have a permanent means of access to the operator's station, including any handholds necessary for safe ascent and descent.

(b) Guarding.

(i) Main sprockets and chains to the wheels shall be guarded as follows:

(A) The upper sprocket shall be fully enclosed;

(B) The upper half of the lower sprocket shall be enclosed; and

(C) The drive chain shall be enclosed to a height of eight feet (2.6 m) except for that portion at the lower half of the lower sprocket.

(ii) Gears shall be fully enclosed and revolving parts which may be contacted by the operator shall be guarded.

(iii) When straddle trucks are used in the vicinity of employees, personnel-deflecting guards shall be provided around leading edges of front and rear wheels.

(c) Visibility. Operator visibility shall be provided in all directions of movement.

(10) Trailer-spotting tractors.

(a) Trailer-spotting tractors (fifth wheels) shall be fitted with any hand grabs and footing necessary for safe access to the fifth wheel.

(b) Rear cab windows shall be of safety glass or equivalent material.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60077, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60077, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60077, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60077, filed 12/11/84.]

WAC 296-56-60079 General rules applicable to vehicles. (1) The requirements of this section apply to general vehicle use within marine terminals except in cases where the provisions of subsections (3) and (13) of this section are preempted by regulations of the department of transportation.

(2) Private vehicle parking in marine terminals shall be allowed only in designated areas.

(3) Trailers shall not be disconnected from tractors at loading docks until the road wheels have been immobilized. The road wheels shall be immobilized from the time the brake system is disconnected until braking is again provided. Supplementary front end support shall be employed as necessary to prevent tipping when a trailer is entered by a material handling vehicle. Rear end support shall be employed if rear wheels are so far forward as to allow tipping when the trailer is entered.

(4) The employer shall direct motor vehicle operators to comply with any posted speed limits, other traffic control signs or signals, and written traffic instructions.

(5) Stop signs shall be posted at main entrances and exits of structures where visibility is impaired, and at blind intersections, unless direct traffic control, warning mirror systems or other systems of equivalent safety are provided.

(6) Vehicular routes, traffic rules and parking areas shall be established, identified and used.

(7) Vehicle drivers shall warn anyone in traffic lanes of the vehicle's approach.

(8) Signs indicating pedestrian traffic shall be clearly posted at vehicular check-in and check-out lines and similar locations where employees may be working.

(9) A distance of not less than twenty feet (6.1 m) shall be maintained between the first two vehicles in a check-in, check-out, road ability, or vessel loading/discharging line. This distance shall be maintained between any subsequent vehicles behind which employees are required to work.

(10) No unattended vehicle shall be left with its engine running unless secured against movement (see WAC 296-56-60077 for powered industrial trucks).

(11) When the rear of a vehicle is elevated to facilitate loading or discharging, a ramp shall be provided and secured. The vehicle shall be secured against accidental movement during loading or discharging.

(12) Only vehicle floors in safe condition shall be used.

(13) When flatbed trucks, platform containers or similar conveyances are loaded or discharged and the cargo consists of pipe or other products which could spread or roll to endanger employees, the cargo shall be contained to prevent movement.

(14) Vehicles used to transport employees within a terminal shall be maintained in safe working order and safety devices shall not be removed or made inoperable.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60079, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60079, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60079, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60079, filed 12/11/84.]

WAC 296-56-60081 Multipiece and single-piece rim wheels. Servicing of multipiece and single-piece rim wheels in marine terminal and other maritime work locations on large vehicles is regulated by requirements of WAC 296-24-21701.

[Statutory Authority: Chapter 49.17 RCW, 88-14-108 (Order 88-11), § 296-56-60081, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60081, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60081, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60081, filed 12/11/84.]

WAC 296-56-60083 Cranes and derricks. (1) Scope.

(a) This section through WAC 296-56-60103 applies to every kind of crane and derrick and to any other type of equipment performing the functions of a crane or derrick except as noted in (b) of this subsection.

(b) This section does not apply to small industrial truck-type cranes, container handling toploaders and sideloaders, chain hoists, and mobile straddle-type cranes incapable of straddling two or more intermodal containers (sixteen feet (4.88 m) in width).

(2) Ratings.

(a) Except for bridge cranes covered by subsection (7) of this section, cranes and derricks having ratings that vary with boom length, radius (outreach) or other variables shall have a durable rating chart visible to the operator, covering the complete range of the manufacturer's (or design) capacity ratings. The rating chart shall include all operating radii (outreach) for all permissible boom lengths and jib lengths as applicable, with and without outriggers, and alternate ratings for optional

equipment affecting such ratings. Precautions or warnings specified by the owner or manufacturer shall be included.

(b) The manufacturer's (or design) rated loads for the conditions of use shall not be exceeded.

(c) Designated working loads shall not be increased beyond the manufacturer's ratings or original design limitations unless such increase receives the manufacturer's approval. When the manufacturer's services are not available or where the equipment is of foreign manufacture, engineering design analysis shall be performed or approved by a person accredited for certifying the equipment under WAC 296-56-60093. Cranes shall conform with the manufacturer's specifications or any current ANSI standards that apply. Engineering design analysis shall be performed by a registered professional engineer competent in the field of cranes and derricks. Any structural changes necessitated by the change in rating shall be carried out.

(3) Radius indicator. When the rated load varies with the boom radius, the crane or derrick shall be fitted with a boom angle or radius indicator visible to the operator.

(4) Prohibited usage.

(a) Equipment shall not be used in a manner that exerts sideloading stresses upon the crane or derrick boom.

(b) No crane or derrick having a visible or known defect that affects safe operation shall be used.

(5) Protective devices.

(a) When exposed moving parts such as gears, chains and chain sprockets present a hazard to employees during crane and derrick operations, those parts shall be securely guarded.

(b) Crane hooks shall be latched or otherwise secured to prevent accidental load disengagement.

(c) When hoisting personnel in an approved man basket, the hook shall have a positive safety latch to prevent rollouts.

(6) General.

(a) Operating controls.

(i) Crane and derrick operating controls shall be clearly marked, or a chart indicating their function shall be posted at the operator's position.

(ii) All crane controls shall operate in a uniform manner within a given port.

(iii) Overhead bridge and container gantry crane operating control levers shall be self-centering so that they will automatically move to the "off" position when the operator releases the control.

(b) Booms. Cranes with elevatable booms and without operable automatic limiting devices shall be provided with boom stops if boom elevation can exceed maximum design angles from the horizontal.

(c) Foot pedals. Foot pedals shall have a nonskid surface.

(d) Access. Ladders, stairways, stanchions, grab irons, foot steps or equivalent means shall be provided as necessary to ensure safe access to footwalks, cab platforms, the cab and any portion of the superstructure which employees must reach.

(i) Footwalks shall be of rigid construction, and shall be capable of supporting a load of one hundred pounds (4.79 kPa) per square foot.

(ii) If more than twenty feet (6.1 m) in height, vertical ladders shall comply with WAC 296-56-60209 (4), (5)(a), (5)(b)(iii) and (5)(b)(iv).

(iii) Stairways on cranes shall be equipped with rigid handrails meeting the requirements of WAC 296-56-60123 (5)(a).

(iv) If the top of a ladder or stairway or any position thereof is located where a moving part of a crane, such as a revolving house, could strike an employee ascending or descending the ladder or stairway, a prominent warning sign shall be posted at the foot of the ladder or stairway. A system of communication (such as a buzzer or bell) shall be established and maintained between the foot of the ladder or stairway and the operator's cab.

(e) Operator's station. The cab, controls, and mechanism of the equipment shall be so arranged that the operator has a clear view of the load or signal person, when one is used. Cab glass, when used, shall be safety plate glass or equivalent and good visibility shall be maintained through the glass. Clothing, tools and equipment shall be stored so as not to interfere with access, operation, or the operator's view.

(f) A seat (lap) belt, meeting the requirements of 49 CFR 571.208-210 for a Type 1 seat belt assembly, shall be installed on the operator's seat of high speed container gantry cranes where the seat trolleys.

(g) Counterweights or ballast. Cranes shall be operated only with the specified type and amount of ballast or counterweights. Ballast or counterweight shall be located and secured only as provided in the manufacturer's or design specifications, which shall be available.

(h) Outriggers. Outriggers shall be used according to the manufacturer's specifications or design data, which shall be available. Floats, when used, shall be securely attached to the outriggers. Wood blocks or other support shall be of sufficient size to support the outrigger, free of defects that may affect safety and of sufficient width and length to prevent the crane from shifting or toppling under load.

(i) Exhaust gases. Engine exhaust gases shall be discharged away from the normal position of crane operating personnel.

(j) Electrical equipment shall be so located or enclosed that live parts will not be exposed to accidental contact. Designated persons may work on energized equipment only if necessary during inspection, maintenance, or repair.

(k) Fire extinguisher.

(i) At least one portable fire extinguisher of at least 5-BC rating or equivalent shall be accessible in the cab of the crane or derrick.

(ii) No portable fire extinguisher using carbon tetrachloride or chlorobromomethane extinguishing agents shall be used.

(l) Rope on drums. At least three full turns of rope shall remain on ungrooved drums, and two turns on grooved drums, under all operating conditions. Wire rope shall be secured to drums by clamps, U-bolts, shackles, or equivalent means. Fiber rope fastenings are prohibited.

(m) Assembly or disassembly of boom sections. Mobile crane booms being assembled or disassembled on the ground with or without the support of the boom harness shall be blocked to prevent dropping of the boom or boom sections.

(n) Brakes.

(i) Each independent hoisting unit of a crane shall be equipped with at least one holding brake, applied directly to the motor shaft or gear train.

(ii) Each independent hoisting unit of a crane, except worm geared hoists, the angle of whose worm is such as to prevent the load from accelerating in the lowering direction, shall, in addition to a holding brake, be equipped with a controlled braking means to control lowering speeds.

(iii) Holding brakes for hoist units shall have not less than the following percentage of the rated load hoisting torque at the point where the brake is applied:

(A) One hundred twenty-five percent when used with a controlled braking means.

(B) One hundred percent when used with a mechanically-controlled braking means.

(C) One hundred percent when two holding brakes are provided.

(iv) All power control braking means shall be capable of maintaining safe lowering speeds of rated loads.

(o) Each crane or derrick shall be equipped with sufficient lights to maintain five foot candles in the working area around the load hook. All crane ladders and machinery houses shall be illuminated at a minimum of two candle power.

(p) Light fixtures connected to the boom, gantry legs, or machinery house shall be provided with safety devices which will prevent the light fixture from falling in case of bracket failure.

(q) Electronic devices may be installed to prevent collision subject to approval of the accredited certification agency.

(r) On all rail gantry cranes, truck guards shall extend on the ends of the trucks, close to the top of the rail to prevent worker's feet from being caught between the rail and wheel. This subsection does not apply if rail sweeps are present.

(s) All hydraulic cylinders used to control crane booms or to provide crane stability (outriggers) shall be equipped with a pilot operated check valve or a device which will prevent the boom or outrigger from retracting in case of failure of a component of the hydraulic system.

(t) Gantry cranes shall be provided with automatic rail clamps or other devices to prevent the crane from moving when not being used or when power is off.

(7) Rail-mounted cranes (excluding locomotive types).

(a) For the purposes of this section, rail-mounted cranes include bridge cranes and portal cranes.

(b) Rated load marking. The rated loads of bridge cranes shall be plainly marked on each side of the crane and in the cab. If there is more than one hoisting unit, each hoist shall have its rated load marked on it or on its load block. Marking shall be legible from the ground level.

(c) Wind-indicating devices.

(i) Each rail-mounted bridge and portal crane located outside of an enclosed structure shall be fitted with an operable wind-indicating device.

(ii) The wind indicating device shall provide a visible or audible warning to alert the operator of high wind conditions. That warning shall be transmitted whenever the following circumstances are present:

(A) When wind velocity reaches the warning speed, not exceeding the crane manufacturer's recommendations; and

(B) When wind velocity reaches the shutdown speed, not exceeding the crane manufacturer's recommendations, at which work is to be stopped and the crane secured.

(iii) Instructions. The employer shall post operating instructions for high wind conditions in the operator's cab of each crane. Operators shall be directed to comply with these instructions. The instructions shall include procedures for responding to high wind alerts and for any coordination necessary with other cranes.

(d) Securing of cranes in high winds.

(i) When the wind reaches the crane's warning speed:

(A) Gantry travel shall be stopped; and

(B) The crane shall be readied for shutdown.

(ii) When the wind reaches the crane's shutdown speed:

(A) Any portion of the crane spanning or partially spanning a vessel shall be moved clear of the vessel if safe to do so; and

(B) The crane shall be secured against travel, using all available means of securing.

(e) The employer shall monitor local weather conditions by subscribing to a weather service or using equally effective means.

(f) Stops and bumpers.

(i) The ends of all tracks shall be equipped with stops or bumpers. If a stop engages the tread of the wheel, it shall be of a height not less than the radius of the wheel.

(ii) When more than one crane operates on the same runway or more than one trolley on the same bridge, each crane or trolley shall be equipped with bumpers or equivalent devices at adjacent ends subject to impact.

(g) Employee exposure to crane movement. When employees may be in the vicinity of the tracks, crane trucks shall be equipped with personnel-deflecting guards.

(h) Pedestrian clearance. If the track area is used for employee passage or for work, a minimum clearance of three feet (0.9 m) shall be provided between trucks or the structures of rail-mounted cranes and any other structure or obstruction. When the required clearance is not available on at least one side of the crane's trucks, the area shall not be used and shall be marked and identified.

(i) Warning devices. Rail-mounted cranes shall be equipped with an effective audible and visible travel warning device which shall be used to warn employees who may be in the path of the moving crane.

(j) Communications.

(i) Means of communication shall be provided between the operator's cab and the base of the gantry of all rail-mounted cranes. This requirement may be met by telephone, radio, sound-signaling system or other effective methods, but not solely by hand-signaling.

(ii) All rail-mounted cranes thirty ton and above capacity shall be equipped with a voice hailing device (PA system) from the operator to the ground, audible within one hundred feet.

(k) Limit switch bypass systems shall be secured during all cargo operations. Such bypass systems shall not be used except in an emergency or during noncargo handling operations such as stowing cranes or derricks or performing

repairs. When a situation requiring the use of a bypass system or the readjustment of a limit switch arises, it shall be done only under the direction of a crane mechanic.

(l) Cranes and crane operations—Scope and application. The sections of this chapter, WAC 296-56-60083 through 296-56-60099, apply to cranes, derricks, and crane operations.

(m) Signal persons. A signal person shall be required when a crane operator's visibility is obstructed. When a signal person is required to transmit hand signals, they shall be in such a position that the operator can plainly see the signals.

(n) Signals. All operators and signal persons shall use standard signals as illustrated for longshore crane operations. (See Appendices C and D, at the end of this chapter.)

(o) Signal person for power units. Where power units, such as cranes and winches are utilized and signaling is required, the operator shall be instructed as to who is authorized to give signals. The operator shall take signals only from such authorized person. In case of emergency, any worker shall be authorized to give a stop signal.

(i) No draft shall be hoisted unless the winch or crane operator can clearly see the draft itself or see the signals of any signal person associated with the operation.

(ii) Loads requiring continuous manual guidance while in motion shall be provided with tag lines.

(p) Landing loads. Persons assisting in landing a load shall face the load and use caution to prevent themselves from getting in a position where they may be caught between the load and a fixed object.

(8) Stabilizing of locomotive cranes. Loads may be hoisted by locomotive cranes only if outriggers are in place, unless means are taken to prevent the load being carried by the truck springs of the crane.

(9) Operations.

(a) Use of cranes together. When two or more cranes hoist a load in unison, a designated person shall direct the operation and instruct personnel in positioning, rigging of the load and movements to be made.

(b) Guarding of swing radius. Accessible areas within the swing radius of the body of a revolving crane shall be physically guarded during operations to prevent an employee from being caught between the body of the crane and any fixed structure or between parts of the crane.

(c) Securing mobile crane components in transit. The crane's superstructure and boom shall be secured against rotation and carried in line with the direction of travel except when negotiating turns with an operator in the cab or when the boom is supported on a dolly. The empty hook or other attachment shall be secured.

(d) Unattended cranes. The following steps shall be taken before leaving a crane unattended between work periods:

(i) Suspended loads, such as those hoisted by lifting magnets or clamshell buckets, shall be landed unless the storage position or maximum hoisting of the suspended device will provide equivalent safety;

(ii) Clutches shall be disengaged;

(iii) The power supply shall be shut off;

(iv) The crane shall be secured against accidental travel; and

(v) The boom shall be lowered or secured against movement.

(e) Operating near electric power lines.

(i) Clearance. Unless electrical distribution and transmission lines are deenergized and visibly grounded at point of work, or unless insulating barriers not a part of or an attachment to the crane have been erected to prevent physical contact with lines, cranes may be operated near power lines only in accordance with following:

(A) For lines rated 50 kV or below, minimum clearance between the lines and any part of the crane or load shall be ten feet (3 m);

(B) For lines rated over 50 kV, minimum clearance between the lines and any part of the crane or load shall be either 10 feet (3 m) plus 0.4 inch (10 mm) for each 1 kV over 50 kV, or twice the length of the line insulator, but never less than ten feet; and

(C) In transit with no load and boom lowered, the clearance shall be a minimum of four feet (1.2 m).

(ii) Boom guards. Cage-type boom guards, insulating links or proximity warning devices may be used on cranes, but they shall not be used in place of the clearances required by subsection (9)(e)(i) of this section.

(iii) Determination of energized lines. Any overhead line shall be presumed to be energized until the owner of the line indicates that it is not energized.

(10) Protection for employees being hoisted.

(a) No employee shall be hoisted by the load hoisting apparatus of a crane or derrick except:

(i) On intermodal container spreaders, equipped in accordance with this subsection; or

(ii) In a boatswain's chair or other device rigged to prevent it from accidental disengagement from the hook or supporting member; or

(iii) On a platform meeting the following requirements:

(A) Enclosed by a railing or other means providing protection equivalent to that described in WAC 296-56-60123(3). If equipped with open railings, the platform shall be fitted with toe boards;

(B) Having a safety factor of four based on ultimate strength;

(C) Bearing a plate or permanent marking indicating maximum load rating, which shall not be exceeded, and the weight of the platform itself;

(D) Equipped with a device to prevent access doors, when used, from opening accidentally;

(E) Equipped with overhead protection for employees on the platform if they are exposed to falling objects or overhead hazards;

(F) Secured to the load line by means other than wedge and socket attachments, unless the free (bitter) end of the line is secured back to itself by a clamp placed as close above the wedge as possible.

(b) Except in an emergency, the hoisting mechanism of all overhead and container gantry cranes used to hoist personnel shall operate in power up and power down, with automatic brake application when not hoisting or lowering.

(c) Variable radius booms of a crane or derrick used to hoist personnel shall be so constructed or secured as to prevent accidental boom movement.

(d) Platforms or devices used to hoist employees shall be inspected for defects before each day's use and shall be removed from service if defective.

(e) Employees being hoisted shall remain in continuous sight of and communication with the operator or signal person.

(f) Operators shall remain at the controls when employees are hoisted.

(g) Cranes shall not travel while employees are hoisted, except in emergency or in normal tier to tier transfer of employees during container operations.

(h) When intermodal container spreaders are used to transfer employees to or from the tops of containers, the spreaders shall be equipped with a personnel platform equipped with fixed railings, provided that the railings have one or more openings for access. The openings shall be fitted with a means of closure, such as chains with hooks. Existing railings shall be at least thirty-six inches (0.91 m) in height. New railings installed after October 3, 1983 shall be forty-two inches (1.07 m), plus or minus three inches (7.6 cm), in height. The provisions of (a)(iii)(C), (D), and (F) of this subsection also apply to personnel platforms when container spreaders are used.

(i) Positive safety latch-type hooks or moused hooks shall be used.

(j) Employees shall not be hoisted on intermodal container spreaders while a load is engaged.

Additional requirements are located in WAC 296-24-23533.

(11) Routine inspection.

(a) Designated persons shall visually inspect each crane and derrick on each day of use for defects in functional operating components and shall report any defect found to the employer. The employer shall inform the operator of the findings.

(b) A designated person shall thoroughly inspect all functional components and accessible structural features of each crane or device at monthly intervals.

(c) Any defects found during such inspections which may create a safety hazard shall be corrected before further use. Repairs shall be performed only by designated persons.

(d) A record of monthly inspections shall be maintained for six months in or on the crane or derrick or at the terminal.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60083, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-56-60083, filed 1/18/95, effective 3/1/95. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60083, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60083, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60083, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60083, filed 12/11/84.]

WAC 296-56-60085 Crane load and limit devices. (1)

Except as provided in subsection (8) of this section, every crane shall be fitted with a load indicating device or alternative device in proper working condition.

The type or model or any load indicating or alternate device which is used shall provide:

(a) A direct indication in the cab of actual weight hoisted or a means of determining this by referencing a weight indi-

cation to crane ratings posted and visible to the operator. The use of a dynamometer or simple scale alone shall not meet this requirement; or

(b) Indications in the cab according to the radius and load at the moment; or

(c) A direct means to prevent an overload from occurring.

(2) Accuracy of the devices required by this section shall be such that any indicated load (or limit), including the sum of actual weight hoisted and additional equipment or "add ons" such as slings, sensors, blocks, etc., is within the range from no less than ninety-five percent of the actual true total load (five percent overload) to one hundred ten percent of the actual true total load (ten percent underload). Such accuracy shall be required over the range of the daily operating variables to be expected under the conditions of use.

(3) The device shall permit the operator to determine, before making any lift, that the indicating or substitute system is operative. In the alternative, if a device is so mounted or attached to preclude such a determination, it may not be used unless it has been certified by the manufacturer to remain operable within the limits stated in subsection (2) of this section for a specific period of use. Checks for accuracy, using known values of load, shall be performed at the time of every certification survey (see WAC 296-56-60093) and at such additional times as may be recommended by the manufacturer.

(4) When a load indicating device or alternative system is so arranged in the supporting system (crane structure) that its failure could cause the load to be dropped, its strength shall not be the limiting factor of the supporting system (crane structure).

(5) Marking shall be conspicuously placed giving: Units of measure in pounds or both pounds and kilograms, capacity of the indicating system, accuracy of the indicating system, and operating instructions and precautions. In the case of systems utilizing indications other than actual weights, the marking shall include data on: The means of measurement, capacity of the system, accuracy of the system, operating instructions and precautions. If the system used provides no readout, but it is such as to automatically cease crane operation when the rated load limit under any specific condition of use is reached, marking shall be provided giving the make and model of the device installed, a description of what it does, how it is operated, and any necessary precautions regarding the system. All weight indications, other types of loading indications, and other data required shall be readily visible to the operator.

(6) All load indicating devices shall be operative over the full operating radius. Overall accuracy shall be based on actual applied load and not on full scale (full capacity) load.

Explanatory note. For example, if accuracy of the load indicating device is based on full scale load and the device is arbitrarily set at plus or minus ten percent, it would accept a reading between ninety thousand and one hundred ten thousand pounds, at full capacity of a machine with one hundred thousand pounds, maximum rating, but would also allow a reading between zero and twenty thousand pounds, at that outreach (radius) at which the rating would be ten thousand pounds capacity—an unacceptable figure. If, however, accu-

racy is based on actual applied load under the same conditions, the acceptable range would remain the same with the one hundred thousand pound load but becomes a figure between nine thousand and eleven thousand pounds, a much different and acceptable condition, at the ten thousand pound load.

(7) When the device uses the radius as a factor in its use or in its operating indications, the indicated radius (which may be in feet and/or meters, or degrees of boom angle, depending on the system used) shall be a figure which is within the range of a figure no greater than one hundred ten percent of the actual radius to a figure which is no less than ninety-seven percent of the actual (true) radius. A conversion chart shall be provided whenever it is necessary to convert between degrees of radius and feet or meters.

(8) The load indicating device requirements of this section do not apply to a crane:

(a) Of trolley equipped bridge type while handling container known to be and identified as empty, or loaded, and in either case in compliance with the provisions of WAC 296-56-60103, or while hoisting other lifts by means of a lifting beam supplied by the crane manufacturer for the purpose, and in all cases within the crane rating;

(b) While handling bulk commodities or cargoes by means of clamshell bucket or magnet;

(c) While used to handle or hold hoses in connection with transfer of bulk liquids or other hose handled products; or

(d) While the crane is used exclusively to handle cargo or equipment the total actual gross weight of which is known by means of marking of the unit or units hoisted, when such total actual gross weight never exceeds eleven thousand two hundred pounds, and when eleven thousand two hundred pounds, is less than the rated capacity of the crane at the maximum outreach that is possible under the conditions of use at the time.

(9) Limit switches shall be installed on the main line and whip line assemblies, of all cranes and derricks, which will deactivate the hoisting power when a load reaches the upper limits of travel and at such other places as required by this chapter. Line limit switches shall be tested prior to or at the beginning of each shift to determine if they are functioning properly. Any malfunction shall be reported to the person in charge immediately and shall be repaired prior to use.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60085, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60085, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60085, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60085, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60085, filed 12/11/84.]

WAC 296-56-60087 Winches. (1) Moving winch parts which present hazards to employees shall be guarded.

(2) Winches shall have clearly identifiable and readily accessible stop controls.

(3) Portable winches shall be secured against accidental shifting while in use.

(4) Portable winches shall be fitted with limit switches if employees have access to areas from which it is possible to be drawn into the winch.

(5) The provisions of WAC 296-56-60083 (6)(l) apply to winches.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60087, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60087, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60087, filed 12/11/84.]

WAC 296-56-60089 Conveyors. (1) Guards.

(a) Danger zones at or adjacent to conveyors shall be guarded to protect employees.

(b) An elevated walkway with guardrail or equivalent means of protection shall be provided where employees cross over moving conveyors. Suitable guarding shall be provided when employees pass under moving conveyors.

(2) Moving parts. Conveyor rollers and wheels shall be secured in position.

(3) Positioning. Gravity conveyor sections shall be firmly placed and secured to prevent them from falling.

(4) Braking.

(a) When necessary for safe operation, provisions shall be made for braking objects at the delivery end of the conveyor.

(b) Conveyors using electrically released brakes shall be constructed so that the brakes cannot be released until power is applied, and the brakes are automatically engaged if the power fails or the operating control is returned to the "stop" position.

(5) Stability. Portable conveyors shall be stable within their operating ranges. When used at variable fixed levels, the unit shall be secured at the operating level.

(6) Emergency stop devices. Readily accessible stop controls shall be provided for use in an emergency whenever employees are required to walk or work in the vicinity of the conveyor. The emergency stop device shall be available within easy reach from any position on or adjacent to the conveyor.

(7) Starting powered conveyors. Powered conveyors shall not be started until all employees are clear of the conveyor or have been warned that the conveyor is about to start.

(8) Loading and unloading. The area around conveyor loading and unloading points shall be kept clear of obstructions during conveyor operations.

(9) Lockout/tagout.

(a) Conveyors shall be stopped and their power sources locked out and tagged out during maintenance, repair, and servicing, unless power is necessary for testing.

(b) The starting device shall be locked out and tagged out in the stop position before an attempt is made to remove the cause of a jam or overload of the conveying medium, unless it is necessary to have the power on to remove the jam.

(10) Chutes, gravity conveyors and rollers.

(a) Chutes used in the manual handling of cargo shall be adequate for the use to which they are put and shall be kept free of splinters and sharp edges.

(b) Chutes shall be equipped with sideboards of sufficient height to prevent cargo from falling off.

(c) Chutes and gravity roller sections shall be firmly placed or secured to prevent displacement.

(d) Gravity rollers shall be of sufficient strength for the weight of material which is placed upon them. Rollers shall

be locked in position to prevent them from falling or jumping out of the frame.

(e) Frames shall be kept free of burrs and sharp edges.

(f) When necessary, provision shall be made for braking objects at the delivery end of the roller or chute.

(11) Safe practices.

(a) Only designated persons shall operate, repair or service powered conveyors.

(b) The employer shall direct employees to stay off operating conveyors.

(c) Conveyors shall be operated only with all overload devices, guards and safety devices in place and functional.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60089, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60089, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60089, filed 12/11/84.]

WAC 296-56-60091 Spouts, chutes, hoppers, bins, and associated equipment. (1) Standing and running rigging and associated gear used as a permanent part of spouts, chutes or similar devices shall be inspected before each use and shall not be used if it has any functional defects. (See WAC 296-56-60093 for certification requirements.)

(2) Direct communication shall be provided between the discharge or shipboard control end of loading spouts or chutes, and the point in the terminal from which the flow of cargo is controlled.

(3) Chute and hopper openings which present a hazard shall be guarded to prevent employees from falling through.

(4) When employees are working on hoppers, the hopper shall be equipped with a safe walkway and safe means of access.

(5) When necessary for the safety of employees, chutes shall be equipped with sideboards to afford protection from falling objects.

(6) Chutes shall be firmly placed and secured to prevent them from falling.

(7) When necessary for the safety of employees, provisions shall be made for braking objects other than bulk commodities at the delivery end of the chute.

(8) Before an employee enters an empty bin:

(a) Personnel controlling the flow of cargo into the bin shall be notified of the entry; and

(b) The power supply to the equipment carrying the cargo to the bin shall be turned off, locked out and tagged.

(9) Before an employee enters a bin containing a bulk commodity such as coal or sugar, the employer shall ensure that:

(a) Personnel controlling the flow of cargo into the bin shall be notified of the entry;

(b) The power supply to the equipment carrying the cargo to the bin shall be turned off, locked out and tagged;

(c) The employee entering the bin shall wear a life-line and safety harness; and

(d) A standby attendant equipped to perform a rescue shall be continuously stationed outside the bin until the employee has left the bin.

(10) Bin top openings that present a hazard to employees shall be covered to prevent employees from falling into bins.

(11) Chutes and hoppers shall be repaired only by designated persons.

(12)(a) Before power shoveling operations begin, a designated person shall inspect the equipment to be used. The inspection shall include at least the eye bolts, wires, and sheaves.

(b) Power shovels and associated equipment with defects affecting safe operation shall not be used.

(c) Before adjustments are made to a power shovel, wire, or associated equipment, the power supply to the shovel shall be turned off, locked out, and tagged, the belt stopped, and the hopper closed.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60091, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60091, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60091, filed 12/11/84.]

WAC 296-56-60093 Certification of marine terminal material handling devices. (1) The employer shall not use any material handling device listed in WAC 296-56-60098(8) until he/she has ascertained that the device has been certified, as evidenced by current and valid documents attesting to compliance with the requirements of WAC 296-56-60097 and 296-56-60098.

(2) Certification surveys are to be completed for the conditions of use found at the time such surveys are performed. Equipment owners or users may change the configurations of the equipment according to the manufacturer's specifications without affecting the established certification status for the equipment.

(3) These rules apply to employment within a marine terminal including the loading, unloading, movement, or other handling of cargo, ship's stores, or gear within the terminal or into or out of any land carrier, holding or consolidation area, or any other activity within and associated with the overall operation and functions of the terminal, such as the use and routine maintenance of facilities and equipment.

(4) Inspection and test certificates shall be issued only for that equipment which meets or exceeds the requirements specified in these rules. All inspection and test certificates shall be issued through the office of the assistant director of the division of consultation and compliance, department of labor and industries, and shall be valid for a period not to exceed one year from the date of issuance.

(5) Equipment requiring certification shall be inspected by individuals who have received a "certificate of competency" from the assistant director, division of WISHA services indicating that they are qualified and capable of performing such work.

(6) When deficiencies are found they shall be noted on forms provided for such purpose by the division of consultation and compliance. Copies shall be delivered to the owner of the equipment and the division of consultation and compliance at the headquarter's office by the person conducting such tests or inspections.

(7) A certificate of unit test or examination of equipment shall not be issued for any equipment found not to be in compliance with the provisions of this chapter.

(8) Persons desiring a "certificate of competency" shall demonstrate and document their capabilities and qualifica-

tions to the assistant director of the division of consultation and compliance, who will issue certificates to those persons who have demonstrated competency. The assistant director reserves the right to revoke such certificates at any time for cause. A "certificate of competency" shall be issued for a period of not more than three years. Applications for renewal may be made not more than sixty days prior to the expiration date shown on the certificate.

(9) The assistant director of the division of consultation and compliance or his/her representative, reserves the right to inspect such equipment or to witness or attend any test or inspection in order to ascertain the adequacy of any certification activity performed.

(10) Unless otherwise exempted, all cranes or derricks required to be certificated by these regulations shall have a current test certificate posted in the operator's cab or station. No person shall operate such crane or derrick unless a current valid certificate is posted.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60093, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60093, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60093, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60093, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60093, filed 12/11/84.]

WAC 296-56-60095 Advisory crane certification panel. (1) Any person desiring a certificate of competency for crane inspection or certification shall make application to the assistant director of the division of consultation and compliance for the certificate of competency. The application shall include documentation of all qualifications, including all past experience, education, training and any other factors deemed to be relevant to the application.

(2) The advisory crane certification panel shall assist the assistant director of the division of consultation and compliance in his/her duties under this chapter. The panel shall consist of six members. Two members shall represent labor, two members shall represent management, and one member shall be a crane expert. The sixth member shall be chair of the panel. He/she shall be the assistant director of consultation and compliance or his/her designee. The panel shall be responsible for advising the assistant director as to the issuance of any certificate of competency. The panel shall review all applications for certificates of competency. Minutes of meetings shall be kept.

(3) In addition, the panel shall, upon request by the assistant director, render advice concerning any matter which is relevant to crane safety. The panel shall meet twice yearly or more often as deemed necessary by the chairman of the panel. Any panel member who is not an employee of the state of Washington shall serve voluntarily.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60095, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60095, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60095, filed 12/11/84.]

WAC 296-56-60097 Unit proof load test and inspection. Cranes and derricks shall be proof load tested, rated and certified in tons (2,000 lbs. = 1 ton). Cranes and derricks shall be inspected and unit proof load tested prior to being put into use, after any significant modification or repairs of structural

parts, or when deemed necessary by the assistant director of consultation and compliance or his/her designee. However, each crane or derrick shall be unit proof load tested at least once during each twelve-month period. Unit proof load tests shall be carried out by the use of weights as a dead load. When use of weights for unit proof load tests is not possible or reasonable a dynamometer or other recording test equipment may be used. Such equipment shall be tested for accuracy with certified calibrating equipment within twelve months prior to being used and a copy of the certified calibration test shall be made available to authorized representatives of the division of consultation and compliance upon request.

The weight of the objects used for a dead load weight test shall be certified and a record of the weight shall be made available upon request. Any replacements or repairs deemed necessary by the person conducting a test shall be carried out before application of the required proof load unit test.

(1) The proof load tests for derricks shall be conducted as follows:

Safe Working Load	Proof Load
to 20 tons	25% in excess
20-50 tons	5 tons in excess
over 50 tons	10% in excess of manufacturer's recommended lifting capacity.

Proof load shall be applied at the designed maximum and minimum boom angles or radii, or if this is impractical, as close to these as practical. The angles or radii of test shall be stated in the certificate of test. Proof loads shall be swung as far as possible in all directions. The weight of auxiliary handling devices such as spreader bars, robots, clams, magnets, or other gear shall be considered a part of the load. Brakes shall be tested by holding the proof load suspended without other mechanical assistance. After satisfactory completion of a unit proof load test the derrick and all component parts thereof shall be carefully examined and nondestructive tests may be conducted to assure that the equipment is safe for use and has not been damaged in the unit proof load testing process.

(2) Unit proof load tests for cranes shall be carried out with the boom in the least stable direction relative to the mounting, based on the manufacturer's specifications.

Unit proof load tests for cranes shall be based on the manufacturer's load ratings for the conditions of use and shall, except in the case of bridge type cranes utilizing a trolley, consist of application of a proof load of ten percent in excess of the load ratings at maximum and minimum radius, and at such intermediate radii as the certifying authority may deem necessary in the circumstances. (The manufacturer's load ratings are usually based upon percentage of tipping loads under some conditions and upon limitations of structural competence at others, as well as on other criteria such as type of crane mounting, whether or not outriggers are used, etc. Some cranes utilizing a trolley may have only one load rating assigned and applicable at any outreach. It is important that the manufacturer's ratings be used.) Trolley equipped cranes shall be subject to a proof load of twenty-five percent in excess of the manufacturer's load rating. In cases of foreign manufacture, the manufacturer's specifications shall be subject to approval by the certifying authority. The weight of all

auxiliary handling devices such as magnets, hooks, slings, and clamshell buckets shall be considered part of the load.

(3) If the operation in which equipment is engaged never utilizes more than a fraction of the safe working load rating, the owner of the equipment may, at his/her option, have the crane or derrick certified for and operated at a lesser maximum safe working load in keeping with the use and based on radius and other pertinent factors, however, the equipment concerned shall be physically capable of operation at the original load rating and the load reduction shall not be for the purpose of avoiding correction of any deficiency.

(4) Safe working load ratings shall not be increased beyond the manufacturer's ratings or original design limitations without prior approval by the accredited certification agency. Such prior approval shall be based on the manufacturer's approval of such increase or documented engineering design analysis or both. All necessary structural changes shall be completed prior to approval by the accredited certification agency.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60097, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-56-60097, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60097, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60097, filed 12/11/84.]

WAC 296-56-60098 Examination and inspection of cranes and derricks. (1) An examination shall be carried out in conjunction with each annual unit proof load test. The accredited person, or their authorized representative, shall make a determination as to correction of deficiencies found. The examination shall include the following: (Refer to WAC 296-56-60093(8) for definition of accredited person.)

(a) All functional operating mechanisms shall be examined for improper function, maladjustment, and excessive component wear, with particular attention to sheaves, pins, and drums. The examinations shall include operation with partial load, in which all functions and movements, including maximum possible rotation in both directions, are checked.

(b) All safety devices shall be examined for malfunction.

(c) Lines, tanks, valves, drains, pumps, and other parts of air or hydraulic systems shall be examined for deterioration or leakage.

(d) Rope reeving shall comply with the manufacturer's recommendations.

(e) Deformed, cracked, or excessively corroded members in crane structure and boom shall be repaired or replaced as necessary.

(f) Loose bolts, rivets, or other connections shall be corrected.

(g) Worn, cracked, or distorted parts affecting safe operation shall be corrected.

(h) All brakes, used to control the load, boom or travel of the crane, shall be tested. Air, hydraulic, or electrically operated brakes shall be of such design as to set and stop the load if the source of power fails.

(i) Brake and clutch system parts, linings, pawls, and ratchets shall be examined for excessive wear and free operation.

(j) Load, boom angle, or other indicators shall be checked over their full range. Defects in such indicators shall be immediately corrected.

(k) Where used, clamshell buckets or other similar equipment, such as magnets, shall be carefully examined in all respects, with particular attention to closing line wires and sheaves. The accredited person may supplement such examination by requesting any operational tests deemed appropriate.

(l) Careful examination of the junction areas of removable boom sections, particularly for proper seating, cracks, deformities, or other defects in securing bolts and in the vicinity of such bolts, shall be made.

(m) All platforms, steps and footwalks located on cranes where workers are exposed to the hazard of slipping shall be of a nonslip material. Wire rope used for railings on cranes shall be kept taut at all times.

Note: In critical areas such as footwalks along booms, a grating material should be used.

(n) No counterweights in excess weight of the manufacturer's specifications shall be fitted or used.

(o) Such other examination or supplemental functional tests shall be made as may be deemed necessary by the accredited person under the circumstances.

(2) Wire rope.

(a) All wire rope shall be inspected at least once a month, dependent upon conditions to which the wire ropes are subjected, and at intervals not exceeding a twelve-month period. Records of inspection of wire rope shall be kept and shall be available to the department of labor and industries representative. Records shall be kept for one year. Refer to the general safety and health standards, WAC 296-24-24013.

(b) Wire rope shall not be used if in any length of eight diameters, the total number of visible broken wires exceeds ten percent of the total number of wires, or if the rope shows other signs of excessive wear, corrosion, or defect. Particular attention shall be given to the condition of those sections of wire rope adjacent to any terminal connections, those sections exposed to abnormal wear, and those sections not normally exposed for examination.

(c) Documentation available for inspection shall include wire rope test certificates relating to any replacements made since the last unit test or annual examination as required.

(d) Wire rope and replacement wire rope shall be of the same size, same or better grade, and same construction as originally furnished by the equipment manufacturer or contemplated in the design, unless otherwise recommended by the equipment or wire rope manufacturer due to actual working conditions. In the absence of specific requirements, wire rope shall be of a size and construction suitable for the purpose, and shall have the capacity to handle five times the heaviest expected load, verified by wire rope test certificate.

(e) Wire rope in use on equipment previously constructed and prior to initial certification of said equipment shall not be required to be tested but shall be subject to thorough examination at the time of initial certification of the equipment.

(3)(a) Accessory components. Container spreader bar twist locks shall be carefully examined periodically and at the time of annual examination and inspection. Cracked or deformed hooks shall be discarded immediately and not reused.

(b) Crane hooks and container spreader bar twist lock. Magnetic particle or other suitable crack detecting inspection shall be performed at least once each year. When testing by x-ray, the pertinent provisions of the Nuclear Regulatory Commission's standards for protection against radiation, relating to protection against occupational radiation exposure, shall apply.

(4) In the event that heat treatment of any loose gear is recommended by the manufacturer, the latest heat treatment certificate attesting to compliance with the manufacturer's specifications shall be part of the available documentation. Heat treatment shall be carried out in accordance with the specifications of the manufacturer by persons competent to perform such work.

(5) Replacement parts shall be of equal or better quality than the original equipment and suitable for the purpose. Repairs or modifications shall be such as to render the equipment equal to or better than the original construction or design.

(6) In cases of foreign manufactured cranes, there shall be an owner's warranty that the design is adequate for the intended use. The warranty shall be based on a thorough examination of the design specifications by a registered professional engineer familiar with the equipment.

(7) The certifications required by this section shall be performed in accordance with WAC 296-56-60093 by persons accredited by the assistant director of WISHA services.

(8) The marine terminal material handling devices listed below shall be certified in the following manner:

(a) Each crane and derrick shall be tested and examined as a unit annually. A copy of the certificate of tests and examinations shall be posted in the crane operator's cab.

(b) Bulk cargo spouts and suckers, together with any portable extensions and rigging or outriggers supporting them vertically, shall be examined annually. Certificates attesting to the required examination shall be made readily available for inspection.

(c) Vertical pocket or bucket conveyors such as banana, sugar, and grain marine legs (other than those within a grain elevator structure) used within a marine terminal facility shall be examined annually. The annual examination shall include all supporting structures, rigging, mechanical components and observation of all steps of operations. Certificates attesting to the required examinations shall be readily available for inspection.

(d)(i) House fall cargo-handling gear shall be proof load tested as a unit upon initial certification and every fourth year thereafter. An examination shall be carried out in conjunction with each unit proof load test and annually thereafter. The unit test shall consist of a proof load of twenty-five percent in excess of the rated safe working load. Examinations shall include all supporting structures and components. Certificates attesting to the required tests and examinations shall be readily available for inspection.

(ii) House fall span beams or other house fall block supports shall be marked with the safe working load, which shall not be exceeded.

(e) Special gear.

(i) Special stevedoring gear provided by the employer, the strength of which depends upon components other than

commonly used stock items such as shackles, ropes or chains, shall be tested as a unit in accordance with the following table before initially being put into use.

Table A	
Safe Working Load	Proof Load
Up to 20 short tons	25 percent in excess
Over 20 to 50 short tons	5 short tons in excess
Over 50 short tons	10 percent in excess

(ii) Special stevedoring gear provided by the employer that has a SWL of five short tons (10,000 or 4.5 metric tons) or less shall be inspected and tested as a unit before initial use according to (d) and (e) of this subsection or by a designated person (see Table A).

(iii) Every spreader not a part of ship's gear and used for hoisting intermodal containers shall be tested to a proof load equal to twenty-five percent in excess of its rated capacity. Additionally, any spreader which suffers damage necessitating structural repair shall be retested after repair and before being returned to service.

(iv) Certificates attesting to the required tests shall be available for inspection.

(v) All cargo handling gear covered by this section with a SWL greater than five short tons (10,000 lbs. or 4.5 metric tons) shall be proof load tested according to Table A every four years in accordance with subsection (7) of this section or by a designated person.

(f) Wire rope and loose gear used for material handling shall be tested and certified before being placed into use in accordance with the provisions of WAC 296-56-60097. Certificates attesting to the required tests, inspections and examinations shall be available.

(9) Disassembly and reassembly of equipment does not require recertification of the equipment provided that the equipment is reassembled and used in a manner consistent with its certification.

(10) Equipment certified in Washington and transferred to a site in another state does not require recertification in this state upon its return, until the next inspection or examination becomes due as if it had not been moved.

(11) Certification procedures shall not be construed as a substitute for, or cause for elimination of, normal operational inspection and maintenance routine throughout the year.

(12)(a) Every unit of equipment requiring annual certification shall have had such annual certification within the previous twelve months. Equipment requiring annual certification shall have had such annual certification within the previous twelve months, except that no annual certification is required within twelve months after any required certification. Annual examinations for certification may be accomplished up to one month early without effect on subsequent due dates.

(b) When certified equipment is out of service for six months or more beyond the due date of a certification inspection, an examination equivalent to an initial certification, including unit proof load test, shall be performed before the equipment re-enters service.

(13) Loose gear shall bear a legible mark indicating that it has been tested (see WAC 296-56-60097). Single sheave

blocks shall be marked with safe working loads and proof test loads. Marks relating to testing shall be identifiable on the related certificates, which shall be available.

(14) The certification requirements of this section do not apply to the following equipment:

(a) Industrial trucks and small industrial crane trucks; and

(b) Any straddle truck not capable of straddling two or more intermodal containers sixteen feet (4.88 m) in width.

(15) Safe working load.

(a) The safe working load of gear as specified in this section shall not be exceeded.

(b) All cargo handling gear provided by the employer with a safe working load greater than five short tons (10,000 lbs. or 4.5 metric tons) shall have its safe working load plainly marked on it.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60098, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-56-60098, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60098, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60098, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60098, filed 12/11/84.]

WAC 296-56-60099 Hand tools. (1) Hand tools used by employees shall be maintained in safe operating condition.

(2)(a) Hand-held portable electric tools shall be equipped with switches that must be manually held in a closed position to operate the tool.

(b) Portable power-driven circular saws shall be equipped with guards above and below the base plate or shoe. The upper guard shall cover the saw to the depth of the teeth, except for the minimum arc needed to permit the base to be tilted for bevel cuts. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc needed to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard shall automatically and instantly return to the covering position.

(3) Only cutting tools shall be used to cut metal strapping or banding used to secure cargo.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-56-60099, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60099, filed 12/11/84.]

PART F—SPECIALIZED TERMINALS

WAC 296-56-60101 General. The provisions of this part apply to specialized terminals.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60101, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60101, filed 12/11/84.]

WAC 296-56-60103 Terminals handling intermodal containers or roll-on roll-off operations. (1) Every intermodal container shall be legibly and permanently marked with:

(a) The weight of the container when empty, in pounds;
 (b) The maximum cargo weight the container is designed to carry, in pounds; and

(c) The sum of the maximum weight of the container with cargo, in pounds (gross container capacity).

(2) No container shall be hoisted by any crane or derrick unless the following conditions have been met:

(a) The employer shall ascertain from the carrier whether a container to be hoisted is loaded or empty. Empty containers shall be identified before loading or discharge in such a manner as will inform every supervisor and foreman on the site and in charge of loading or discharging, and every crane or other hoisting equipment operator and signalman, if any, that the container is empty. Methods of identification may include cargo plans, manifests or markings on the container.

(b) In the case of a loaded container:

(i) The actual gross weight shall be plainly marked so as to be visible to the crane operator, other hoisting equipment operator, signalman, and to every supervisor and foreman on the site and in charge of the operation; or

(ii) The cargo stowage plan or equivalent permanently recorded display serving the same purpose, containing the actual gross weight and the serial number or other positive identification of that specific container, shall be provided to the crane or other hoisting equipment operator and signalman, if any, and to every supervisor and foreman on the site and in charge of the operation.

(c) Every outbound loaded container which is received at a marine terminal ready to load aboard a vessel without further consolidation or loading shall be weighed to obtain the actual gross weight before being hoisted.

(d)(i) When container weighing scales are located at a marine terminal, any outbound container with a load consolidated at that terminal shall be weighed to obtain an actual weight before being hoisted.

(ii) If the terminal has no scales, the actual gross weight may be calculated on the basis of the container's contents and the container's empty weight. The weights used in the calculation shall be posted conspicuously on the container, with the name of the person making the calculation and the date.

(iii) Container weights shall be subject to random sample weight checks at the nearest weighing facility. In cases where such weight checks or experience otherwise indicate consistently inaccurate weights, the weight of containers so calculated at the source from which the inaccurate weights originated shall no longer be recognized as true gross weights. Such containers shall not be hoisted unless actual gross weights have been obtained by weighing.

(e) The following containers are exempted from the requirements of (c) and (d) of this subsection:

(i) Open type vehicle containers.

(ii) The container is marked on the outside in such a manner that an employee can readily discern that the container is carrying vehicles.

(iii) Containers built specifically for the carriage of compressed gases.

(iv) The container carries only completely assembled vehicles and no other cargo.

(v) The vehicles were loaded into the container at the marine terminal.

(f) The weight of loaded inbound containers from foreign ports shall be determined by weighing or by the method of calculation described in (d)(ii) of this subsection or by shipping documents.

(g) Any scale used within Washington state to weigh containers for the purpose of the requirements of this section shall meet the accuracy standards of the state or local public authority in which the scale is located.

(3) No container shall be hoisted if its actual gross weight exceeds the weight marked as required in subsection (1)(c) of this section, or if it exceeds the capacity of the crane or other hoisting device intended to be used.

(4)(a) Marked or designated areas shall be set aside within a container or roll-on roll-off terminal for passage of employees to and from active cargo transfer points, except where transportation to and from those points is provided by the employer.

(b) The employer shall direct employees to stay clear of the area beneath a suspended container. Employees shall stay clear of the area beneath a suspended container.

(5) Each employee working in the immediate area of container handling equipment or in the terminal's traffic lanes shall wear a high visibility vest (or equivalent protection).

Note to subsection (5): High visibility vests or equivalent protection means high visibility/retroreflective materials which are intended to provide conspicuity of the user by day through the use of high visibility (fluorescent) material and in the dark by vehicle headlights through the use of retroreflective material. The minimum area of material for a vest or equivalent protection is .5m(2)(760 in.(2)) for fluorescent (background) material and .13m(2)(197 in.(2)) for retroreflective material.

(6) Containers shall be handled using lifting fittings or other arrangements suitable and intended for the purposes as set forth in (a) and (c) of this subsection, except when damage to an intermodal container makes special means of handling necessary.

(a) Loaded intermodal containers of twenty feet (6.1 m) or more in length shall be hoisted as follows:

(i) When hoisting by the top fittings, the lifting forces shall be applied vertically from at least four top fittings or by means which will safely lift the container without damage. The lifting fittings provided shall be used.

(A) The container being lifted is an ISO closed box container;

(B) The condition of the box is sound;

(C) The speed of hoisting and lowering is moderated when heavily laden containers are encountered;

(D) The lift angle is at eighty to ninety degrees;

(E) The distance between the lifting beam and the load is at least eight feet and 2.4 inches (2.5m); and

(F) The length of the spreader beam is at least 16.3 feet (5 m) for a twenty-foot container, and at least 36.4 feet (11 m) for a forty-foot container.

(ii) If hoisted from bottom fittings, the hoisting connections shall bear on the fittings only, making no other contact with the container. The angles of the four bridle legs shall not be less than thirty degrees to the horizontal in the case of forty foot (12.2 m) containers, thirty-seven degrees in the case of thirty foot (9.1 m) containers, or forty-five degrees in the case of twenty foot (6.1 m) containers.

(iii) Lifting containers by fork lift trucks or by grappling arms from above or from one side may be done only if the container is designed for this type of handling.

(b) Other means of hoisting may be used only if the containers and hoisting means are designed for such use.

(c)(i) When using intermodal container spreaders that employ lanyards for activation of load-disengagement, all possible precautions shall be taken to prevent accidental release of the load.

(ii) Intermodal container spreader twistlock systems shall be designed and used so that a suspended load cannot accidentally be released.

(d) Flat bed trucks or container chassis used to move intermodal containers shall be equipped with pins, flanges, or other means to prevent the container from shifting.

(e) Flat bed, low boy trailers (mafis) and other similar equipment used to transport containers shall be marked with their cargo capacities and shall not be overloaded.

(f) Each tractor shall have all brake air lines connected when pulling trailers equipped with air brakes and shall have the brakes tested before commencing operations.

(7)(a) Intermodal containers shall be inspected for defects in structural members or fittings before handling.

(b) Any intermodal container found to be unsafe shall be identified as such, promptly removed from service and repaired before being returned to service.

(8) Containers shall not be hoisted unless all engaged chassis twist locks are released.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60103, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60103, filed 10/30/92, effective 12/8/92. Statutory Authority: Chapter 49.17 RCW, 89-11-035 (Order 89-03), § 296-56-60103, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60103, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60103, filed 12/11/84.]

WAC 296-56-60105 Grain elevator terminals.

Reserved.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 85-01-022 (Order 84-24), § 296-56-60105, filed 12/11/84.]

WAC 296-56-60107 Terminal facilities handling menhaden and similar species of fish.

(1)(a) Tanks in terminal areas used for receiving or storing brailwater for recirculating into vessel holds in discharging operations shall be opened or ventilated to minimize contamination of water circulated to the vessel. Brailwater tanks shall be thoroughly drained upon completion of each day's operations and shall be left open to the air. Drainage is unnecessary when brailwater has been treated to remove hydrogen sulfide-producing contaminants and the efficiency of such treatment has been established.

(b) Before employees enter a dock tank, it shall first be drained, rinsed and tested for hydrogen sulfide and oxygen deficiency. Employees shall not enter the tank when the hydrogen sulfide level exceeds twenty ppm or oxygen content is less than nineteen and one-half percent, except in emergencies.

(c) Tests shall be conducted by designated personnel with suitable test equipment and respiratory protective equipment complying with the provisions of this chapter and chapter 296-62 WAC.

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(2) Pipelines and hoses on the dock or terminal used for receiving and circulating used brailwater shall be completely drained upon completion of each day's operation and left open to the air.

(3) At least four units of respiratory protective equipment consisting of supplied-air respirators or self-contained breathing apparatus complying with the requirements of chapter 296-62 WAC shall be available in a suitably labeled cabinet for immediate use in case of an emergency caused by oxygen deficiency or hydrogen sulfide. Any employee entering a tank in an emergency shall, in addition to respiratory protective equipment, wear a lifeline and safety harness to facilitate rescue. At least two other employees, similarly equipped, shall be continuously stationed outside the tank to observe and to provide rescue services.

(4) The plant superintendent and foremen shall be trained and knowledgeable about the hazards of hydrogen sulfide and oxygen deficiency. They shall be trained in the use of appropriate respiratory and other protective equipment, and in rescue procedures. Other supervisory plant personnel shall be informed of these hazards and instructed in the necessary safety measures, including use of respiratory and rescue equipment.

(5) Supervisory personnel shall be on hand at dockside to supervise discharging of brailwater from vessels.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60107, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60107, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60107, filed 12/11/84.]

PART G—PERSONAL PROTECTION

WAC 296-56-60109 Eye protection. (1)(a) When employees perform work hazardous to the eyes, the employer shall provide eye protection equipment marked or labeled as meeting the manufacturing specifications of American National Standards Practice for Occupational and Educational Eye and Face Protection, ANSI Z87.1-1968, and shall direct that it be used.

(b) For employees wearing corrective spectacles, eye protection equipment required by (a) of this subsection shall be of a type which can be worn over spectacles. Prescription ground safety lenses may be substituted if they provide equivalent protection.

(c) For additional requirements covering eye protection against radiant energy, see WAC 296-56-60235(8).

(2) Eye protection equipment shall be maintained in good condition.

(3) Used eye protection equipment shall be cleaned and disinfected before reissuance to another employee.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60109, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60109, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60109, filed 12/11/84.]

WAC 296-56-60110 Respiratory protection. The respiratory protection requirements of the general occupational health standards, chapter 296-62 WAC, apply.

(1999 Ed.)

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60110, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60110, filed 12/11/84.]

WAC 296-56-60111 Head protection. (1) Employees exposed to impact, falling or flying objects, or electric shocks or burns shall wear protective hats.

(2) Protective hats shall bear identifying marks or labels indicating compliance with the manufacturing provisions of American National Standard Safety Requirements for Industrial Head Protection, ANSI Z89.1-1969.

(3) Protective hats previously worn shall be cleaned and disinfected before issuance by the employer to another employee.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60111, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60111, filed 12/11/84.]

WAC 296-56-60113 Foot protection. (1) The employer shall ensure that each affected employee wears protective footwear when working in areas where there is a danger of foot injuries due to falling or rolling objects or objects piercing the sole.

(2) Protective shoes shall bear identifying marks or labels indicating compliance with the manufacturing provisions of American National Standard for Men's Safety Toe Footwear, ANSI Z41.1-1991.

(3) The employer shall, through means such as vendors or local stores, make safety shoes readily available to all employees.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60113, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60113, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60113, filed 12/11/84.]

WAC 296-56-60115 Other protective measures. (1) Protective clothing.

(a) Employees performing work that requires special protective clothing shall be directed by the employer to wear the necessary special protective clothing.

(b) When necessary, protective clothing previously worn shall be cleaned and disinfected before reissuance.

(2) Personal flotation devices.

(a) The employer shall provide, and shall direct the wearing of personal flotation devices for those employees, such as line handlers, who are engaged in work in which they may fall into the water:

(i) When such employees are working in isolation: or

(ii) Where physical limitations of available working space creates a hazard of falling into the water; or

(iii) Where the work area is obstructed by cargo or other obstacles so as to prevent employees from obtaining safe footing for their work.

(b) Employees working on, over or along water, where the danger of drowning exists, shall be provided with and shall wear approved personal flotation devices.

(i) Employees are not considered exposed to the danger of drowning when:

(A) The water depth is known to be less than chest deep on the exposed individual;

(B) Working behind standard height and strength guard-rails;

(C) Working inside operating cabs or stations which eliminate the possibility of accidental falling into the water;

(D) Wearing approved safety belts with lifeline attached so as to preclude the possibility of falling into the water.

(ii) Prior to and after each use, personal flotation devices shall be inspected for defects which would reduce their designed effectiveness. Defective personal flotation devices shall not be used.

(iii) To meet the requirement of (b) of this subsection, a personal flotation device shall be approved by the United States Coast Guard as a Type I PFD, Type II PFD, Type III PFD, or Type V PFD, or equivalent, pursuant to 46 CFR 160 (Coast Guard Lifesaving Equipment Specifications) and 33 CFR 175.23 (Coast Guard Table of Devices Equivalent to Personal Flotation Devices). Ski belt or inflatable type personal flotation devices are specifically prohibited.

(c) Life rings.

(i) Along docks, walkways or other fixed installations on or adjacent to open water more than five feet deep, approved life rings with line attached shall be provided. The life rings shall be spaced at intervals not to exceed two hundred feet and shall be kept in easily visible and readily accessible locations.

(ii) When employees are assigned work at other casual locations where exposure to drowning exists, at least one approved life ring with line attached shall be provided in the immediate vicinity of the work.

(iii) Work assigned over water where the vertical drop from an accidental fall exceeds fifty feet, is subject to specific procedures approved by the department.

(iv) Lines attached to life rings shall be at least ninety feet in length, at least one-quarter inch in diameter and have a minimum breaking strength of five hundred pounds.

(v) Life rings must be United States Coast Guard approved thirty inch size.

(vi) Life rings and attached lines must be maintained to retain at least seventy-five percent of their designed buoyancy and strength.

(3) Emergency facilities. When employees are exposed to hazardous substances which may require emergency bathing, eye washing or other facilities, the employer shall provide such facilities and maintain them in good working order.

(4) Employers shall instruct employees to report every injury, regardless of severity, to the employer.

(5) Stretchers permanently equipped with bridles for hoisting shall be readily accessible. A blanket or other suitable covering shall be available.

(6) Telephone or equivalent means of communication shall be readily available.

(7) Employees working on any bridge or structure leading to a detached vessel berthing installation shall wear United States Coast Guard approved personal flotation devices except where protected by railings, nets, or safety belts and lifelines.

(8) Life ladders. On all docks there shall be substantial built-in-place ladders, spaced at intervals not to exceed four hundred feet, to reach the lowest water use. When portable ladders are to be used, ladders may be bolted to the bullrail or

dock structure, or ladders can be secured to an embedded eye bolt in a concrete dock surface. The immediate area where such ladders or fastenings are located shall be painted with a bright color or of a color which contrasts with the surrounding area. There shall be a ladder at each end of the dock.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60115, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60115, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60115, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60115, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60115, filed 12/11/84.]

WAC 296-56-60117 Maintenance and load limits. (1)

The structural integrity of docks, piers, wharves, terminals and working surfaces shall be maintained.

(2) Maximum safe load limits, in pounds per square foot (kilograms per square meter), of floors elevated above ground level, and pier structures over the water shall be conspicuously posted in all cargo areas.

Exception: Pier structures used primarily for vehicle traffic may be posted in maximum pounds per axle weight.

(3) Maximum safe load limits shall not be exceeded.

(4) All walking and working surfaces in the terminal area shall be maintained in good repair.

(5) All steel plates, boards, etc., used to temporarily cover small holes or weakened surfaces shall be secured in such a manner as to prevent movement.

(6) All large openings or weakened surfaces shall be barricaded on all exposed sides with barricades equipped with blinkers, flashing lights, or reflectors.

(7) Areas around bitts or cleats where workers perform their duties shall be lighted as required in this section and have a nonslip surface around each bitt or cleat.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60117, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60117, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60117, filed 12/11/84.]

WAC 296-56-60119 Protection from falling. Employees doing maintenance work on cranes, spouts or similar types of equipment, eight feet or more above the ground or surface and not in an area that is protected by any standard safeguards such as walkways with standard railings, or ladders with protective cages, shall wear a safety belt and lanyard which can be attached to the structure.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60119, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60119, filed 12/11/84.]

WAC 296-56-60121 Minimum safety requirements for docks and dock facilities. No provision of this section shall be construed to imply that an employer or employees are responsible for repair, construction or otherwise bringing into compliance facilities over which they have no control.

(1) Working prohibited on unsafe docks or dock facilities. Employers shall not allow employees to perform work on docks or dock facilities which the employer should know do not meet the minimum safety requirements of this section.

(2) Known unsafe conditions by employees. Employees shall not work on docks or dock facilities which they should

know do not meet the minimum safety requirements of this section.

(3) Bulletin boards. At each dock, pier, warehouse or designated area at the job site, there shall be installed a safety bulletin board.

(4) Posting of notices. It shall be the responsibility of the employer to post at prominent places in or adjacent to the work area, legible notices stating:

(a) The location of stretchers, blankets, first-aid equipment and telephones. (Where possible, directional arrows should point to locations.)

(b) The phone numbers of doctors, ambulance services and hospitals within the area and the phone numbers of the police department or other law enforcement agency. (Where possible these numbers shall also be posted on or inside the cover of first-aid cabinets and kits.)

(5) Ventilation. All areas where employees are required to work shall be ventilated as required by the "general occupational health standards," chapter 296-62 WAC.

(6) Power outlets. Power outlets installed to supply power to vessels shall be located in such a manner that the workers will not come into contact with supply lines. Unprotected power lines shall not be driven over by equipment. If located on the underside or waterside of the bull rail, a well lighted walkway with hand rails shall be provided to the power outlets.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60121, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60121, filed 12/11/84.]

WAC 296-56-60122 Access to vessels. (1) Access to vessels. The employer shall not permit employees to board or leave any vessel, except a barge or river towboat, until the following requirements have been met:

(a) Whenever practical a gangway of not less than twenty inches wide walking surface of adequate strength, maintained and secured shall be used. If a gangway is not practical a substantial straight ladder, extending at least thirty-six inches above the upper landing surface and adequately secured against shifting or slipping shall be provided. When conditions are such that neither a gangway nor a straight ladder can be used, a Jacob's ladder meeting the requirements of subsection (4) of this section may be used.

(b) Each side of such gangway, and the turn table if used, shall have a railing with a minimum height of thirty-three inches measured perpendicularly from rail to walking surface at the stanchion, and a mid rail. Rails shall be of wood, pipe, chain, wire or rope and shall be kept taut at all times.

(c) Gangways on vessels inspected and certified by the United States Coast Guard are deemed to meet the foregoing requirements, except in cases where the vessel's regular gangway is not being used.

(d) The gangway shall be kept properly trimmed at all times.

(e) When a fixed tread accommodation ladder is used, and the angle is low enough to require employees to walk on the edge of the treads, cleated duckboards shall be laid over and secured to the ladder.

(f) When the lower end of a gangway overhangs the water between the ship and the dock in such a manner that

there is danger of employees falling between the ship and the dock, a net or other suitable protection shall be rigged at the foot of the gangway in such a manner as to prevent employees from falling from the end of the gangway into the water or into the surface.

(g) If the foot of the gangway is more than one foot away from the edge of the apron, the space between them shall be bridged by a firm walkway equipped with railings, with a minimum height of thirty-three inches with midrails on both sides.

(h) Supporting bridles shall be kept clear so as to permit unobstructed passage for employees using the gangway.

(i) When the upper end of the means of access rests on or flush with the top of the bulwark, substantial steps properly secured and equipped with at least one substantial handrail approximately thirty-three inches in height shall be provided between the top of the bulwark and the deck.

(j) Obstructions shall not be laid on or across the gangway.

(k) The means of access shall be illuminated for its full length.

(l) Unless construction of the vessel makes it impossible, the means of access shall be so located that drafts of cargo do not pass over it. Loads shall not be passed over the means of access while employees are on it.

(2) Access to vessels in drydock or between vessels. Gangways meeting the requirements of subsection (1)(a), (b), (i), (j) and (k) of this section shall be provided for access from wingwall to vessel or, when two or more vessels other than barges or river towboats are lying abreast, from one vessel to another.

(3) Access to barges and river towboats.

(a) Ramps for access of vehicles to or between barges shall be of adequate strength, provided with side boards, well maintained and properly secured.

(b) Unless employees can step safely to or from the wharf, float, barge, or river towboat, a ramp meeting the requirements of subsection (1)(a) of this section shall be provided. When a walkway is impractical, a substantial straight ladder, extending at least thirty-six inches above the upper landing surface and adequately secured against shifting or slipping, shall be provided. When conditions are such that neither a walkway nor a straight ladder can be used, a Jacob's ladder meeting the requirements of subsection (4) of this section may be used.

(c) The means of access shall meet the requirements of subsection (1)(i), (j), and (k) of this section.

(4) Jacob's ladders.

(a) Jacob's ladders shall be of the double rung or flat tread type. They shall be well maintained and properly secured.

(b) A Jacob's ladder shall either hang without slack from its lashings or be pulled up entirely.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60122, filed 1/17/86.]

WAC 296-56-60123 Guarding of edges. (1) Vehicle protection.

(a) Vehicle curbs, bull rails, or other effective barriers at least six inches (15.24 cm) in height and six inches in width,

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shall be provided at the waterside edges of aprons and bulkheads, except where vehicles are prohibited. Curbs or bull rails installed after January 1, 1985, shall be at least ten inches (22.9 cm) in height.

(b) The provisions of (a) of this subsection also apply at the edge of any fixed level above the common floor area from which vehicles may fall, except at loading docks, platforms and skids where cargo is moved by vehicles.

(2) Employee protection.

(a) Guardrails shall be provided at locations where employees are exposed to falls of more than four feet from floor or wall openings or waterside edges, including bridges or gangway-like structures leading to pilings, vessel mooring or berthing installations.

(b) Guardrails are not required:

(i) At loading platforms and docks;

(ii) At waterside edges used for cargo or mooring line handling;

(iii) On the working sides of work platforms, skids, or similar workplaces which abut the work area; or

(iv) On railroad rolling stock, highway vehicles, intermodal containers, or similar equipment.

(c) Where guardrails are impractical due to machinery requirements or work processes, an alternate means of fall protection, such as nets, shall be used.

(3) Criteria for guardrails. Guardrails shall meet the following criteria:

(a) They shall be capable of withstanding a force of at least two hundred pounds (890 N) applied in any direction at mid-span of the top rail (when used), or at the uppermost point if there is no guard rail.

(b) If not of solid baluster, grillwork, slatted, or similar construction, guardrails shall consist of top rails and midrails. Midrails, when used, shall be positioned at approximately half the height of the top rail.

(c) The top surface of guardrails installed before October 3, 1983, shall be at least thirty-six inches (.091 m) high. Those installed after October 3, 1983, shall be forty-two inches (1.07 m) high, plus or minus two inches (5.1 cm), high.

(d) Any nonrigid railing such as chain or wire rope shall have a maximum sag, at the mid-point between posts, of not more than six inches (15.2 cm).

(e) Top rails shall be free of sharp edges and maintained in good repair.

(f) Rail ends shall not overhang. This does not prohibit scrollwork, boxed ends or similar nonhazardous projections.

(4) Toeboards. Toeboards shall be provided when employees below could be exposed to falling objects such as tools. Toeboards shall be at least three and one-half inches (8.9 cm) in height from top edge to floor level, and be capable of withstanding a force of fifty pounds (220 N) applied in any direction. Drainage clearance not in excess of one-eighth inch under toeboards is permitted.

(5) Stair railings. Stair railings shall be capable of withstanding a force of at least two hundred pounds (890 N) applied in any direction, and shall not be more than thirty-six inches (0.9 m) nor less than thirty-two inches (0.8 m) in height from the upper top rail surface to the tread surface in line with the leading edge of the tread. Railings and midrails

shall be provided at any stairway having four or more risers, as follows:

(a) For stairways less than forty-four inches (1.12 m) wide, at least one railing; and

(b) For stairways more than forty-four inches (1.12 m) but less than eighty-eight inches (2.24 m) wide, a stair rail or handrail on each side, and if eighty-eight or more inches wide, an additional intermediate handrail.

(6) Condition. Railings shall be maintained free of sharp edges and in good repair.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60123, filed 12/30/98, effective 3/30/99. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60123, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60123, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60123, filed 12/11/84.]

WAC 296-56-60125 Clearance heights. Clearance heights shall be prominently posted where the height is insufficient for vehicles or equipment.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60125, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60125, filed 12/11/84.]

WAC 296-56-60127 Cargo doors. (1) Mechanically operated cargo doors.

(a) Cargo door counterweights shall be guarded.

(b) Lift trucks and cranes shall not be used to move mechanically operated doors except when necessary during repair to the doors. Ropes or other guarding shall be provided to prevent entry into any area if the door may fall or slide.

(c) Vertically operated doors partially opened for work or ventilation shall be secured to prevent accidental closing.

(2) Tackle operated cargo doors.

(a) Doors shall be connected to their lifting tackle with shackles or other secure means.

(b) Lifting bridles and tackles shall have a safety factor of five, based upon maximum anticipated static loading conditions.

(c) Devices shall be provided to hold overhead doors in the open position and to secure them when closed.

(d) Lifting gear and hardware shall be maintained in safe condition.

(e) Lifting ropes shall be placed out of the work area and off the floor.

(3) Horizontal sliding.

(a) Horizontal sliding door rollers shall be constructed to prevent the door from disengaging from overhead tracks.

(b) Sliding doors shall be secured to prevent them from swinging.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60127, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60127, filed 12/11/84.]

WAC 296-56-60129 Platforms and skids. (1) Platforms and skids extending from piers, transit sheds or lofts and used for landing or hooking drafts shall be provided with guardrails meeting the requirements of WAC 296-56-60123(3) on all open sides. Alternate means, such as nets or safety belts and lifelines, may be used if guardrails are impractical.

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(2) Any employee working below a second-story platform or skid shall be protected from falling objects.

(3) Platforms and skids shall be strong enough to bear the loads handled and shall be maintained in safe condition. Safe working loads, which shall be posted or marked on or adjacent to platforms and skids, shall have a minimum safety factor of five for all parts, based upon maximum anticipated static loading conditions and the ultimate strength of the construction material.

(4) The employer shall provide and maintain platform and skid attachments that will prevent accidental movement of the skid or platform.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60129, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60129, filed 12/11/84.]

WAC 296-56-60131 Elevators and escalators. (1) "Elevator" means a permanent hoisting and lowering mechanism with a car or platform moving vertically in guides and serving two or more floors of a structure. The term excludes such devices as conveyors, tiering or piling machines, material hoists, skip or furnace hoists, wharf ramps, lift bridges, car lifts, and dumpers.

(2) "Escalator" means a power-driven continuous moving stairway principally intended for the use of persons.

(3) No elevator or escalator with a defect which affects safety shall be used.

(4) Elevator safety devices shall not be overridden or made inoperable.

(5) Elevators and escalators shall be thoroughly inspected at intervals not exceeding one year. Additional monthly inspections for satisfactory operation shall be conducted by designated persons. Records of the results of the latest annual elevator inspections shall be posted in elevators. Records of annual escalator inspections shall be posted in the vicinity of the escalator or be available at the terminal.

(6) Elevator landing openings shall be provided with doors, gates, or equivalent protection, which shall be in place when the elevator is not at that landing, to prevent employees from falling into the shaft.

(7) The elevator or escalator maximum load limits shall be posted and shall not be exceeded. Elevator load limits shall be posted conspicuously both inside and outside of the car.

(8) Elevators shall be operated only by designated persons except for automatic or door interlocking elevators which provide full shaft door closing and automatic car leveling.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60131, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60131, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60131, filed 12/11/84.]

WAC 296-56-60133 Manlifts. (1) Inspection. Manlifts shall be inspected monthly by a designated person. Safety switches shall be checked weekly. Manlifts found to be unsafe shall not be operated until repaired. Inspections shall include at least the following:

(a) Step fastenings;

(b) Rails;

- (c) Rail supports and fastenings;
- (d) Roller and slides;
- (e) Belt and belt tension;
- (f) Handholds and fastenings;
- (g) Floor landings;
- (h) Guardrails;
- (i) Lubrication;
- (j) Safety switches;
- (k) Warning signs and lights;
- (l) Illumination;
- (m) Drive pulley;
- (n) Bottom (boot) pulley and clearance;
- (o) Pulley supports;
- (p) Motor;
- (q) Drive mechanism;
- (r) Brake;
- (s) Electrical switches;
- (t) Vibration and misalignment;
- (u) "Skip" on up or down run when mounting the step (indicating worn gears); and
- (v) Emergency exit ladders.

(2) Inspection records. Inspection records shall be kept for at least one year. The record of the most recent inspection shall be posted in the vicinity of the manlift or in the terminal.

(3) Emergency stop. An emergency stop device shall be available within easy reach from any position on the belt.

(4) Instructions. Manlift use instructions shall be conspicuously posted.

(5) Top floor warning sign and light. An illuminated sign and red light that are visible to the user shall be provided under the top floor opening of the manlift to warn the user to get off at that floor.

(6) Bottom floor warning sign. A sign visible to descending passengers shall be provided to warn them to get off at the bottom floor.

(7) Upper limit stop. An automatic stop device shall be provided to stop the manlift when a loaded step passes the top landing, except that manlifts installed after October 3, 1983, shall have two such devices.

(8) Handholds and steps. Each step shall be provided with a corresponding handhold.

(9) Emergency ladder. A fixed emergency ladder accessible from any position on the lift and meeting the requirements of WAC 296-56-60209 shall be provided for the entire run of the manlift.

(10) Landings.

(a) Clear and unobstructed landing spaces shall be provided at each level. Manlifts constructed after October 3, 1983, that have a distance of fifty feet (15.24 m) or more between floor landings shall have an emergency landing every twenty-five feet (7.62 m) or less of manlift travel.

(b) Open sides of emergency landings shall be protected by guardrails.

(c) Floor landing entrances and exits shall be guarded by mazes, self-closing gates, or equivalent protection.

(d) Landings shall be of sufficient size and strength to support two hundred fifty pounds (1120 N).

(11) Floor opening guards. The ascending sides of manlift floor openings shall be provided with cones or bevel guards to direct the user through the openings.

(12) Maintenance. Manlifts shall be equipped, maintained, and used in accordance with the manufacturer's specifications, which shall be available at the terminal.

(13) Bottom pulley.

(a) The lower pulley shall be supported by the lowest landing.

(b) Sides of the bottom pulley support shall be guarded to prevent contact with the pulley or the steps.

(14) Top clearance. A clearance of at least eleven feet (3.3 m) shall be provided between the top landing and the ceiling.

(15) Brakes. Manlifts shall be equipped with brakes that are:

(a) Self-engaging;

(b) Electrically released; and

(c) Capable of stopping and holding the manlift when the descending side is loaded with the maximum rated load.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60133, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60133, filed 12/11/84.]

PART H—MANLIFTS—ELECTRIC

WAC 296-56-60135 Manlifts—Electric.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60135, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60135, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60135, filed 12/11/84.]

WAC 296-56-60139 Hoistway enclosures and landings. Hoistways shall be fully enclosed, or enclosed on all landings to a height of six feet above the landing floor or six feet above highest working level or stair level adjacent to the hoistway. Perforated hoistway enclosures can be used where fire resistance is not required, provided:

(1) Steel wire grill or expanded metal grill shall be at least thirteen U.S. gauge steel wire.

(2) Openings in the enclosure shall reject a one inch steel ball.

(3) All hoistway landings shall be properly and adequately lighted.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60139, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60139, filed 12/11/84.]

WAC 296-56-60141 Scope and application. WAC 296-56-60141 through 296-56-60171 apply to the installation, design, and use of all one man capacity, electric elevators subject to inspection under RCW 49.17.120.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60141, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60141, filed 12/11/84.]

WAC 296-56-60143 Hoistway gates. (1) Hoistway gates may be constructed of wood slat, steel wire grill, expanded metal or solid material, providing all openings reject a two inch ball and resist a two hundred fifty pound horizontal thrust.

(a) Steel wire and expanded metal gates shall be of at least thirteen gauge steel.

(b) Wood slats must be not less than two inches wide and one-half inch thick, nominal size.

(c) Solid material shall be not less than one-eighth inch reinforced sheet steel or one-half inch plywood.

(2) Hoistway gates may be horizontal swinging, vertical or horizontal sliding or biparting gates.

(a) Hoistway gates shall extend the full width of the elevator car and from one inch above the landing floor to six feet or more above the floor.

(b) Horizontal swinging gates shall be prevented from swinging into hoistway.

(3) Gates shall be equipped with interlocks or mechanical locks and electric contacts designed so that hoistway gates cannot be opened when the car is away from the landing.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60143, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60143, filed 12/11/84.]

WAC 296-56-60145 Elevator car. (1) Elevator cars shall be fully enclosed to car height or to a height of not less than six feet six inches whichever is greater. Elevator cars may be of perforated or solid material provided the material will withstand a horizontal thrust of seventy-five pounds without deflecting one-quarter inch and all openings will reject a one inch ball.

(a) Car frames shall be of substantial metal or wood construction with a safety factor of four for metal frames and six for wood frames.

(b) Wood frames shall be gusseted and bolted or otherwise secured with large washers and lock washers.

(c) The car platform shall not exceed thirty inches inside dimension on each side (6.25 square foot area).

(2) Every car shall have a substantial protective top. The front half may be hinged. The protective top may be made from number nine U.S. wire gauge screen, eleven gauge expanded metal, fourteen gauge sheet steel, or three-quarter inch or heavier plywood. If made of wire screen or metal, the openings shall reject a one-half inch diameter ball.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60145, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60145, filed 12/11/84.]

WAC 296-56-60147 Elevator doors. Elevator car doors shall be provided on all elevators, except on fully enclosed hoistways equipped with hoistway gates and enclosed from the top of the hoistway opening to the ceiling on the landing side.

(1) Car doors may be of solid or perforated construction and shall be capable of resisting a seventy-five pound thrust without deflecting one-quarter inch.

(2) Car doors may be biparting or otherwise horizontally swung provided the door swings within the elevator car.

(3) A positive locking latch device which resists a two hundred fifty pound thrust shall be provided.

(4) Interlocks or mechanical locks and electric contacts must be provided on cars operating in open hoistways.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60147, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60147, filed 12/11/84.]

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WAC 296-56-60149 Counterweight, enclosures, and fastenings. All counterweights shall be fully enclosed for their full length of travel except in closed hoistways where counterweight guide rails have been provided.

(1) Counterweight enclosures shall provide an inspection opening in the bottom of the enclosure large enough to provide for the inspection of cable fastenings, counterweight and buffer. Counterweights of rectangular shape shall be secured by not less than two one-half inch mild steel bolts with locknuts. Round counterweights shall be fastened with a center bolt not less than three-quarter inch diameter and secured with a locknut.

(2) Bolt eyes shall be welded closed.

(3) Cable fastenings shall be not less than three U-shaped clamps with U's on the dead side of the rope or babbitted tapered elevator sockets.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60149, filed 12/11/84.]

WAC 296-56-60151 Guide rails. A minimum of two car guide rails shall be provided. They shall:

(1) Extend at least six inches beyond the maximum travel of the car with buffers compressed.

(2) Be securely fastened to a vertical supporting member for the full length of elevator travel.

(3) Be not less than one and one-half inch by one and one-half inch vertical grain fir or equivalent, one-quarter inch by two inch by two inch angle iron or equivalent.

(4) Not vary more than three-sixteenths inch thickness on brake surfaces for wood guide rails.

(5) Be secured to resist more than one-half inch total deflection on car safety application and resist a two hundred fifty pound horizontal thrust.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60151, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60151, filed 12/11/84.]

WAC 296-56-60153 Hoisting ropes. Hoisting ropes shall be of good grade elevator traction wire rope and shall:

(1) Be at least two ropes of not less than three-eighths inch diameter providing a safety factor of five.

(2) Be fastened by at least three U-type cable clamps with the U on the dead return end of the rope or by approved elevator sockets of the babbitted type.

(3) Be of such length that the car platform will not be more than six inches above the top landing when the counterweight buffer is fully compressed. The counterweight shall be six inches or more away from the counterbalance sheave when the car buffer is fully compressed.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60153, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60153, filed 12/11/84.]

WAC 296-56-60155 Space under hoistway. There shall be no habitable space below the elevator hoistway and counterweight shaft unless the floor is designed to withstand an impact one hundred twenty-five percent greater than the impact generated by a free fall of either the car or counterweight from the full height of the hoistway.

(1999 Ed.)

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60155, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60155, filed 12/11/84.]

WAC 296-56-60157 Car safeties. All cars suspended or operated from overhead machinery shall be equipped with an approved car safety capable of stopping and holding the car with rated load.

(1) Car safeties shall operate mechanically and be independent of interruption of any electrical circuit.

(2) Car safeties and governor controlled safeties shall automatically operate and the control circuit shall be broken in the event of cable breakage.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60157, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60157, filed 12/11/84.]

WAC 296-56-60159 Brakes. All elevators shall be equipped with brakes designed to engage mechanically and release electrically.

(1) Brakes shall be located on the final drive of all elevator machines.

(2) The brake actuating circuit shall be so designed that interruption of power by slack cable switch, control switch, and limit switches actuate the brake.

(3) The brakes shall actuate under short circuit, phase failure, or reverse phase conditions.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60159, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60159, filed 12/11/84.]

WAC 296-56-60161 Car controls and safety devices.

(1) Car controls may be automatic pushbutton, constant pressure pushbutton or momentary pushbutton types. Hand rope and car switch controls shall not be used.

(2) Manually operated emergency stop switches shall be installed in all cars not equipped with constant pressure pushbutton controls. The switch shall be clearly marked "emergency stop."

(3) Terminal limiting devices shall operate independently of the car controls and automatically stop the car at the top and bottom terminal landings.

(4) All winding drum machine type elevators shall be equipped with top and bottom final limit switches.

(5) A slack rope device of manual reset design shall be required on all winding drum type machines. The device shall be designed to de-energize the circuit to the drive motor and brake.

(6) All installations shall be equipped with an overspeed governor. This governor shall be set not to exceed one hundred seventy-five feet per minute and shall be designed to de-energize the brake control and motor drive circuits simultaneously with the activation of the car safety mechanism. Car speeds for these types of installations shall not exceed a speed of one hundred twenty-five feet per minute.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60161, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60161, filed 12/11/84.]

WAC 296-56-60167 Hoisting machine mechanisms.

(1) Elevator machines shall be driven by approved type units.

(1999 Ed.)

(a) On direct drive or approved worm gear driven type, a mechanically actuated, electrically released brake shall be installed on the driving unit.

(b) On V belt driven types, a minimum of four belts, one-half inch minimum size, shall be used to transmit power from the motor to the drive shaft and a mechanically actuated, electrically released brake shall be installed on the final drive shaft.

(2) Wherever practical, elevator machines shall be installed on the top side of their supporting structure.

(3) All components of the driving mechanism and parts subject to stress involved in suspending the load or related equipment shall be designed to withstand eight times the total weight to be suspended, including load, counterweight, car and cables.

(4) Gears shall be made of steel or equivalent material. Cast iron gears are prohibited.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60167, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60167, filed 12/11/84.]

WAC 296-56-60169 Elevator car and counterweight buffers. (1) Elevator cars shall be provided with adequate car buffers.

(2) All elevators using a counterweight shall be provided with adequate counterweight buffers.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60169, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60169, filed 12/11/84.]

WAC 296-56-60171 General requirements. (1) Adequate lighting shall be provided at each landing and in the shaftway.

(2) A sign bearing the following information shall be conspicuously posted within the car:

(a) Maximum capacity one person;

(b) Total load limit in pounds;

(c) For authorized personnel use only.

(3) A fire extinguisher in proper working condition shall be available in the car.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60171, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60171, filed 12/11/84.]

PART I—MANLIFTS—HAND POWER

WAC 296-56-60180 Scope and application. WAC 296-56-60180 through 296-56-60207 apply to the installation, design, and use of all one man capacity, hand power counterweighted elevators subject to inspection under RCW 49.17.120.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60180, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60180, filed 12/11/84.]

WAC 296-56-60183 Hoistway landings. (1) Every hoistway landing shall be protected on all sides other than the landing opening side with a standard guard rail and intermediate guard rail. All landings except the bottom landing shall have a toe board installed on all sides except the landing opening side.

[Title 296 WAC—p. 1245]

(2) All hoistway entrances shall be not less than six feet six inches in height and in no case shall the width exceed the corresponding car dimensions.

(3) All hoistway entrances must be provided with an approved maze or with a hoistway gate which shall:

- (a) Be at least thirty-six inches in height.
 - (b) Extend downward to within one inch of the landing sill.
 - (c) Be of the self-closing type, designed to swing horizontally out from the hoistway and closing against a full jam stop.
 - (d) Be located within four inches of the hoistway edge of the landing sill.
 - (e) Have a "DANGER" sign conspicuously posted on the landing side of the hoistway gate.
 - (f) Withstand a two hundred fifty pound horizontal thrust.
- (4) All projections extending inwardly from the hoistway enclosure at the entrance side of the car platform shall be bevelled and substantially guarded on the underside by smooth solid material set at an angle of not less than sixty degrees, nor more than seventy-five degrees from the horizontal when cars are not equipped with gates.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60183, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60183, filed 12/11/84.]

WAC 296-56-60185 Hoistway clearances. (1) The minimum clearance between the side of the car and a hoistway enclosure shall be one inch.

(2) The clearance between the car platform and the landing sill shall not be less than one-half inch and not more than one and one-half inches.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60185, filed 12/11/84.]

WAC 296-56-60187 Habitable space under hoistways. There shall be no habitable space below the elevator hoistway or counterweight shaft unless the floor is supported to withstand any impact caused by the car or counterweight dropping freely onto the floor.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60187, filed 12/11/84.]

WAC 296-56-60189 Hoistway guide rails. (1) There shall be a minimum of two opposing guide rails extending to a point six inches beyond the full height of travel of the car when the counterweight buffer is fully compressed.

(2) All rails shall be attached by bolts, lag screws or other approved methods to a vertical supporting member which shall not exceed one-half inch deflection with the application of a two hundred fifty pound horizontal thrust at any point.

(3) Wood guide rails shall be at least one and one-half inch by one and one-half inch vertical grain fir or equivalent and shall not vary more than three-sixteenth inch in thickness on the sides which the brakes contact. All joints shall be kept smooth and even.

[Title 296 WAC—p. 1246]

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60189, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60189, filed 12/11/84.]

WAC 296-56-60191 Buffer springs and overtravel of car. Substantial spring buffers shall be installed below the car and also below the counterweight. The hoisting rope shall be of such length that the car platform will not be more than eight inches above the top landing when the counterweight buffer spring is fully compressed.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60191, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60191, filed 12/11/84.]

WAC 296-56-60193 Car specifications. (1) The car shall be built to the following specifications:

- (a) The car platform shall be not greater than thirty inches on either side (6.25 square feet area).
- (b) The car frame and platform shall be of steel or sound seasoned wood construction and be designed with a safety factor of not less than four for metal and six for wood, based on a maximum capacity of two hundred fifty pounds.
- (c) All frame members shall be securely bolted, riveted or welded and braced. If bolted, lock washers or lock nuts shall be used.

(d) Where wooden frame members are bolted, large washers or metal plates shall be used to minimize the possibility of splitting or cracking the wood.

(2) The sides of the car shall be enclosed by a minimum of two safety guard rails with the top rail not less than thirty-six inches nor more than forty-two inches from the car floor. Rails shall sustain a horizontal thrust of two hundred fifty pounds. If solid material is used it shall be smooth surfaced and not less than one-half inch thickness, if wood; not less than sixteen gauge thickness, if steel; and shall be constructed from the car floor to a height of not less than three feet.

(a) Where the hoistway is not enclosed on the entrance side of the car, a self-locking or drop bar gate must be provided. The car gate may be of the folding type, horizontally swung, provided it swings into the car enclosure. Drop bar gates must be of two bar construction, parallelogram type, and conform to requirements specified for car guard rails.

(b) The car gate shall drop into locking slots or be provided with a positive locking type latch capable of withstanding two hundred fifty pounds horizontal thrust.

(3) Every car shall have a substantial protective top. The front half may be hinged. The protective top may be made from number nine U.S. wire gauge screen, eleven gauge expanded metal, fourteen gauge sheet steel, three-quarter inch or heavier plywood. If made of wire screen or metal, the openings shall reject a one-half inch diameter ball.

(4) Every car shall have a proper rack to hold the balance weights.

(5) A sign bearing the following information shall be conspicuously posted within the car:

- (a) Maximum capacity one person;
 - (b) Total load limit in pounds;
 - (c) For authorized personnel use only.
- (6) Every car shall be equipped with a spring loaded foot brake which:

- (a) Operates independently of the car safeties;

(b) Operates in both directions and will stop and hold the car and its load;

(c) Locks the car in its position automatically whenever the operator releases the pressure on the foot pedal.

(7) Every car shall be equipped with a car safety device which:

(a) Applies to the sides of the main guide rails;

(b) Stops and holds the car and its load immediately when the hoisting rope breaks.

(8) Every car shall have a minimum clearance of six feet six inches from the top of the car platform to the bottom edge of the crosshead or any other obstruction.

(9) A tool box with minimum dimensions of four inches wide by sixteen inches long by three inches in depth shall be provided and firmly attached to the car structure.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60193, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60193, filed 12/11/84.]

WAC 296-56-60195 Counterweights. (1) The assembly of sectional counterweights shall conform to the following requirements:

(a) Rectangular counterweights shall be held together by at least two tie rods one-half inch in diameter fastened with lock washers and double nuts or other approved means.

(b) One three-quarter inch rod may be used to hold the sections of a round counterweight together. Any additional sections or weights shall be secured by an approved means.

(2) The eye bolt for the rope hitch shall be attached to the counterweight in a manner that will prevent the eye bolt from coming loose. The eye of eye bolts shall be welded to prevent it from opening.

(3) Every counterweight runway shall be enclosed with substantial unperforated material for its full distance of travel. Inspection openings shall be provided at either the top or bottom of the counterweight runway. These openings shall be substantially covered at all times except when actually being used for inspection of counterweight fastenings.

(4) Workmen shall load the counterweight for the proper balance of the heaviest person using the elevator and others shall use compensating weights, which shall be available, to maintain a balance.

(5) On elevators with travel of seventy-five feet or more, a compensating chain or cable shall be installed to maintain the proper balance of the counterweight to the car and load in all positions.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60195, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60195, filed 12/11/84.]

WAC 296-56-60197 Sheaves. The minimum sheave diameter shall be forty times the diameter of the ropes used, i.e., fifteen inch for three-eighths inch rope.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60197, filed 12/11/84.]

WAC 296-56-60199 Hoisting ropes. (1) Hoisting rope shall be of good grade traction elevator wire rope, and shall:

(a) Be not less than three-eighths inches in diameter.

(b) Provide a safety factor of five based on the maximum weight supported.

(c) Be of sufficient length to prevent the counterweight from striking the overhead structure when car is at bottom, and prevent the car from striking the overhead before the counterweight is at its lower limit of travel.

(d) Be fastened at each end by at least three or more clamps, with the "U" of the clamp bearing on the dead end of the rope.

(e) Where passed around a metal or other object less than three times the diameter of the cable, have a thimble of the correct size inserted in the eye.

(2) Approved sockets or fittings with the wire properly turned back and babbitted may be used in place of clamps noted in subsection (1)(d) of this section.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60199, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60199, filed 12/11/84.]

WAC 296-56-60201 Operating rope. The operating rope shall be of soft hemp or cotton at least three-quarter inch in diameter. It shall be securely fastened at each end and shall be in proper vertical alignment to prevent bending or cutting where it passes through the openings in the platform or the protective top of the car.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60201, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60201, filed 12/11/84.]

WAC 296-56-60203 Lighting. Adequate lighting shall be provided at each landing and in the shaftway.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60203, filed 12/11/84.]

WAC 296-56-60205 Overhead supports. The overhead supporting members shall be designed, based upon impact loads, with a safety factor of:

(1) Nine if wood;

(2) Five if steel.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60205, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60205, filed 12/11/84.]

WAC 296-56-60207 General requirements. (1) No person other than an employee or duly authorized person shall ride or be permitted to ride in the car.

(2) Escape ladders shall be installed extending the full length of the hoistway and shall be located in a position so that, in an emergency, a person can safely transfer from the car platform to the ladder. An "IMPAIRED CLEARANCE" sign shall be posted at the bottom of a ladder when the face of the ladder is less than thirty inches from any structure.

(3) An automatic safety dog or device which will prevent the car from leaving the landing until manually released by the operator shall be installed at the bottom landing.

(4) A fire extinguisher in proper working condition shall be available in the car.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60207, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60207, filed 12/11/84.]

**PART J—LADDERS, STAIRWAYS OPENINGS,
SANITATION, SIGNS, ETC.**

WAC 296-56-60209 Fixed ladders. (1) Scope. This section applies to all fixed ladders except:

(a) Ladders forming an integral part of railway cars, highway carriers, cargo containers, or other transportation carrier equipment;

(b) Climbing devices such as step bolts or structural members of tanks and towers;

(c) Ladders built into or vertically attached to tubular scaffold framing; and

(d) Ladders used only for fire fighting or emergency purposes are exempt from the provisions of subsection (5) of this section. All other requirements of this section apply.

(2) Definitions.

(a) "Cage" (basket guard) means a barrier enclosing or nearly enclosing a ladder's climbing space and fastened to one or both of the ladder's side rails or to another structure.

(b) "Fixed ladder" means a ladder, including individual rung ladders, permanently attached to a structure, building, or piece of equipment.

(c) "Ladder safety device" means a support system limiting an employee's drop or fall from the ladder, and which may incorporate friction brakes, lifelines and lanyards, or sliding attachments.

(d) "Well" means a permanent complete enclosure around a fixed ladder, which is attached to the walls of the well.

(3) Defects.

(a) Ladders with broken, split, or missing rungs, steps or rails, broken welds or connections, corrosion or wastage, or other defect which may affect safe use shall be removed from service.

(b) Ladder repairs shall provide strength at least equivalent to that of the original ladder.

(4) Ladder specifications.

(a)(i) Ladders installed before October 3, 1983, shall be capable of withstanding without damage a minimum concentrated load, applied uniformly over a three and one-half inch (8.8 cm) width at the rung center, of two hundred pounds (890 N).

(ii) Ladders installed after October 3, 1983, shall be capable of withstanding two hundred fifty pounds (1120 N) applied as described in (a)(i) of this subsection. If used by more than one employee simultaneously, the ladder as a unit shall be capable of simultaneous additional loading in two hundred fifty pound (1120 N) increments for each additional employee, applied to a corresponding number of rungs. The unit shall have a safety factor of four based on ultimate strength, in the designed service.

(b)(i) Ladders installed before October 3, 1983, shall have rungs evenly spaced from nine to sixteen and one-half inches (22.9 to 41.9 cm) apart, center to center.

(ii) Ladders installed after October 3, 1983, shall have rungs evenly spaced twelve inches apart, plus or minus two inches (30 cm, plus or minus 5 cm), center to center.

(c)(i) Ladders installed before October 3, 1983, shall have a width between side rails of at least ten inches (25.4 cm).

(ii) Ladders installed after October 3, 1983, shall have a width between side rails of at least twelve inches (30.48 cm).

(d) The minimum distance between the rung center line and the nearest permanent object behind the rung shall be four inches (10.2 cm), except that in ladders installed after October 3, 1983, the minimum distance shall be seven inches (17.8 cm) unless physical limitations make a lesser distance, not less than four and one-half inches (11.5 cm), necessary.

(e) When a ladder passes through an opening or past overhead obstructions, a minimum twenty-four inch (.61 m) clearance shall exist between the climbing side and any obstruction. Where this distance is less than thirty inches (0.76 m), a deflection device shall be installed for guidance through the opening.

(f) The side rails of ladders shall extend at least thirty-six inches (0.91 m) above the top landing surface, unless grab bars or equivalent holds are provided.

(g) Ladders whose pitch exceeds ninety degrees to the horizontal (slanting backward on the climbing side) shall not be used.

(5) Protection against falls.

(a) Fixed ladders more than twenty feet (6.1 m) in height shall be provided with a cage, well, or ladder safety device.

(b) When a well or cage is used, ladders with length of climb exceeding thirty feet (9.14 m) shall comply with the following provisions:

(i) The ladder shall consist of multiple sections not exceeding thirty feet (9.14 m) each;

(ii) Each section shall be horizontally offset from adjacent sections, except as specified in (b)(iv) of this subsection; and

(iii) A landing platform capable of supporting a load of one hundred pounds per square foot (4.79 kPa) and fitted with guardrails complying with WAC 296-56-60123(3) shall be provided at least every thirty feet, except as specified in (b)(iv) of this subsection;

(iv) For ladders installed after October 3, 1983, offset sections and landing platforms are not required if hinged platforms capable of supporting one hundred pounds per square foot (4.79 kPa), and which are kept closed except when opened for passage, are within the cage or well at intervals not exceeding thirty feet (9.14 m).

(c) Ladders equipped with ladder safety devices shall have rest platforms:

(i) Capable of supporting a load of one hundred pounds per square foot (4.79 kPa);

(ii) Located at intervals of one hundred fifty feet (46 m) or less; and

(iii) Protected by guardrails complying with WAC 296-56-60123(3) on three sides.

(d) Where used, ladder safety devices shall:

(i) Be installed and maintained in accordance with the manufacturer's instructions, which shall be available for inspection upon request;

(ii) Be repaired only with replacement parts having performance capability at least equal to that of the original parts;

(iii) Have a connection length between carrier centerlines and safety belts of 10 ± 2 inches (25.4 ± 5.08 cm); and

(iv) Be installed in a manner that does not reduce the ladder's structural capacity.

(e) Ladder cages or wells shall:

(i) Be of rigid construction that allows unobstructed use but prevents an employee from falling through or dislodging the cage or well by falling against it;

(ii) Have smooth inner surfaces;

(iii) Extend at least thirty-six inches (0.9 m) above landings; and

(iv) Extend to within eight feet (2.4 m) above the ground or base, except that a maximum of twenty feet (6.1 m) is permitted where the cage or well would extend into traffic lanes.

(f) Ladders installed after January 1, 1985, on radio, microwave communications, electrical power and similar towers, poles and structures, including stacks and chimneys, shall meet the requirements of this subsection.

(6) Individual rung ladders. Ladders consisting of individual rungs that are attached to walls, conical manhole sections or river cells shall:

(a) Be capable of supporting a load of three hundred fifty pounds (1557 N) without deformation;

(b) Form a continuous ladder, uniformly spaced vertically from twelve inches to sixteen inches (30.5 to 41 cm) apart, with a minimum width of ten inches (25.4 cm), and projecting at least four and one-half inches (11.43 cm) from the wall;

(c) Be so constructed that an employee's foot cannot slide off the ends; and

(d) Be firmly attached and without sharp edges.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60209, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60209, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60209, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60209, filed 12/11/84.]

WAC 296-56-60211 Portable ladders. (1) Scope and applicability. This section applies to all portable ladders, including job-made ladders for temporary use, unless otherwise specified.

(2) Standards for existing manufactured portable ladders.

(a) Rungs of manufactured portable ladders obtained before October 3, 1983, shall be capable of supporting a two hundred pound (890 N) load without deformation.

(b) Rungs shall be evenly spaced from nine to sixteen and one-half inches (22.9 to 41.9 cm), center to center.

(c) Rungs shall be continuous members between rails. Each rung of a double-rung ladder (two side rails and a center rail) shall extend the full width of the ladder.

(d) Width between side rails at the base of the ladder shall be at least twelve inches (30 cm) for ladders ten feet (3.05 m) or less in overall length, and shall increase at least one-fourth inch (0.6 cm) for each additional two feet (0.61 m) of ladder length.

(3) Standards for manufactured portable ladders. Manufactured portable ladders obtained after October 3, 1983, shall bear identification indicating that they meet the appropriate ladder construction requirements of the following standards:

ANSI A14.1-1990 Safety Requirements for Portable Wood Ladders

(1999 Ed.)

ANSI A14.2-1990 Safety Requirements for Portable Metal Ladders

ANSI A14.5-1992 Safety Requirements for Portable Reinforced Plastic Ladders

(4) Standards for job-made portable ladders. Job-made ladders shall:

(a) Have a minimum and uniform distance between rungs of twelve inches (30 cm), center to center;

(b) Be capable of supporting a two hundred fifty pound (1112 N) load without deformation; and

(c) Have a minimum width between side rails of twelve inches (30 cm) for ladders ten feet (3.05 m) in height. Width between rails shall increase at least one-fourth inch (0.6 cm) for each additional two feet (0.61 m) of ladder length.

(5) Maintenance and inspection.

(a) The employer shall maintain portable ladders in safe condition. Ladders with the following defects shall not be used and either shall be tagged as unusable if kept on the premises or shall be removed from the worksite:

(i) Broken, split or missing rungs, cleats, or steps;

(ii) Broken or split side rails;

(iii) Missing or loose bolts, rivets, or fastenings;

(iv) Defective ropes; or

(v) Any other structural defect.

(b) Ladders shall be inspected for defects prior to each day's use, and after any occurrence, such as a fall, which could damage the ladder.

(6) Ladder usage.

(a) Ladders made by fastening rungs or devices across a single rail are prohibited.

(b) Ladders shall not be used:

(i) As guys, braces, or skids; or

(ii) As platforms, runways, or scaffolds.

(c) Metal and wire-reinforced ladders with wooden side rails shall not be used when employees on the ladder might come into contact with energized electrical conductors.

(d) Individual sections from different multisectional ladders or two or more single straight ladders shall not be tied or fastened together to achieve additional length.

(e) Except for combination ladders, self-supporting ladders shall not be used as single straight ladders.

(f) Unless intended for cantilever operation, nonself-supporting ladders shall not be used to climb above the top support point.

(g) Ladders shall extend at least thirty-six inches (0.91 m) above the upper support level if employees are to leave or mount the ladder at that level, except that where such extension is impractical other equivalent means such as grab bars may be used to provide a hand grip.

(h) Ladders shall be securely positioned on a level and firm base.

(i) Ladders shall be fitted with slip-resistant bases and secured at top or bottom to prevent the ladder from slipping.

(j) Ladders shall be placed so that employees climbing are not exposed to injury from projecting objects or doors that open toward the ladder.

[Statutory Authority: RCW 49.17.040. 99-02-024, § 296-56-60211, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60211, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60211, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60211, filed 12/11/84.]

WAC 296-56-60213 Jacob's ladders. (1) Jacob's ladders shall be of the double rung or flat tread type. They shall be well maintained and properly secured to the dock.

(2) A Jacob's ladder shall either hang without slack from its lashings or be pulled up entirely.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 85-01-022 (Order 84-24), § 296-56-60213, filed 12/11/84.]

WAC 296-56-60215 Fixed stairways. (1) Definition. "Fixed stairway" means interior or exterior stairs serving machinery, tanks, or equipment, and stairs to or from floors, platforms, or pits. The term does not apply to stairs intended only for fire exit purposes, to articulated stairs (the angle of which changes with the rise and fall of the base support) or to stairs forming an integral part of machinery.

(2) New installations.

(a) Fixed stairs installed after October 3, 1983, shall be positioned within the range of thirty degrees to fifty degrees to the horizontal with uniform riser height and tread width throughout each run and be capable of a minimum loading of one hundred pounds per square foot (448 N) and a minimum concentrated load of three hundred pounds (1344 N) at the center of any treads. Riser height shall be from six to seven and one-half inches (15.2 to 19.0 cm), stair width a minimum of twenty-two inches (56 cm) between vertical barriers, and tread depth a minimum of 12 ± 2 inches (30.48 ± 5.08 cm), and tread nosing shall be straight leading edges.

(b) Stair landings shall be at least twenty inches (51 cm) in depth. Where doors or gates open on a stairway, a landing platform shall be provided. Door swing shall not reduce the effective standing area on the landing to less than eighteen inches (45.7 cm) in depth.

(c) Fixed stairs having four or more risers shall have stair railings or handrails complying with WAC 296-56-60123(3).

(d) The railing height from tread surface at the riser face shall be 33 plus or minus 3 inches (83 plus or minus 7.6 cm).

(e) Restricted areas. When physical features require stairs steeper than those provided for by (a) of this subsection, stairs at angles of fifty degrees to seventy-five degrees from the horizontal may be used if they:

(i) Are capable of supporting a single concentrated load of two hundred pounds (890 N) at the tread centers;

(ii) Have open treads at least four inches (10.2 cm) in depth and eighteen inches (45.7 cm) in width with a uniformly spaced vertical rise between treads of six to nine and one-half inches (15.2 to 24.1 cm); and

(iii) Have handrails that meet the requirements of WAC 296-56-60123(3) on both sides that are not less than thirty inches (76.2 cm) in height from the tread surface at the riser face.

(f) Maintenance. Fixed stairways shall be maintained in safe condition and shall not be obstructed.

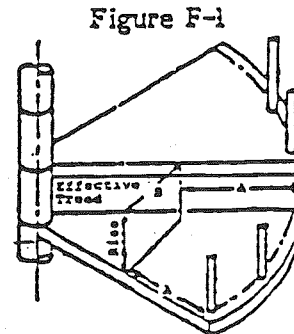
[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-56-60215, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60215, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60215, filed 12/11/84.]

WAC 296-56-60217 Spiral stairways. (1) Definition. "Spiral stairway" means one with closed circular form, uniform sector-shaped treads and a supporting column.

[Title 296 WAC—p. 1250]

(2) Requirements. Spiral stairways shall meet the following requirements:

(a) Stairways shall conform to the minimum dimensions of Figure F-1;



Spiral Stairway—Minimum Dimensions

	A (Half-tread width)	B
Normal use by employees	11 inches (27.9 cm)	6 inches (15.2 cm)
Limited access	9 inches (22.9 cm)	5 inches (12.7 cm)

(b) Stairway risers shall be uniform and shall range from six and one-half to ten and one-half inches (16.5 to 26.7 cm) in height;

(c) Minimum loading capability shall be one hundred pounds per square foot (445 N), and minimum tread center concentrated loading shall be three hundred pounds (1334 N);

(d) Railing shall conform to the requirements of WAC 296-56-60123(3). If balusters are used, there shall be a minimum of one per tread. Handrails shall be a minimum of one and one-fourth inches (3.3 cm) in outside diameter; and

(e) Vertical clearance shall be at least six feet, six inches (1.98 m) above the top step.

(3) Maintenance. Spiral stairways shall be maintained in safe condition.

[Statutory Authority: RCW 49.17.040, 99-02-024, § 296-56-60217, filed 12/30/98, effective 3/30/99. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60217, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60217, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60217, filed 12/11/84.]

WAC 296-56-60219 Employee exits. (1) Employee exits shall be clearly marked.

(2) If an employee exit is not visible from employees' work stations, directional signs indicating routes to the exit shall be posted.

(3) Exits shall be readily accessible and sufficient in number to provide employees with a convenient means of escape in emergencies. A clear passage to the exit shall be maintained.

(4) The minimum width of any employee exit shall be twenty-eight inches (71.1 cm).

(5) All fire exits and aiseways of all docks and warehouses shall be clearly marked and kept clear. All main aiseways shall be wide enough to permit passage of a fire truck.

(6) There shall be a twenty-eight inch clearance maintained where employees use a passageway to an exit.

(7) Every building, structure or crane, new or old, shall be provided with an emergency means of egress to permit the prompt escape of occupants in case of fire or other emergency, at all locations with a vertical height of thirty feet or more. Cranes, buildings, or structures erected prior to January 1, 1985, shall comply with the provisions of this standard by July 1, 1986.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60219, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60219, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60219, filed 12/11/84.]

WAC 296-56-60221 Illumination. Lighting. All areas shall be lighted to meet the requirements of this code.

(1) Active work areas shall be lighted in such a manner that the general area being worked will be illuminated at a minimum intensity of approximately five foot candles measured thirty inches above the dock floor. Supplemental lighting shall be utilized where more than the minimum intensity is necessary for safe operation.

(2) A minimum of three foot candles illumination measured in the manner described above shall be maintained at all points along the bull rail.

(3) The quality of light shall be such that it is reasonably free from glare, and has correct direction, diffusion, and distribution.

(4) Lighting shall not be obstructed by any placement of cargo, structures or other objects which might create a shadow in the work area. Portable lighting shall be provided in those areas that do not meet the minimum requirements of this subsection.

(5) Portable illumination.

(a) All walking and working areas shall be illuminated.

(b) Portable lights shall meet the following requirements:

(i) Portable lights shall be equipped with reflectors and guards to prevent flammable and other material from coming in contact with the bulb, except that guards are not required where the construction of the reflector is such that the bulb is recessed.

(ii) Portable lights shall be equipped with heavy duty electric cords. They may be suspended by such cords only when the means of attachment of the cord to the light is such as to prevent the light from being suspended by the electrical connections.

(iii) All connections and insulation shall be maintained.

(iv) Lighting wires and fixtures for portable lights shall be so arranged as to be free from contact with drafts, running gear, or other moving equipment.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60221, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60221, filed 12/11/84.]

(1999 Ed.)

WAC 296-56-60223 Passage between levels and across openings. (1) General. The employer shall provide safe means of passage between different surface levels and across openings.

(2) Definitions.

(a) "Dockboards (car and bridge plates)" mean devices for spanning short distances between rail cars or highway vehicles and loading platforms which do not expose employees to falls greater than four feet (1.2 m).

(b) "Ramps" means other flat-surface devices for passage between levels and across openings not included in "dockboards."

(3) Dockboards (car and bridge plates).

(a) Dockboards shall be strong enough to support the loads imposed on them.

(b) Portable dockboards shall be anchored in position or be equipped with devices to prevent their movement.

(c) Hand holds or other effective means shall be provided on portable dockboards to permit safe handling.

(d) Positive means shall be used to prevent railcars or highway vehicles from being moved while dockboards or bridge plates are in position.

(4) Ramps.

(a) Ramps shall be strong enough to support the loads imposed on them, provided with sideboards, properly secured and well maintained.

(b) Ramps shall be equipped with guardrails meeting the requirements of WAC 296-56-60123(3) if the slope is more than twenty degrees to the horizontal or if employees could fall more than four feet (1.2 m).

(c) Ramps shall have slip-resistant surfaces.

(d) When necessary to prevent displacement by vehicle wheels, steel plates or similar devices, used to temporarily bridge or cover uneven surfaces or tracks, shall be anchored.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60223, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60223, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60223, filed 12/11/84.]

WAC 296-56-60225 Guarding temporary hazards. Ditches, pits, excavations, and surfaces in poor repair shall be guarded by readily visible barricades, rails or other equally effective means.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60225, filed 12/11/84.]

WAC 296-56-60227 River banks. (1) This section applies to temporary installations or temporary operations near a river bank.

(2) Where working surfaces at river banks slope so steeply that an employee could slip or fall into the water, the employer shall ensure that the outer perimeter of the working surface is protected by posting or other portable protection such as roping off, and that employees wear a personal flotation device meeting the requirements of WAC 296-56-60115(2).

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-56-60227, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60227, filed 12/11/84.]

[Title 296 WAC—p. 1251]

WAC 296-56-60229 Sanitation. (1) Washing and toilet facilities.

(a) The employer shall provide accessible washing and toilet facilities sufficient for the sanitary requirements of employees. The facilities shall have:

(i) Running water, including hot and cold or tepid water (when cargo handling is conducted at locations without permanent facilities, containers of potable water may be provided in lieu of running water);

(ii) Soap;

(iii) Individual hand towels, clean individual sections of continuous toweling or warm air blowers; and

(iv) Fixed or portable toilets in separate compartments with latch-equipped doors.

(b) Separate toilet facilities shall be provided for male and female employees except when toilet rooms are occupied by only one person at a time. A means of locking shall be provided.

(c) Washing and toilet facilities shall be regularly cleaned and maintained in good order.

(2) Drinking water.

(a) Potable drinking water shall be accessible to employees at all times.

(b) Potable drinking water containers shall be clean, containing only water and ice, and shall be fitted with covers.

(c) Common drinking cups are prohibited.

(3) Prohibited eating areas. Consumption of food or beverages in areas where hazardous materials are being stored or handled shall be prohibited.

(4) Garbage and overboard discharges. Work shall not be conducted in the immediate vicinity of uncovered garbage or in the area of overboard discharges from the vessel's sanitary lines unless employees are protected from the garbage or discharge by a baffle or splash boards.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60229, filed 10/30/92, effective 12/8/92. Statutory Authority: Chapter 49.17 RCW. 91-11-070 (Order 91-01), § 296-56-60229, filed 5/20/91, effective 6/20/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60229, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60229, filed 12/11/84.]

WAC 296-56-60231 Signs and marking. (1) General. Signs required by this chapter shall be clearly worded and legible. They shall contain a key word or legend indicating the reason for the sign.

(a) Key words are such words as danger, warning, caution.

(b) Legends are more specific explanations such as high voltage, close clearance, pedestrian crossing.

(2) Specific. Every marine terminal shall have conspicuously posted signs as follows:

(a) Locations of first-aid facilities;

(b) Locations of telephones;

(c) Telephone numbers of the closest ambulance service, hospital or other source of medical attention, police, fire department, and emergency squad (if any); and

(d) Locations of fire fighting and emergency equipment and fire exits.

[Title 296 WAC—p. 1252]

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60231, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60231, filed 12/11/84.]

PART K—RELATED TERMINAL OPERATIONS AND EQUIPMENT

WAC 296-56-60233 Related terminal operations and equipment—Machine guarding. (1) Definition. "Guarded" means shielded, fenced, or enclosed by covers, casings, shields, troughs, spillways or railings, or guarded by position or location. Examples of guarding methods are guarding by location (positioning hazards so they are inaccessible to employees) and point of operation guarding (using barrier guards, two-hand tripping devices, electronic safety devices, or other such devices).

(2) General.

(a) Danger zones on machines and equipment used by employees shall be guarded.

(b) Where chips and dust produced by machine operation may result in a hazard to the operator, the machinery shall be equipped with an effective exhaust system at the point of origin, or other equally effective means shall be provided to protect the operator.

(c) Fixed machinery shall be secured to prevent shifting.

(d) A power cut-off device for machinery and equipment shall be provided at the operator's working position.

(e) Machines driven by belts and shafting shall be fitted with a belt-locking or equivalent protective device if the belt can be shifted.

(f) In operations where injury to the operator might result if motors were to restart after power failures, provisions shall be made to prevent machines from automatically restarting upon restoration of power.

(g) The power supply to machines shall be turned off, locked out, and tagged out during repair, adjustment, or servicing.

(h) Machines shall be maintained in a safe working condition.

(i) Only designated employees shall maintain or repair machinery and equipment.

(j) Machines with defects that affect the safety of operation shall not be used.

(3) Hand-fed circular rip saws and hand-fed circular crosscut table saws. Unless fixed or manually adjustable enclosures or guarding provides equivalent protection, hand-fed circular rip saws and hand-fed circular crosscut table saws shall be guarded as follows:

(a) They shall be equipped with hoods completely enclosing those portions of the saw above the table and the material being cut;

(b) They shall have spreaders to prevent material from squeezing the saw. Spreaders shall be in true alignment with the saw. Spreaders may be removed only during grooving, dadoing, or rabbeting operations, and shall be replaced at the completion of such operations; and

(c) They shall have nonkickback fingers or dogs to oppose the tendency of the saw to pick up material or throw material toward the operator.

(4) Swing cutoff saws.

(1999 Ed.)

(a) Swing cutoff saws shall have hoods completely enclosing the upper half of the saw, the arbor end and the point of operation at all saw positions to protect the operator from material thrown up by the saw. The hood shall automatically cover the lower portion of the blade so that when the saw returns to the back of the table the hood rises on top of the fence, and when the saw is moved forward the hood drops on top, remaining in contact with the table or the material.

(b) Swing cutoff saws shall have a device to return the saw automatically to the back of the table without rebound. The device shall not be dependent upon rope, cord or springs.

(c) Devices shall be provided to prevent saws from swinging beyond the front or back edges of the table.

(d) Inverted swing cutoff saws shall have hoods covering the part of the saw protruding above the table top or the material being cut. Hoods shall automatically adjust to the thickness of, and remain in contact with, material being cut.

(5) Radial saws. Unless fixed or manually adjustable enclosures or guards provide equivalent protection, radial saws shall be guarded as follows:

(a) The upper hood of radial saws shall enclose the upper portion of the blade up to and including the end of the saw arbor and shall protect the operator from being struck by debris. The sides of the lower exposed portion of the blade shall be guarded to the blade diameter by a device automatically adjusting to the thickness of the stock and remaining in contact with the stock. The lower guard may be removed only when the saw is used for bevel cuts;

(b) Radial saws used for ripping shall have nonkickback fingers or dogs on both sides to oppose the thrust or tendency of the saw to pick up material or throw material toward the operator;

(c) An adjustable stop shall be provided to prevent travel of radial saw blades beyond the table's edge;

(d) Radial saws shall be installed so that the cutting head returns to the starting position without rebound when released; and

(e) The employer shall direct that employees perform ripping and ploughing against the saw turning direction. Rotation direction and an indication of the end of the saw to be used shall be conspicuously marked on the hood.

(6) Band saws and band resaws.

(a) Saw blades and band saw wheels shall be enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table, to protect employees from point-of-operation hazards and flying debris.

(b) Band saws shall be equipped with brakes to stop the band saw wheel if the blade breaks.

(c) Band saws shall be equipped with a tension control device to keep the blade taut.

(7) Abrasive wheels and machinery.

(a) Abrasive wheels shall be used only on machines having enclosure guards to restrain pieces of grinding wheels and to protect employees if the wheel breaks, except as provided in (b) and (c) of this subsection. Where the operator stands in front of the safety guard opening, the safety guard shall be adjustable or have an adjustable tongue or piece at the top of the opening. The safety guard or the tongue shall be adjusted so that it is always within one-fourth inch of the periphery of the wheel. Guards shall be aligned with the wheel and the

strength of fastenings shall be greater than the strength of the guard.

(b) When the work provides equivalent protection, or when the machine is designed as a portable saw, guards may be constructed with the spindle end, nut and outer flange exposed. When the work entirely covers the side of the wheel, the side covers of the guard may be removed.

(c) Guarding is not required:

(i) For wheels used for internal work while the wheel is contained within the work being ground; or

(ii) For mounted wheels two inches (5 cm) and smaller in diameter used in portable operations.

(d) Work rests shall be used on fixed grinding machines. Work rests shall be rigidly constructed and adjustable for wheel wear. They shall be adjusted closely to the wheel with a maximum opening of one-eighth inch (3.2 mm) and shall be securely clamped. Adjustment shall not be made while the wheel is in motion.

(e) Grinding wheels shall fit freely on the spindle. The spindle nut shall be tightened only enough to hold the wheel in place.

(f) Grinding machine wheels shall turn at a speed that is compatible with the rated speed of the wheel.

(g) Flanges and blotters shall be used only with wheels designed for their use. Flanges shall be of a type ensuring retention of pieces of the wheel in case of breakage.

(h) Abrasive wheels with operational defects shall not be used.

(8) Rotating parts, drives and connections.

(a) Rotating parts, such as gears and pulleys, that are located seven feet (2.1 m) or less above working surfaces shall be guarded to prevent employee contact with moving parts.

(b) Belt, rope and chain drives shall be guarded to prevent employees from coming into contact with moving parts.

(c) Gears, sprockets and chains shall be guarded to prevent employees coming into contact with moving parts. This requirement does not apply to manually operated sprockets.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60233, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60233, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60233, filed 12/11/84.]

WAC 296-56-60235 Welding, cutting and heating (hot work). (1) Definition. "Hot work" means riveting, welding, flame cutting or other fire or spark-producing operation.

(2) Hot work in confined spaces. Hot work shall not be performed in a confined space until all requirements of chapter 296-62 WAC, Part M, are met.

(3) Fire protection.

(a) To the extent possible, hot work shall be performed in designated locations that are free of fire hazards.

(b) When hot work must be performed in a location that is not free of fire hazards, all necessary precautions shall be taken to confine heat, sparks, and slag so that they cannot contact flammable or combustible material.

(c) Fire extinguishing equipment suitable for the location shall be immediately available and shall be maintained in readiness for use at all times.

(d) When the hot work operation is such that normal fire prevention precautions are not sufficient, additional personnel shall be assigned to guard against fire during hot work and for a sufficient time after completion of the work to ensure that no fire hazard remains. The employer shall instruct all employees involved in hot work operations as to potential fire hazards and the use of fire fighting equipment.

(e) Drums and containers which contain or have contained flammable or combustible liquids shall be kept closed. Empty containers shall be removed from the hot work area.

(f) When openings or cracks in flooring cannot be closed, precautions shall be taken to ensure that no employees or flammable or combustible materials are exposed to sparks dropping through the floor. Similar precautions shall be taken regarding cracks or holes in walls, open doorways and open or broken windows.

(g) Hot work shall not be performed:

(i) In flammable or potentially flammable atmospheres;

(ii) On or in equipment or tanks that have contained flammable gas or liquid or combustible liquid or dust-producing material, until a designated person has tested the atmosphere inside the equipment or tanks and determined that it is not hazardous; or

(iii) Near any area in which exposed readily ignitable materials such as bulk sulphur, baled paper or cotton are stored. Bulk sulphur is excluded from this prohibition if suitable precautions are followed, the person in charge is knowledgeable and the person performing the work has been instructed in preventing and extinguishing sulphur fires.

(h)(i) Drums, containers or hollow structures that have contained flammable or combustible substances shall either be filled with water or cleaned, and shall then be ventilated. A designated person shall test the atmosphere and determine that it is not hazardous before hot work is performed on or in such structures.

(ii) Before heat is applied to a drum, container or hollow structure, an opening to release built-up pressure during heat application shall be provided.

(4) Gas welding and cutting.

(a) Compressed gas cylinders:

(i) Shall have valve protection caps in place except when in use, hooked up or secured for movement. Oil shall not be used to lubricate caps;

(ii) Shall be hoisted only while secured, as on a cradle or pallet, and shall not be hoisted by magnet, choker sling or cylinder caps;

(iii) Shall be moved only by tilting or rolling on their bottom edges;

(iv) Shall be secured when moved by vehicle;

(v) Shall be secured while in use;

(vi) Shall have valves closed when cylinders are empty, being moved or stored;

(vii) Shall be secured upright except when hoisted or carried;

(viii) Shall not be freed when frozen by prying the valves or caps with bars or by hitting the valve with a tool;

(ix) Shall not be thawed by boiling water;

(x) Shall not be exposed to sparks, hot slag, or flame;

(xi) Shall not be permitted to become part of electrical circuits or have electrodes struck against them to strike arcs;

(xii) Shall not be used as rollers or supports;

(xiii) Shall not have contents used for purposes not authorized by the supplier;

(xiv) Shall not be used if damaged or defective;

(xv) Shall not have gases mixed within, except by gas suppliers;

(xvi) Shall be stored so that oxygen cylinders are separated from fuel gas cylinders and combustible materials by either a minimum distance of twenty feet (6 m) or a barrier having a fire-resistance rating of thirty minutes; and

(xvii) Shall not have objects that might either damage the safety device or obstruct the valve placed on top of the cylinder when in use.

(b) Use of fuel gas. Fuel gas shall be used only as follows:

(i) Before regulators are connected to cylinder valves, the valves shall be opened slightly (cracked) and closed immediately to clear away dust or dirt. Valves shall not be cracked if gas could reach possible sources of ignition;

(ii) Cylinder valves shall be opened slowly to prevent regulator damage and shall not be opened more than one and one-half turns. Any special wrench required for emergency closing shall be positioned on the valve stem during cylinder use. For manifolded or coupled cylinders, at least one wrench shall be immediately available. Nothing shall be placed on top of a cylinder or associated parts when the cylinder is in use;

(iii) Pressure-reducing regulators shall be attached to cylinder valves when cylinders are supplying torches or devices equipped with shut-off valves;

(iv) Cylinder valves shall be closed and gas released from the regulator or manifold before regulators are removed;

(v) Leaking fuel gas cylinder valves shall be closed and the gland nut tightened. If the leak continues, the cylinder shall be tagged, removed from service, and moved to a location where the leak will not be hazardous. If a regulator attached to a valve stops a leak, the cylinder need not be removed from the workplace but shall be tagged and may not be used again before it is repaired; and

(vi) If a plug or safety device leaks, the cylinder shall be tagged, removed from service, and moved to a location where the leak will not be hazardous.

(c) Hose.

(i) Fuel gas and oxygen hoses shall be easily distinguishable from each other by color or sense of touch. Oxygen and fuel hoses shall not be interchangeable. Hoses having more than one gas passage shall not be used.

(ii) When oxygen and fuel gas hoses are taped together, not more than four of each twelve inches (10.2 cm of each 30.5 cm) shall be taped.

(iii) Hose shall be inspected before use. Hose subjected to flashback or showing evidence of severe wear or damage shall be tested to twice the normal working pressure but not less than two hundred p.s.i. (1378.96 kPa) before re-use. Defective hose shall not be used.

(iv) Hose couplings shall not unlock or disconnect without rotary motion.

(v) Hose connections shall be clamped or securely fastened to withstand twice the normal working pressure but not less than three hundred p.s.i. (2068.44 kPa) without leaking.

(vi) Gas hose storage boxes shall be ventilated.

(d) Torches.

(i) Torch tip openings shall only be cleaned with devices designed for that purpose.

(ii) Torches shall be inspected before each use for leaking shut-off valves, hose couplings and tip connections. Torches shall be inspected before each use for leaking shut-off valves, hose couplings and tip connections. Torches with such defects shall not be used.

(iii) Torches shall not be lighted from matches, cigarette lighters, other flames or hot work.

(e) Pressure regulators. Pressure regulators, including associated gauges, shall be maintained in safe working order.

(f) Operational precaution. Gas welding equipment shall be maintained free of oil and grease.

(5) Arc welding and cutting.

(a) Manual electrode holders.

(i) The employer shall ensure that only manual electrode holders intended for arc welding and cutting and capable of handling the maximum current required for such welding or cutting shall be used.

(ii) Current-carrying parts passing through those portions of the holder gripped by the user and through the outer surfaces of the jaws of the holder shall be insulated against the maximum voltage to ground.

(b) Welding cables and connectors.

(i) Arc welding and cutting cables shall be insulated, flexible and capable of handling the maximum current required by the operation, taking into account the duty cycles.

(ii) Only cable free from repair or splice for ten feet (3 m) from the electrode holder shall be used unless insulated connectors or splices with insulating quality equal to that of the cable are provided.

(iii) When a cable other than the lead mentioned in (b)(ii) of this subsection wears and exposes bare conductors, the portion exposed shall not be used until it is protected by insulation equivalent in performance capacity to the original.

(iv) Insulated connectors of equivalent capacity shall be used for connecting or splicing cable. Cable lugs, where used as connectors, shall provide electrical contact. Exposed metal parts shall be insulated.

(c) Ground returns and machine grounding.

(i) Ground return cables shall have current-carrying capacity equal to or exceeding the total maximum output capacities of the welding or cutting units served.

(ii) Structures or pipelines, other than those containing gases or flammable liquids or conduits containing electrical circuits, may be used in the ground return circuit if their current-carrying capacity equals or exceeds the total maximum output capacities of the welding or cutting units served.

(iii) Structures or pipelines forming a temporary ground return circuit shall have electrical contact at all joints. Arcs, sparks or heat at any point in the circuit shall cause rejection as a ground circuit.

(iv) Structures or pipelines acting continuously as ground return circuits shall have joints bonded and maintained to ensure that no electrolysis or fire hazard exists.

(v) Arc welding and cutting machine frames shall be grounded, either through a third wire in the cable containing the circuit conductor or through a separate wire at the source of the current. Grounding circuits shall have resistance low enough to permit sufficient current to flow to cause the fuse or circuit breaker to interrupt the current.

(vi) Ground connections shall be mechanically and electrically adequate to carry the current.

(d) When electrode holders are left unattended, electrodes shall be removed and holders placed to prevent employee injury.

(e) Hot electrode holders shall not be dipped in water.

(f) The employer shall ensure that when arc welders or cutters leave or stop work or when machines are moved, the power supply switch is kept in the off position.

(g) Arc welding or cutting equipment having a functional defect shall not be used.

(h)(i) Arc welding and cutting operations shall be separated from other operations by shields, screens, or curtains to protect employees in the vicinity from the direct rays and sparks of the arc.

(ii) Employees in areas not protected from the arc by screening shall be protected by appropriate filter lenses in accordance with subsection (8) of this section. When welders are exposed to their own arc or to each other's arc, they shall wear filter lenses complying with the requirements of subsection (8) of this section.

(i) The control apparatus of arc welding machines shall be enclosed, except for operating wheels, levers, and handles.

(j) Input power terminals, top change devices and live metal parts connected to input circuits shall be enclosed and accessible only by means of insulated tools.

(k) When arc welding is performed in wet or high-humidity conditions, employees shall use additional protection, such as rubber pads or boots, against electric shock.

(6) Ventilation and employee protection in welding, cutting and heating.

(a) Mechanical ventilation requirements. The employer shall ensure that general mechanical ventilation or local exhaust systems shall meet the following requirements:

(i) General mechanical ventilation shall maintain vapors, fumes and smoke below a hazardous level;

(ii) Local exhaust ventilation shall consist of movable hoods positioned close to the work and shall be of such capacity and arrangement as to keep breathing zone concentrations below hazardous levels;

(iii) Exhausts from working spaces shall be discharged into the open air, clear of intake air sources;

(iv) Replacement air shall be clean and respirable; and

(v) Oxygen shall not be used for ventilation, cooling or cleaning clothing or work areas.

(b) Hot work in confined spaces. Except as specified in (c)(ii) and (iii) of this subsection, when hot work is performed in a confined space the employer shall, in addition to the requirements of chapter 296-62 WAC, Part M, ensure that:

(i) General mechanical or local exhaust ventilations shall be provided; or

(ii) Employees in the space shall wear supplied air respirators in accordance with WAC 296-62-071 et seq. and a

standby observer on the outside shall maintain communication with employees inside the space and shall be equipped and prepared to provide emergency aid.

(c) Welding, cutting or heating of toxic metals.

(i) In confined or enclosed spaces, hot work involving the following metals shall only be performed with general mechanical or local exhaust ventilation that ensures that employees are not exposed to hazardous levels of fumes:

- (A) Lead base metals;
- (B) Cadmium-bearing filler materials; and
- (C) Chromium-bearing metals or metals coated with chromium-bearing materials.

(ii) In confined or enclosed spaces, hot work involving the following metals shall only be performed with local exhaust ventilation meeting the requirements of this subsection or by employees wearing supplied air respirators in accordance with chapter 296-62 WAC;

- (A) Zinc-bearing base or filler metals or metals coated with zinc-bearing materials;
- (B) Metals containing lead other than as an impurity, or coated with lead-bearing materials;
- (C) Cadmium-bearing or cadmium-coated base metals; and
- (D) Metals coated with mercury-bearing materials.

(iii) Employees performing hot work in confined or enclosed spaces involving beryllium-containing base or filler metals shall be protected by local exhaust ventilation and wear supplied air respirators or self-contained breathing apparatus, in accordance with the requirements of chapter 296-62 WAC.

(iv) The employer shall ensure that employees performing hot work in the open air that involves any of the metals listed in (c)(i) and (ii) of this subsection shall be protected by respirators in accordance with the requirements of chapter 296-62 WAC and those working on beryllium-containing base or filler metals shall be protected by supplied air respirators, in accordance with the requirements of chapter 296-62 WAC.

(v) Any employee exposed to the same atmosphere as the welder or burner shall be protected by the same type of respiratory and other protective equipment as that worn by the welder or burner.

(d) Inert-gas metal-arc welding. Employees shall not engage in and shall not be exposed to the inert-gas metal-arc welding process unless the following precautions are taken:

(i) Chlorinated solvents shall not be used within two hundred feet (61 m) of the exposed arc. Surfaces prepared with chlorinated solvents shall be thoroughly dry before welding is performed on them.

(ii) Employees in areas not protected from the arc by screening shall be protected by appropriate filter lenses in accordance with the requirements of subsection (8) of this section. When welders are exposed to their own arc or to each other's arc, filter lenses complying with the requirements of subsection (8) of this section shall be worn to protect against flashes and radiant energy.

(iii) Employees exposed to radiation shall have their skin covered completely to prevent ultraviolet burns and damage. Helmets and hand shields shall not have leaks, openings or highly reflective surfaces.

(iv) Inert-gas metal-arc welding on stainless steel shall not be performed unless exposed employees are protected either by local exhaust ventilation or by wearing supplied air respirators.

(7) Welding, cutting and heating on preservative coatings.

(a) Before hot work is commenced on surfaces covered by a preservative coating of unknown flammability, a test shall be made by a designated person to determine the coating's flammability. Preservative coatings shall be considered highly flammable when scrapings burn with extreme rapidity.

(b) Appropriate precaution shall be taken to prevent ignition of highly flammable hardened preservative coatings. Highly flammable coatings shall be stripped from the area to be heated. An uncoiled fire hose with fog nozzle, under pressure, shall be immediately available in the hot work area.

(c) Surfaces covered with preservative coatings shall be stripped for at least four inches (10.2 cm) from the area of heat application or employees shall be protected by supplied air respirators in accordance with the requirements of chapter 296-62 WAC.

(8) Protection against radiant energy.

(a) Employees shall be protected from radiant energy eye hazards by spectacles, cup goggles, helmets, hand shields or face shields with filter lenses complying with the requirements of this subsection.

(b) Filter lenses shall have an appropriate shade number, as indicated in Table G-1, for the work performed. Variations of one or two shade numbers are permissible to suit individual preferences.

(c) If filter lenses are used in goggles worn under the helmet, the shade numbers of both lenses equals the value shown in Table G-1 for the operation.

Table G-1.—Filter Lenses for Protection Against Radiant Energy

Operation	Shade No.
Soldering	2
Torch Brazing	3 or 4
Light cutting, up to 1 inch	3 or 4
Medium cutting, 1-6 inches	4 or 5
Heavy cutting, over 6 inches	5 or 6
Light gas welding, up to 1/8 inch	4 or 5
Medium gas welding, 1/8-1/2 inch	5 or 6
Heavy gas welding, over 1/2 inch	6 or 8
Shielded Metal-Arc Welding 1/16 to 5/32-inch electrodes	10
Inert gas Metal-Arc Welding (non-ferrous) 1/16 to 5/32-inch electrodes	11
Shielded Metal-Arc Welding: 3/16 to 1/4-inch electrodes	12
5/16 and 3/8-inch electrodes	14

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-56-60235, filed 1/18/95, effective 3/1/95. Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60235, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60235, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60235, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60235, filed 12/11/84.]

WAC 296-56-60237 Spray painting. (1) Scope. This section covers painting operations connected with maintenance of structures, equipment and gear at the marine terminal and of transient equipment serviced at the terminal. It does not apply to overall painting of terminal structures under construction, major repair or rebuilding of terminal structures, or portable spraying apparatus not used regularly in the same location.

(2) Definitions.

(a) "Spraying area" means any area where flammable vapors, mists or combustible residues, dusts or deposits may be present due to paint spraying operations.

(b) "Spray booth" means an enclosure containing a flammable or combustible spraying operation and confining and limiting the escape of paint, vapor and residue by means of a powered exhaust system.

(c) "Approved" means, for the purpose of this section, that the equipment has been approved for the specified use by a nationally recognized testing laboratory.

(3) Spray painting requirements for indoor and outdoor spraying areas and booths.

(a) Shut-off valves, containers or piping with attached hoses or flexible connections shall have shut-off valves closed at the connection when not in use.

(b) Pumps used to transfer paint supplies shall have automatic pressure-relieving devices.

(c) Hoses and couplings shall be inspected before use. Hoses showing deterioration, leakage or weakness in the carcass or at the couplings shall be removed from service.

(d)(i) No open flame or spark-producing equipment shall be within twenty feet (6 m) of a spraying area unless it is separated from the spraying area by a fire-retardant partition.

(ii) Hot surfaces shall not be located in spraying areas.

(iii) Whenever combustible residues may accumulate on electrical installations, wiring shall be in rigid conduit or in boxes containing no taps, splices or connections.

(iv) Portable electric lights shall not be used during spraying operations. Lights used during cleaning or repairing operations shall be approved for the location in which they are used.

(e) When flammable or combustible liquids are being transferred between containers, both containers shall be bonded and grounded.

(f)(i) Spraying shall be performed only in designated spray booths or spraying areas.

(ii) Spraying areas shall be kept as free from combustible residue accumulations as practical.

(iii) Residue scrapings, debris, rags, and waste shall be removed from the spraying area as they accumulate.

(g) Spraying with organic peroxides and other dual-component coatings shall only be conducted in sprinkler-equipped spray booths.

(h) Only the quantity of flammable or combustible liquids required for the operation shall be allowed in the spraying area, and in no case shall the amount exceed a one-day supply.

(i) Smoking shall be prohibited and "No Smoking" signs shall be posted in spraying and paint storage areas.

(4) Additional requirements for spraying areas and spray booths.

(a) Distribution or baffle plates shall be of noncombustible material and shall be removable or accessible for cleaning. They shall not be located in exhaust ducts.

(b) Any discarded filter shall be removed from the work area or placed in water.

(c) Filters shall not be used when the material being sprayed is highly susceptible to spontaneous heating and ignition.

(d) Filters shall be noncombustible or of an approved type. The same filter shall not be used when spraying with different coating materials if the combination of materials may spontaneously ignite.

(e) Spraying areas shall be mechanically ventilated for removal of flammable and combustible vapor and mist.

(f) Mechanical ventilation shall be in operation during spraying operations and long enough thereafter to exhaust hazardous vapor concentrations.

(g) Rotating fan elements shall be nonsparking or the casing shall consist of or be lined with nonsparking material.

(h) Piping systems conveying flammable or combustible liquids to the spraying booth or area shall be made of metal and be both electrically bonded and grounded.

(i) Air exhausted from spray operations shall not contaminate makeup air or other ventilation intakes. Exhausted air shall not be recirculated unless it is first cleaned of any hazardous contaminants.

(j) Original closed containers, approved portable tanks, approved safety cans or a piping system shall be used to bring flammable or combustible liquids into spraying areas.

(k) If flammable or combustible liquids are supplied to spray nozzles by positive displacement pumps, the pump discharge line shall have a relief valve discharging either to a pump section or detached location, or the line shall be equipped with a device to stop the prime mover when discharge pressure exceeds the system's safe operating pressure.

(l) Wiring, motors and equipment in a spray booth shall be of approved explosion-proof type for Class I, Group D locations and conform with the requirements of chapter 296-24 WAC Part L for Class I, Division 1, Hazardous Locations. Wiring, motors and equipment within twenty feet (6 m) of any interior spraying area and not separated by vapor-tight partitions shall not produce sparks during operation and shall conform to the requirements of chapter 296-24 WAC Part L for Class I, Division 2, Hazardous Locations.

(m) Outside electrical lights within ten feet (3 m) of spraying areas and not separated from the areas by partitions shall be enclosed and protected from damage.

(5) Additional requirements for spray booths.

(a) Spray booths shall be substantially constructed of noncombustible material and have smooth interior surfaces. Spray booth floors shall be covered with noncombustible material. As an aid to cleaning, paper may be used to cover the floor during painting operations if it is removed after the painting is completed.

(b) Spray booths shall be separated from other operations by at least 3 feet (0.91 m) or by fire-retardant partitions or walls.

(c) A space of at least 3 feet (0.91 m) on all sides of the spray booth shall be maintained free of storage or combustible materials.

(d) Metal parts of spray booths, exhaust ducts, pipings, airless high-pressure spray guns and conductive objects being sprayed shall be grounded.

(e) Electric motors driving exhaust fans shall not be located inside booths or ducts.

(f) Belts shall not enter ducts or booths unless the belts are completely enclosed.

(g) Exhaust ducts shall be made of steel, shall have sufficient access doors to permit cleaning, and shall have a minimum clearance of 18 inches (0.46 m) from combustible materials. Any installed dampers shall be fully opened when the ventilating system is operating.

(h) Spray booths shall not be alternately used to spray different types of coating materials if the combination of the materials may spontaneously ignite unless deposits of the first material are removed from the booth and from exhaust ducts before spraying of the second material begins.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60237, filed 10/30/92, effective 12/8/92. Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-56-60237, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60237, filed 1/17/86; 85-10-004 (Order 85-09), § 296-56-60237, filed 4/19/85; 85-01-022 (Order 84-24), § 296-56-60237, filed 12/11/84.]

WAC 296-56-60239 Compressed air. Employees shall be protected by appropriate eye protection and personal protective equipment complying with the requirements of WAC 296-56-60109 through 296-56-60115 during cleaning with compressed air. Compressed air used for cleaning shall not exceed a pressure of thirty p.s.i. Compressed air shall not be used to clean employees.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060. 92-22-067 (Order 92-06), § 296-56-60239, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60239, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60239, filed 12/11/84.]

WAC 296-56-60241 Air receivers. (1) Application. This section applies to compressed air receivers and equipment used for operations such as cleaning, drilling, hoisting and chipping. It does not apply to equipment used to convey materials or in transportation applications such as railways, vehicles or cranes.

(2) Gauges and valves.

(a) Air receivers shall be equipped with indicating pressure gauges and spring-loaded safety valves. Safety valves shall prevent receiver pressure from exceeding one hundred ten percent of the maximum allowable working pressure.

(b) No other valves shall be placed between air receivers and their safety valves.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60241, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60241, filed 12/11/84.]

WAC 296-56-60243 Fuel handling and storage. (1) Liquid fuel. See WAC 296-24-475 through 296-24-47517.

(a) Only designated persons shall conduct fueling operations.

(b) In case of spillage, filler caps shall be replaced and spillage disposed of before engines are started.

(c) Engines shall be stopped and operators shall not be on the equipment during refueling operations.

(d) Smoking and open flames shall be prohibited in areas used for fueling, fuel storage or enclosed storage of equipment containing fuel.

(e) Equipment shall be refueled only at designated locations.

(f) Liquid fuels not handled by pump shall be handled and transported only in portable containers designed for that purpose. Portable containers shall be metal, have tight closures with screw or spring covers and shall be equipped with spouts or other means to allow pouring without spilling. Leaking containers shall not be used.

(g) Flammable liquids shall only be dispensed in the open from a tank or from other vehicles equipped for delivering fuel to another vehicle if:

(i) Dispensing hoses do not exceed fifty feet (15.2 m) in length; and

(ii) Any powered dispensing nozzles are of the automatic-closing type.

(h) Liquid fuel dispensing devices shall be provided with an easily accessible and clearly identified shut-off device, such as a switch or circuit breaker, to shut off the power in an emergency.

(i) Liquid fuel dispensing devices, such as pumps, shall be mounted either on a concrete island or be otherwise protected against collision damage.

(2) Liquefied gas fuels.

(a) Fueling locations.

(i) Liquefied gas powered equipment shall be fueled only at designated locations.

(ii) Equipment with permanently mounted fuel containers shall be charged outdoors.

(iii) Equipment shall not be fueled or stored near underground entrances, elevator shafts or other places where gas or fumes might accumulate.

(b) Fuel containers.

(i) When removable fuel containers are used, the escape of fuel when containers are exchanged shall be minimized by:

(A) Automatic quick-closing couplings (closing in both directions when uncoupled) in fuel lines; or

(B) Closing fuel container valves and allowing engines to run until residual fuel is exhausted.

(ii) Pressure-relief valve openings shall be in continuous contact with the vapor space (top) of the cylinder.

(iii) Fuel containers shall be secured to prevent their being jarred loose, slipping or rotating.

(iv) Containers shall be located to prevent damage to the container. If located within a compartment, that compartment shall be vented. Containers near the engine or exhaust system shall be shielded against direct heat radiation.

(v) Container installation shall provide the container with at least the vehicle's road clearance under maximum spring deflection, measured from the bottom of the container or to the lowest fitting on the container or housing, whichever is lower.

(vi) Valves and connections shall be protected from contact damage. Permanent protection shall be provided for fittings on removable containers.

(vii) Defective containers shall be removed from service.

(c) Fueling operations. See WAC 296-24-47517.

(i) Fueling operations for liquefied gas fuels shall also comply with the requirements of subsection (1) of this section.

(ii) Using matches or flames to check for leaks is prohibited.

(iii) Containers shall be examined before recharging and again before reuse for the following:

(A) Dents, scrapes and gouges of pressure vessels;

(B) Damage to valves and liquid level gauges;

(C) Debris in relief valves;

(D) Leakage at valves or connections; and

(E) Deterioration or loss of flexible seals in filling or servicing connections.

(d) Fuel storage. See WAC 296-24-47517(6).

(i) Stored fuel containers shall be located to minimize exposure to excessive temperatures and physical damage.

(ii) Containers shall not be stored near exits, stairways or areas normally used or intended for egress.

(iii) Outlet valves of containers in storage or transport shall be closed. Relief valves shall connect with vapor spaces.

(e) Vehicle storage and servicing.

(i) Liquefied gas fueled vehicles may be stored or serviced inside garages or shops only if there are no fuel system leaks.

(ii) Liquefied gas fueled vehicles under repair shall have container shut-off valves closed unless engine operation is necessary for repairs.

(iii) Liquefied gas fueled vehicles shall not be parked near open flames, sources of ignition or unventilated open pits.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60243, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60243, filed 12/11/84.]

WAC 296-56-60245 Battery charging and changing.

(1) Only designated persons shall change or charge batteries.

(2) Battery charging and changing shall be performed only in areas designated by the employer.

(3) Smoking and other ignition sources are prohibited in charging areas.

(4) Filler caps shall be in place when batteries are being moved.

(5) Parking brakes shall be applied before batteries are charged or changed.

(6) When a jumper battery is connected to a battery in a vehicle, the ground lead shall connect to ground away from the vehicle's battery. Ignition, lights and accessories on the vehicle shall be turned off before connections are made.

(7) Batteries shall be free of corrosion buildup and cap vent holes shall be open.

(8) Adequate ventilation shall be provided during charging.

(9) Facilities for flushing the eyes, body and work area with water shall be provided wherever electrolyte is handled, except when employees are only checking battery electrolyte levels or adding water.

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(10) Carboy tilters or siphons shall be used to handle electrolyte in large containers.

(11) Battery handling equipment which could contact battery terminals or cell connectors shall be insulated or otherwise protected.

(12) Metallic objects shall not be placed on uncovered batteries.

(13) When batteries are being charged, the vent caps shall be in place.

(14) Chargers shall be turned off when leads are being connected or disconnected.

(15) Installed batteries shall be secured to avoid physical or electrical contact with compartment walls or components.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60245, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60245, filed 12/11/84.]

WAC 296-56-60247 Prohibited operations. (1) Spray painting and abrasive blasting operations shall not be conducted in the vicinity of cargo handling operations.

(2) Welding and burning operations shall not be conducted in the vicinity of cargo handling operations unless such hot work is part of the cargo operation.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-56-60247, filed 12/11/84.]

WAC 296-56-60249 Petroleum docks. (1) Pipe lines which transport petroleum liquids from or to a wharf shall be equipped with valves on shore, so located as to be readily accessible and not endangered by fire on the wharf.

(2) Drip pans, buckets, or other means shall be provided and shall be used to prevent oil spillage upon wharves during loading, disconnecting and draining hoses. After transfer is completed the contents of drip pans and buckets shall be removed and taken to a place of disposal.

(3) Package goods, freight or ship stores shall not be swing-loaded or unloaded during the bulk handling of oils or other flammable liquids in such a manner that the swing-loads will endanger the hose.

(4) Water lights for use at petroleum wharves shall be a type which does not create a source of ignition.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-56-60249, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-60249, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60249, filed 12/11/84.]

WAC 296-56-60251 Boat marinas. (1) All hoisting equipment including derricks, cranes, or other devices used for boat launching, handling cargo, or supplies shall be inspected once a month. Records of this inspection shall be made available upon request.

(2) Floating docks are not required to have bull rails unless lift trucks or other power driven equipment is used on the dock.

(3) "No smoking" signs shall be posted in areas where fueling or flammable material is present.

(4) Flammable material or petroleum products shall be stored in a fireproof storage room or shed.

(5) Slippery surfaces shall be cleaned and nonslip material shall be used if necessary.

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[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60251, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60251, filed 12/11/84.]

WAC 296-56-60253 Canneries and cold storage docks. (1) Hoisting equipment used to load or unload cargo or supplies of fishing vessels shall be inspected once a month certified in accordance with the requirements of WAC 296-56-60093. The record of inspection shall be made available upon request.

(2) Slippery surfaces shall be cleaned and nonslip material shall be used if necessary.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-60253, filed 1/17/86; 85-01-022 (Order 84-24), § 296-56-60253, filed 12/11/84.]

WAC 296-56-60255 Excerpts from Revised Code of Washington. (1) RCW 49.28.100 Hours of operators of power equipment in waterfront operations. It shall be unlawful for any employer to permit any of his employees to operate on docks, in warehouses and/or in or on other waterfront properties any power driven mechanical equipment for the purpose of loading cargo on, or unloading cargo from, ships, barges, or other watercraft, or of assisting in such loading or unloading operations, for a period in excess of twelve and one-half hours at any one time without giving such person an interval of eight hours' rest: Provided, however, The provisions of this section and RCW 49.28.110 shall not be applicable in cases of emergency, including fire, violent storms, leaking or sinking ships or services required by the armed forces of the United States.

(2) RCW 51.28.010 Notice of accident—Notification of worker's rights. Whenever any accident occurs to any worker it shall be the duty of such worker or someone in his or her behalf to forthwith report such accident to his or her employer, superintendent or foreman or forewoman in charge of the work, and of the employer to at once report such accident and the injury resulting therefrom to the department pursuant to RCW 51.28.025, as now or hereafter amended, where the worker has received treatment from a physician, has been hospitalized, disabled from work, or has died as the apparent result of such accident and injury.

Upon receipt of such notice of accident, the department shall immediately forward to the worker or his or her beneficiaries or dependents notification, in nontechnical language, of their rights under this title.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 85-01-022 (Order 84-24), § 296-56-60255, filed 12/11/84.]

WAC 296-56-99002 Form—Appendix A—Standard signals for longshore crane signals.

APPENDIX A
STANDARD SIGNALS FOR LONGSHORE CRANE SIGNALS



HOIST THE LOAD



LOWER THE LOAD



HOIST THE LOAD SLOWLY



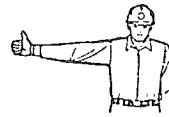
LOWER THE LOAD SLOWLY



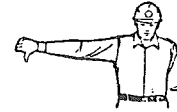
USE MAIN HOOK



USE WHIP HOOK



RAISE THE BOOM



LOWER THE BOOM

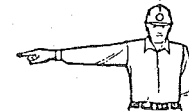
[Statutory Authority: RCW 49.17.040 and 49.17.050, 86-03-064 (Order 86-02), § 296-56-99002, filed 1/17/86; Order 74-14, Appendix C (codified as WAC 296-56-99002), filed 4/22/74; Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.]

WAC 296-56-99003 Form—Appendix B—Standard signals for longshore crane signals.

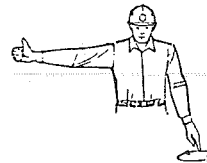
APPENDIX B
STANDARD SIGNALS FOR LONGSHORE CRANE SIGNALS



STOP



SWING LOAD IN DIRECTION FINGER POINTS



FOR MOBILE CRANES
LOWER THE LOAD AND RAISE THE BOOM



FOR MOBILE CRANES
HOIST THE LOAD AND LOWER THE BOOM



FOR MOBILE CRANES
 LOCK THE CRAWLER
 BELT ON SIDE
 INDICATED BY RAISED
 FIST TRAVEL OTHER
 CRAWLER BELT IN
 DIRECTION INDICATED
 BY REVOLVING FIST



FOR MOBILE CRANE
 TRAVEL BOTH CRAWLER
 BELTS IN DIRECTION
 INDICATED BY
 REVOLVING FISTS

[Statutory Authority: RCW 49.17.040 and 49.17.050. 86-03-064 (Order 86-02), § 296-56-99003, filed 1/17/86; Order 74-14, Appendix D (codified as WAC 296-56-99003), filed 4/22/74; Rules (part), filed 9/24/65; Rules (part), filed 3/23/60.]

Chapter 296-59 WAC

SAFETY STANDARDS FOR SKI AREA FACILITIES AND OPERATIONS

WAC

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296-59-100	Avalanche control.
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296-59-130	Ski lift machinery guarding.
296-59-135	Appendix 1—Nonmandatory alternative lock-out procedure for ski lifts and tows.

WAC 296-59-001 Foreword. (1) This vertical standard is promulgated in accordance with applicable provisions of the Washington State Administrative Procedure Act, chapter 34.04 RCW, and the Washington Industrial Safety and Health Act, chapter 49.17 RCW.

(2) The requirements of this chapter shall be applied through the department of labor and industries, division of industrial safety and health, in accordance with administrative procedures provided for in chapter 49.17 RCW, and chapters 296-27, 296-350, and 296-360 WAC.

(1999 Ed.)

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-001, filed 7/6/88.]

WAC 296-59-003 Scope and application. (1) The rules of this chapter are applicable to all persons, firms, corporations, or others engaged in the operation of organized ski areas and facilities within the jurisdiction of the department of labor and industries. These rules shall augment the WAC general horizontal standards, specifically referenced WAC vertical standards, and specifically referenced national standards or manuals.

(2) In the event that specific provisions of this chapter may conflict with any other WAC chapter, national standard, or manual, the provisions of this chapter shall prevail.

(3) The rules of this chapter shall not be applied to rescue crews during the time that rescue procedures are in process provided that reasonably prudent methods, equipment, and processes are employed. Personnel directly engaged in rescue operations shall not be subjected to the immediate restraint provisions of RCW 49.17.130.

(4) Nothing herein contained shall prevent the use of existing ski lift and tow equipment during its lifetime unless specific requirements of this chapter require retrofitting or modifications, provided that it shall be in conformance with applicable national or state code requirements at the time of manufacture and be maintained in good condition to conform with safety factors for the materials and method of manufacture used.

(5) Severability. If any provision of this chapter, or its application to any person, firm, corporation, or circumstance is held invalid under state (RCW) or national (Public Law) laws, the remainder of this chapter, or the application of the provision to other persons or circumstances is not affected.

(6) Variance and procedure. Recognizing that conditions may exist which do not exactly meet the literal requirements of this or other applicable Title 296 WAC standards, pursuant to RCW 49.17.080 and 49.17.090, the director of the department of labor and industries or his/her authorized representative may permit a variance when other means of providing an equivalent measure of protection are afforded. The specific requirements and procedures for variance application are contained in chapters 296-350 and 296-360 WAC. Application forms may be obtained from the assistant director for safety and health or from regional departmental offices.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-003, filed 7/6/88.]

WAC 296-59-005 Incorporation of other standards. (1) Lifts and tows shall be designed, installed, operated, and maintained in accordance with American National Standard Institute (ANSI) B77.1-1982, Standards for Passenger Tramways—Aerial Tramways and Lifts, Surface Lifts, and Tows—Safety Requirements.

(2) Future revised editions of ANSI B77.1-1982 may be used for new installations or major modifications of existing installations, as recommended or approved by the equipment manufacturer or a qualified design engineer, except that, where specific provisions exist, variances shall be requested from the department.

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(3) Commercial explosives shall be transported, stored, and used in compliance with chapter 296-52 WAC, Safety standards for the possession and handling of explosives, and chapter 70.74 RCW, Washington State Explosives Act, except that avalanche control blasting shall comply with the special provisions of this chapter.

(4) The use of military type weapons for avalanche control shall comply with all requirements of the United States government and/or the military branch having jurisdiction. Compliance shall include qualification of employees, security requirements, and storage and handling of ammunition.

(5) The employer shall develop and maintain a hazard communication program as required by chapter 296-62 WAC, Part C, which will provide information to all employees relative to hazardous chemicals or substances to which they are exposed, or may become exposed, in the course of their employment.

(6) When employees perform activities such as construction work or logging, the WAC chapter governing the specific activity shall apply, e.g., chapter 296-155 or 296-54 WAC, et seq.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-59-005, filed 8/3/94, effective 9/12/94; 89-11-035 (Order 89-03), § 296-59-005, filed 5/15/89, effective 6/30/89; 88-14-108 (Order 88-11), § 296-59-005, filed 7/6/88.]

WAC 296-59-007 Definitions. (1) "Act" means the Washington Industrial Safety and Health Act of 1973, RCW 49.17.010 et seq.

(2) "Aerial work platform" means any form of work platform, work chair, or workbasket designed to lift or carry workmen to an elevated work position.

(3) "ANSI" means the American National Standards Institute.

(4) "Approved" means approved by the director of the department of labor and industries except where this code requires approval by another specific body or jurisdiction authority.

(5) "ASME" means the American Society of Mechanical Engineers.

(6) "Attended," as attending explosives, means the physical presence of an authorized person within the field of vision of explosives. The said attendant shall be awake, alert, and not engaged in activities which may divert their attention so that in case of an emergency the attendant can get to the explosives quickly and without interference, except for brief periods of necessary absence, during which absence simple theft of explosives is not ordinarily possible.

(7) "Authorized person" means a person approved or assigned by the employer to perform specific duties or to be at specific restricted locations.

(8) "Avalanche" means the sliding or falling of a large amount of snow down a steep slope which has a destructive force due to its mass.

(9) "Avalanche control pack" means a specially designed and constructed pack for carrying explosives.

(10) "Avalanche control route" means a route or specific path which is used by authorized persons in order to control the occurrence of avalanches.

(11) "Avalancher" means a device like a cannon which is used for avalanche control blasting. It has a rotating base calibrated for pointing and the barrel is mounted on an elevating mechanism. It uses a compressed gas to propel a projectile containing an explosive charge and detonating means. The gas source is connected to the gun by high pressure hose with in-line control valves and pressure gauges ahead of the trigger mechanism.

(12) "Belay" means to provide an anchor for a safety line when a person is working in a position exposed to falling or sliding, the mountaineering term.

(13) "Blaster's license" means an individual license issued by the department under the provisions of chapter 296-52 WAC.

(14) "Blasting cap" or "cap" when used in connection with the subject of explosives shall mean detonator.

(15) "Buildings that are not inhabited" means a building(s) which has no one in it while explosives are being made up in an adjacent explosives makeup room or while explosives are being held in an adjacent day box or hand charge storage facility.

(16) "Designated" means appointed or authorized by the highest management authority available at the site.

(17) "Department" means the department of labor and industries, division of industrial safety and health, unless the context clearly indicates otherwise.

(18) "Director" means the director of the department of labor and industries or his/her designated representative.

(19) "Dud" or "misfire" means an explosive charge with a detonating means which does not explode when detonation is attempted.

(20) "Fuse igniter" means a special pyrotechnic device intended to be used to ignite safety fuses.

(21) "Handcharge" means an explosive charge with a cap and fuse assembly inserted in place.

(22) "Hazard" means that condition, potential or inherent, which might cause injury, death, or occupational disease.

(23) "Lift certificate to operate" means an operating certificate issued by the Washington state parks and recreation commission pursuant to chapter 70.88 RCW subsequent to annual inspections as required by chapter 352-44 WAC.

(24) "N.E.C." means the National Electric Code, as published by either the National Fire Protection Association or ANSI.

(25) "Occupied building" means a building regularly occupied in whole or in part as a habitation for human beings, or any church, schoolhouse, railroad station, store, or other building where people are accustomed to assemble.

(26) "Qualified" means one who, by possession of a recognized degree, certificate, license, or professional standing, has successfully demonstrated the personal ability to solve or resolve problems relating to the subject matter, the work, or the project.

(27) "RCW" means the Revised Code of Washington, legislative law.

(28) "ROPS" means rollover protective structure.

(29) "S.A.E." means the society of automotive engineers.

(30) "Safety factor" means the ratio of ultimate breaking strength of any member or piece of material or equipment to the actual working stress or safe load when in use.

(31) "Shall" indicates a mandatory requirement.

(32) "Should" indicates a recommended practice.

(33) "WAC" means the Washington Administrative Code.

(34) "WISHA" means Washington industrial safety and health administration.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-007, filed 7/6/88.]

WAC 296-59-010 Safe place standards. The safe place requirements of the general safety and health standards, WAC 296-24-073, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-010, filed 7/6/88.]

WAC 296-59-015 General requirements. (1) The use of any machinery, tool, material, or equipment which is not in compliance with any applicable requirement of this chapter is prohibited. Such machine, tool, material, or equipment shall either be identified as unsafe by tagging or locking the controls to render them inoperable or shall be physically removed from its place of operation.

(2) The employer shall permit only those employees qualified by training or experience to operate equipment and machinery.

(3) Employees shall use safeguards provided for their protection.

(4) Loose or ragged clothing, scarfs, or ties shall not be worn while working around moving machinery.

(5) Workers should not be assigned or permitted to occupy work locations directly under other workers. When such practice is unavoidable, all parties shall be made aware of the potential hazard and adequate protective measures shall be taken. When adequate protective measures are not available, one party shall be moved to eliminate the potential exposure.

(6) Employees shall report to their employers the existence of any unsafe equipment or method, or any other hazard which, to their knowledge, is unsafe. Where such unsafe equipment or method or other hazard exists in violation of this chapter it shall be corrected.

(7) Housekeeping.

(a) All places of employment shall be kept clean to the extent that the nature of the work allows.

(b) The floor of every workroom shall be maintained so far as practicable in a dry condition. Where wet processes are used, drainage shall be maintained. Where necessary or appropriate, waterproof footwear shall be worn.

(c) To facilitate cleaning, every floor, working place, and passageway shall be kept free from protruding nails, splinters, loose boards, unnecessary holes and openings or other tripping hazards.

(d) Cleaning and sweeping shall be done in such a manner as to minimize the contamination of the air with dust and so far as is practical, shall be done outside of working hours.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-015, filed 7/6/88.]

(1999 Ed.)

WAC 296-59-020 Management's responsibility. The "management's responsibility" section of the general safety and health standards, WAC 296-24-020, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-020, filed 7/6/88.]

WAC 296-59-025 Employee's responsibility. The "employee's responsibility" section of the general safety and health standards, WAC 296-24-025, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-025, filed 7/6/88.]

WAC 296-59-027 Work activities which include skiing. Management shall develop a written safety program for all employees whose job duties include skiing. The program shall include but is not limited to the following:

(1) The skiing ability and physical condition of individuals shall be considered when determining individual job assignments;

(2) The ski equipment used shall be appropriate for the individual when performing any given job assignment;

(3) The condition of all ski equipment shall be checked by a qualified individual at the beginning of each ski season;

(4) Employees shall be instructed not to use ski equipment until it has been checked and approved;

(5) Employees shall be instructed to ski within their ability and in control at all times;

(6) Employees shall be required to check all ski equipment, including adjustments, before starting work each day;

(7) Employees shall be instructed not to use ski equipment which is defective or out of adjustment.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-027, filed 7/6/88.]

WAC 296-59-030 Safety bulletin board. The "safety bulletin board" requirements of the general safety and health standards, WAC 296-25-055, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-030, filed 7/6/88.]

WAC 296-59-035 First-aid training and certification. The "first-aid training and certification" requirements of the general safety and health standards, WAC 296-24-060, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-035, filed 7/6/88.]

WAC 296-59-040 First-aid kits and supplies. The "first-aid kits and supplies" requirements of the general safety and health standards, WAC 296-24-065, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-040, filed 7/6/88.]

WAC 296-59-050 Personal protective equipment, general requirements. (1) Application.

(a) Protective equipment, including personal protective equipment for eyes, face, head, and extremities, protective clothing, respiratory devices, and protective shields and barriers, shall be provided, used, and maintained in a sanitary and reliable condition wherever it is indicated by reason of hazards of processes or environment, chemical hazards, radiological hazards, or mechanical irritants encountered in a manner capable of causing injury or impairment in the function of any part of the body through absorption, inhalation, or physical contact.

(b) Employee-owned equipment. Where employees provide their own protective equipment, the employer shall be responsible to assure its adequacy, including proper maintenance, and sanitation of such equipment.

(c) Design, construction, testing, and use of personal protective equipment shall comply with the requirements of the General safety and health standards, chapter 296-24 WAC; the Occupational health standards—Safety standards for carcinogens, chapter 296-62 WAC; or the currently applicable ANSI standard.

(2) Eye and face protection. Eye and face protective equipment shall be provided and worn where there is exposure in the work process or environment to hazard of injury, which can be prevented by such equipment.

(3) Occupational head protection. Employees working in areas where there is a possible danger of head injury from impact, or from falling or flying objects, or from electrical shock and burns, shall be protected by protective helmets, i.e., a lift operator would not be required to use a hardhat while operating the lift. However, if that same person is assisting with maintenance operations and is working under a tower where overhead work is being done, that operator would now be required to wear an approved helmet.

(a) Helmets for the protection of employees against impact and/or penetration of falling and flying objects shall meet the specifications contained in American National Standards Institute, Z89.1-1986, Safety Requirements for Industrial Head Protection.

(b) Helmets for the head protection of employees exposed to high voltage electrical shock and burns shall meet the specifications contained in American National Standards Institute, Z89.2-1971, Safety Requirements for Industrial Protective Helmets for Electrical Workers, Class B.

(c) Approved head protection shall be worn by operators of snowmobiles and other mobile oversnow equipment which is not equipped with a rigid metal operator's cab.

(4) Occupational foot protection.

(a) Substantial footwear appropriate for the work conditions encountered shall be worn by all employees.

(b) Where the job assignment includes exposure to slipping hazards, soles and heels of footwear shall be of such material and design as to reduce the hazard of slipping.

(5) Safety belts, lifelines, lanyards, and nets.

(a) Safety belts, lifelines, and lanyards which meet the requirements of ANSI A10.14 shall be provided and used whenever employees are working in locations which expose them to a fall of more than ten feet. The particular work location and application shall dictate which type of belt or harness and length of lanyard is used.

(b) Lifelines shall be secured to an anchorage or structural member capable of supporting a minimum dead weight of five thousand four hundred pounds.

(c) Lifelines used on rock scaling applications or in areas where the lifeline may be subjected to cutting or abrasion shall be a minimum of seven-eighths inch wire core manila rope or equivalent. For all other lifeline applications, three-fourths inch manila rope or equivalent with a minimum break strength of five thousand four hundred pounds may be used.

(d) Each safety belt lanyard shall be a minimum of one-half inch nylon, or equivalent, with a minimum of five thousand four hundred pounds breaking strength.

(e) Employees will not be required to wear a safety belt and lanyard while riding on a standard lift chair while seated in the normal riding position.

(f) Safety nets meeting the requirements of ANSI A10.11 shall be used when other acceptable forms of fall protection are not useable. When used, safety nets shall extend a minimum of eight feet beyond the edge offering exposure, shall be hung with sufficient clearance to prevent user's contact with surfaces or objects below, and shall not be more than twenty-five feet below the fall exposure edge.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-050, filed 7/6/88.]

WAC 296-59-055 Lockout requirements. (1) Each employer shall develop a formal written policy and procedure for lockout requirements. The policy shall embody the principles of subsection (2) of this section and shall clearly state that the procedures must be applied in all instances.

(a) The lockout policy shall be posted on all required employee bulletin boards.

(b) The lockout policy and procedures shall be made a part of new employee orientation and employee training programs.

(c) Supervisors and crew leadpersons shall assure compliance with the published policy and procedures in all instances.

(2) Whenever the unexpected start-up of machinery, the energizing of electrical circuits, the flow of material in piping systems, or the removal of guards would endanger workers, such exposure shall be prevented by deactivating and locking out the controls as required by this section.

(3) Equipment requirements.

(a) The employer shall provide and each employee shall use as many padlocks, tags, chains, or devices as are necessary to implement these requirements.

(b) Provisions shall be made whereby the source of power or exposure can be locked out in accordance with the requirements of this section.

(c) On electrically powered equipment, "stop/start" control switches shall not be used as lockout switches. Lockout switches must be the primary circuit disconnects and must adequately separate both the power source and any auxiliary power unit from the prime mover so that accidental start-up of the equipment being locked out is precluded.

(d) Keyed-alike locks, which all open with identical keys, shall not be issued as personal lockout locks.

(4) Training requirements.

(a) Each person who will be given authority to implement these requirements shall first be thoroughly trained in the requirements and procedures.

(b) Before being given authority to deactivate and lock-out a particular system or piece of equipment, authorized personnel shall be made fully aware of all power sources and/or material entry sources which may offer exposure.

(c) Checklists shall be used to implement effective lock-out procedures for complex systems or equipment.

(i) Complex is identified as those systems or equipment which require the locking out of four or more controls to assure isolation or which have controls remote from the immediate work area.

(ii) Checklists shall identify all controls necessary to achieve isolation at the intended worksite(s).

(iii) Checklists shall provide a space after each listed control to be used for the identity of the person(s) who performed the lockout and required post-lockout tests of each control.

(iv) Checklists shall be prepared by qualified personnel and approved by the responsible area supervisor before each use.

(5) Control procedure.

(a) Each person who could be exposed to the hazard shall apply a personal padlock on each control mechanism. Padlocks shall be applied in such a manner as to physically block the controls from being moved into the operating position. Each lock shall be personally identified or an information tag identifying the owner shall be attached to the lock.

(b) Padlocks used in lockout procedures may only be removed by the person identified on the lock, except, when it is positively determined that the owner/user of the lock has left the premises without removing a lock, the job supervisor may remove the lock in accordance with a specific procedure formulated by the local plant labor management safety committee or approved by the department.

(6) Testing after lockout or tagout. After tagging or locking out equipment, a test shall be conducted to ascertain that the equipment has been made inoperative or the flow of material has been positively stopped. Precautions shall be taken to ascertain that persons will not be subjected to any hazard while conducting the test if the power source or flow of material is not shut off.

(7) Temporary or alternate power to be avoided. Whenever possible, temporary or alternate sources of power to the equipment being worked on shall be avoided. If the use of such power is necessary, all affected employees shall be informed and the source of temporary or alternate power shall be identified.

(8) Where tags or signs are required to implement the lockout and control procedures, the tag and attachment device shall be constructed of such material that it will not be likely to deteriorate in the environment that it will be subjected to.

(9) Provisional exception. Electrical lighting and instrument circuits of two hundred forty volts or less on single phase systems or two hundred seventy-seven volts on three-phase systems may be exempted from the lockout requirements of subsection (5)(a) of this section provided that:

(a) An information tag meeting the requirements of subsection (8) of this section is used in lieu of a padlock.

(b) The information tag shall be placed on the switch or switch cover handle in such a manner as to easily identify the deactivated switchgear.

(10) Deactivating piping systems.

(a) Hazardous material systems are defined as: Gaseous systems that are operated at more than two hundred psig; systems containing any liquid at more than five hundred psig; systems containing any material at more than 130°F; systems containing material which is chemically hazardous as defined by NFPA 704 M Class 3 and 4; systems containing material classified as flammable or explosive as defined in NFPA Class I.

(b) Lockout of piping systems shall provide isolation to the worksite, including backflow where such potential exists and where the system is classified as a hazardous material system. The required method shall be applied based on the content of the system as specified below:

(i) Nonhazardous systems shall be deactivated by locking out either the pump or a single valve.

(ii) Hazardous material systems shall be deactivated by one of the following methods:

(A) Locking out both the pump and one valve between the pump and the worksite;

(B) Locking out two valves between the hazard source and the worksite;

(C) Installing and locking out a blank flange between the hazard source and worksite.

Exception:

Aerial tramways and lifts, surface lifts and tows. It is recognized that some inspection, testing, running adjustments, and maintenance tasks cannot be accomplished on this equipment while using standard lockout procedures, particularly when using a work platform suspended from the haulrope. Management of each ski area shall therefore develop a specific written procedure to be used in any instance where any potentially exposed personnel cannot personally lock the controls. The procedure for each area shall meet the following minimum requirements:

(I) The controls shall be attended by a qualified operator at all times when personnel are in potentially exposed work positions and the controls are not padlocked out.

(II) Direct communication capability between the control operator and remote work crew shall be maintained at all times.

(III) All personnel involved shall be thoroughly trained in the exact procedures to be followed.

(IV) Extension tools which minimize personnel exposure shall be used where possible.

(V) The equipment shall be operated at the slowest speed possible consistent with the task at hand.

(VI) This exception shall not be used by more than one workcrew at more than one remote location on any single piece of equipment or system.

(VII) This exception is limited to work on the haulrope, towers, and replacing bullwheel liners. For all other work on the bullwheels or drive operations, the master disconnect shall be deactivated and locked out.

Note: See Appendix 1 for illustrative example.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-055, filed 7/6/88.]

WAC 296-59-060 Vessel or confined area requirements. The requirements of WAC 296-62-145 through 296-62-14529, general occupational health standards for permit - required confined spaces, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-59-060, filed 1/18/95, effective 3/1/95; 88-14-108 (Order 88-11), § 296-59-060, filed 7/6/88.]

WAC 296-59-065 Fire protection and ignition sources. The requirements of WAC 296-24-585, et seq., relating to fire protection requirements, shall be applicable within the scope of chapter 296-59 WAC.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-065, filed 7/6/88.]

WAC 296-59-070 Illumination. (1) Sufficient illumination required. All areas shall be sufficiently illuminated in order that persons in the area can safely perform their assigned duties. The recommended levels of illumination specified in chapter 296-62 WAC, general occupational health standards, shall be followed. When areas are not specifically referred to in chapter 296-62 WAC and the adequacy of illumination for the area or task performed is questionable, a determination of the amount of illumination needed may be made by the division of industrial safety and health.

(2) Emergency or secondary lighting system required.

(a) There shall be an emergency or secondary lighting system which can be actuated immediately upon failure of the normal power supply system. The emergency or secondary lighting system shall provide illumination in the following areas:

(i) Wherever it is necessary for workers to remain at their machine or station to shut down equipment in case of power failure;

(ii) At stairways and passageways or aiseways used by workers as an emergency exit in case of power failure;

(iii) In all plant first-aid and/or medical facilities;

(iv) In emergency power and control room, i.e., in emergency generator rooms unless arranged to start automatically in the event of power failure, or on ski lift motor drive rooms where it would be necessary for employees to switch on the emergency drive system during night skiing.

(b) Emergency lighting facilities shall be checked at least every thirty days for mechanical defects. Defective equipment shall be given priority for repair schedule.

(3) Extension cord type lights. All extension cord type lights shall be provided with proper guards.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-070, filed 7/6/88.]

WAC 296-59-075 Electrical equipment and distribution. (1) National Electrical Code to prevail. All electrical installations and electrical utilization equipment shall comply with the National Electrical Code requirements.

Exception: In instances where (N.E.C.) conflicts with ANSI B77.1 with respect to tramways, surface lifts, or trows, ANSI B77.1 shall prevail.

(2) Authorized personnel to do electrical work. Only those persons who are qualified to do the work assigned and

are authorized by the employer shall be allowed to perform electrical work on any electrical equipment or wiring installations.

(3) High voltage areas to be guarded. Motor rooms, switch panel rooms, or other areas where persons may come in contact with high voltages shall be fenced off or be enclosed in a separate area. The gate, door, or access to such area shall be posted with a notice stating that only authorized persons are allowed in the area.

(4) Control panels. In areas where mobile equipment operates, floor stand panels shall be protected from being struck by moving equipment. Start or run handles and buttons shall be protected from accidental actuation.

(5) Switches or control devices. Switches, circuit breakers, or other control devices shall be so located that they are readily accessible for activation or deactivation and shall be marked to indicate their function or machine which they control. The positions of ON and OFF shall be marked or indicated and provision shall be made for locking out the circuit.

(6) Starting requirements for electrically driven equipment after power failure. Electrically driven equipment shall be so designed that it will not automatically start upon restoration of power after a power failure if it will create a hazard to personnel.

(7) Posting equipment automatically activated or remotely controlled. Equipment which is automatically activated or remotely controlled shall be posted, warning persons that machine may start automatically if it will create a hazard to personnel.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-075, filed 7/6/88.]

WAC 296-59-080 Installation, inspection, and maintenance of pipes, piping systems, and hoses. (1) Definitions applicable to this section.

(a) "Hazardous material system" is any system within the following classifications:

(i) "Flammable or explosive" - any system containing materials which are hazardous because they are easily ignited and create a fire or explosion hazard, defined by NFPA as Class I liquids;

(ii) "Chemically active or toxic" - any system containing material which offers corrosion or toxic hazard in itself or can be productive of harmful gases upon release, defined by NFPA 704M as Class 3 and 4 materials;

(iii) "Thermally hazardous" - any system above 130°F which exposes persons to potential thermal burns;

(iv) "Pressurized" - any gaseous system above two hundred psig or liquid system above five hundred psig.

(b) "Piping system" - any fixed piping, either rigid pipe or flexible hose, including all fittings and valves, in either permanent or temporary application.

(2) Design and installation. All new piping systems intended to be used in hazardous material service shall be designed and installed in accordance with applicable provisions of the ASME Code for Pressure Piping or in accordance with applicable provisions of ANSI B31.1 through B31.8. The referenced edition in effect at the time of installation shall be utilized.

Note: Both referenced standard have identical requirements.

(3) Inspection and maintenance.

(a) Management shall develop a formal program of inspections for all hazardous material piping systems. The program shall be based on sound maintenance engineering principles and shall demonstrate due consideration for the manufacturing specifications of the pipe, hose, valves, and fittings, the ambient environment of the installation and the corrosive or abrasive effect of the material handled within the system.

(b) Type and frequency of tests and/or inspections and selection of inspection sites shall be adequate to give indications that minimum safe design operating tolerances are maintained. The tests may include visual and nondestructive methods.

(c) All employers shall submit their formal program of initial and ongoing inspections to the department for approval within one year after the effective date of this requirement.

(d) All existing hazardous material systems shall be inspected to the criteria of this section prior to two years after effective date, or in accordance with a schedule approved by the department.

(4) Inspection records.

(a) Results of inspections and/or tests shall be maintained as a record for each system.

(b) Past records may be discarded provided the current inspection report and the immediate preceding two reports are maintained.

(c) When a system is replaced, a new record shall be established and all past records may be discarded.

(d) The records for each system shall be made available for review by the department upon request.

(e) The employer may omit the inspection requirements for portions of existing systems that are buried or enclosed in permanent structures in such a manner as to prevent exposure to employees even in the event of a failure.

(5) Systems or sections of systems found to be below the minimum design criteria requirements for the current service shall be repaired or replaced with component parts and methods which equal the requirements for new installations.

(6) Identification of piping systems.

(a) Pipes containing hazardous materials shall be identified. It is recommended that USAS A13.1 "Scheme for Identification of Piping Systems" be followed.

(b) Positive identification of piping system content shall be identified by lettered legend giving the name of the content in full or abbreviated form, or a commonly used identification system. Such identification shall be made and maintained at suitable intervals and at valves, fittings, and on both sides of walls or floors. Arrows may be used to indicate the direction of flow. Where it is desirable or necessary to give supplementary information such as hazard of use of the piping system content, this may be done by additional legend or by color applied to the entire piping system or as colored bands. Legends may be placed on colored bands.

Examples of legends which may give both positive identification and supplementary information regarding hazards or use are:

Ammonia	Hazardous liquid or gas
Chlorine	Hazardous liquid or gas
Liquid caustic	Hazardous liquid
Sulphuric acid	Hazardous liquid
Natural gas	Flammable/explosive gas

Note: Manual L-1, published by Chemical Manufacturers Association, Inc., is a valuable guide in respect to supplementary legend.

(c) When color, applied to the entire piping system or as colored bands, is used to give supplementary information it should conform to the following:

CLASSIFICATION	PREDOMINANT COLOR
F-Fire-protection equipment	Red
D-Dangerous materials	Yellow (or orange)
S-Safe materials	Green (or the achromatic colors, white, black, gray, or aluminum)

And, when required, P-Protective materials Bright blue

(d) Legend boards showing the color and identification scheme in use shall be prominently displayed at each plant. They shall be located so that employees who may be exposed to hazardous material piping systems will have a frequent reminder of the identification program.

(e) All employees who work in the area of hazardous material piping systems shall be given training in the color and identification scheme in use.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-080, filed 7/6/88.]

WAC 296-59-085 Scaffolds, construction, use, and maintenance. (1) Whenever work must be performed at a height which cannot be reached from the floor or permanent platform and where it would not be a safe practice to use a ladder, a properly constructed scaffold shall be provided and used.

(2) Scaffolds shall be constructed and used in compliance with WAC 296-24-825 through 296-24-84013.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-085, filed 7/6/88.]

WAC 296-59-090 Mobile equipment and lift trucks.

(1) Mobile equipment shall be designed, constructed, maintained, and used in accordance with this section and appropriate ANSI and/or SAE requirements.

(2) Operator training.

(a) Methods shall be devised by management to train personnel in the safe operation of mobile equipment.

(b) Training programs for all mobile equipment shall include the manufacturer's operating instructions when such instructions are available.

(c) Only trained and authorized operators shall be permitted to operate such vehicles.

(3) Special duties of operator. Special duties of the operator of a power-driven vehicle shall include the following:

(a) Test brakes, steering gear, lights, horns, warning devices, clutches, etc., before operating vehicle;

(b) Not move a vehicle while an unauthorized rider is on the vehicle;

(c) Slow down and sound horn upon approaching blind corners or other places where vision or clearance is limited;

(d) Comply with all speed and traffic regulations and other applicable rules;

(e) Have the vehicle being operated under control at all times so that he can safely stop the vehicle in case of emergency; and

(f) Keep the load on the uphill side when driving a fork-lift vehicle on a grade.

(4) Operator to be in proper position. Control levers of lift trucks, front end loaders, or similar types of equipment shall not be operated except when the operator is in his proper operating position.

(5) Raised equipment to be blocked. Employees shall not work below the raised bed of a dump truck, raised buckets of front end loaders, raised blades of tractors or in similar positions without blocking the equipment in a manner that will prevent it from falling. When working under equipment suspended by use of jacks, safety stands or blocking shall be used in conjunction with the jack.

(6) Precautions to be taken while inflating tire. Unmounted split rim wheels shall be placed in a safety cage or other device shall be used which will prevent a split rim from striking the worker if it should dislodge while the tire is being inflated.

(7) Reporting suspected defects. If, in the opinion of the operator, a power-driven vehicle is unsafe, the operator shall report the suspected defect immediately to the person in charge. Any defect which would make the vehicle unsafe to operate under existing conditions shall be cause for immediate removal from service. The vehicle shall not be put back into use until it has been made safe.

(8) Safe speed. Vehicles shall not be driven faster than a safe speed compatible with existing conditions.

(9) Unobstructed view.

(a) Vehicle operators shall have a reasonably unobstructed view of the direction of travel. Where this is not possible, the operator shall be directed by a person or by a safe guidance means or device.

(b) Where practical, mirrors shall be installed at blind corners or intersections which will allow operators to observe oncoming traffic.

(c) It is recommended that vehicles operating in congested areas be provided with an automatic audible or visual alarm system.

(10) Passengers to ride properly.

(a) Passengers shall not be permitted to ride with legs or arms extending outside the running lines of the cab, FOPS, or ROPS of any vehicle.

(b) Passengers on mobile oversnow equipment shall ride within the cab unless exterior seating is provided. The exterior seating may include the cargo bed provided that the bed is equipped with sideboards and a tailgate at least ten inches high. If passengers are permitted to stand in the bed, adequate handholds shall be provided.

(c) The number of passengers and seating arrangements within the cab on any mobile equipment shall not interfere with the operator's ability to safely operate the equipment.

(d) Exterior passengers shall not be permitted on mobile oversnow equipment which has snow grooming equipment mounted on the bed or when the machine is towing any kind of equipment, sleds, etc.

(e) Operators shall use good judgment with respect to speed and terrain when carrying exterior passengers.

(11) Horns and lights.

(a) Every vehicle shall be provided with an operable horn distinguishable above the surrounding noise level.

(b) Any vehicle required to travel away from an illuminated area shall be equipped with a light or lights which adequately illuminate the direction of travel.

(12) Brakes on power-driven vehicles. Vehicles shall be equipped with brakes and devices which will hold a parked vehicle with load on any grade on which it may be used. The brakes and parking devices shall be kept in proper operating condition at all times.

(13) Cleaning vehicles. All vehicles shall be kept free of excessive accumulations of dust and grease which may present a hazard.

(14) Lifting capacity of vehicle to be observed. At no time shall a load in excess of the manufacturer's maximum lifting capacity rating be lifted or carried. Such lifting capacity may only be altered with the approval of the equipment manufacturer or a qualified design engineer.

(15) Posting rated capacity. The maximum rated lifting capacity of all lift trucks shall at all times be posted on the vehicle in such a manner that it is readily visible to the operator.

(16) Carrying loose material. Lift trucks shall not be used to carry loose loads of pipe, steel, iron, lumber, palletized material, rolls of paper, or barrels unless adequate clearance is provided and the loads are stabilized.

(17) Position of lift forks or clamps. The forks or clamps of lift trucks shall be kept as low as possible while the vehicle is moving. They shall be lowered to the ground or floor when the vehicle is parked.

(18) Walking under loads prohibited. No person shall be allowed under the raised load of a lift truck, backhoe, or front end loader.

(19) Hoisting of personnel on vehicle forks prohibited. Personnel shall not be hoisted by standing directly on the forks of vehicles.

(20) Using forklifts as elevated work platforms. A platform or structure built specifically for hoisting persons may be used providing the following requirements are met:

(a) The structure must be securely attached to the forks and shall have standard guardrails and toeboards installed on all sides;

(b) The hydraulic system shall be so designed that the lift mechanism will not drop faster than one hundred thirty-five feet per minute in the event of a failure in any part of the system. Forklifts used for elevating work platforms shall be identified that they are so designed;

(c) A safety strap shall be installed or the control lever shall be locked to prevent the boom from tilting;

(d) An operator shall attend the lift equipment while workers are on the platform;

(e) The operator shall be in the normal operating position while raising or lowering the platform. A qualified operator shall remain in attendance whenever an employee is on the work platform;

(f) The vehicle shall not travel from point to point while workers are on the platform except that inching or maneuvering at very slow speed is permissible; and

(g) The area between workers on the platform and the mast shall be adequately guarded to prevent contact with chains or other shear points.

(21) Overhead guards on lift trucks. All lift trucks shall be equipped with an overhead guard constructed and installed to conform to USAS B56.1-1969 "Safety Code for Powered Industrial Trucks." This guard may be removed only when it cannot be used due to the nature of the work being performed in which case loads shall be maintained so as not to create a hazard to the operator.

(22) Protection from exhaust system. Any exhaust system which might be exposed to contact shall be properly insulated or isolated to protect personnel. Exhaust systems on lift trucks and jitneys shall be constructed to discharge either within twenty inches from the floor or eighty-four inches or more above the floor. The exhausted gases shall be directed away from the operator. The equipment shall be designed in such a manner that the operator will not be exposed to the fumes.

(23) Emergency exit from mobile equipment. Mobile equipment with an enclosed cab shall be provided with an escape hatch or other method of exit in case the regular exit cannot be used.

(24) Vehicle wheels chocked. When driving mobile equipment onto the bed of a vehicle, the wheels of the vehicle shall be chocked.

(25) Prevent trailer from tipping. Suitable methods shall be used or devices installed which will prevent the trailer from tipping while being loaded or unloaded.

(26) Refueling. Gasoline or LPG engines shall be shut off during refueling.

(27) Close valve on LPG container. Whenever vehicles using LP gas as a fuel are parked overnight or stored for extended periods of time indoors, with the fuel container in place, the service valve of the fuel container shall be closed.

(28) LPG tanks. LPG vehicle fuel tanks shall be installed and protected in a manner which will minimize the possibility of damage to the tank.

(29) Inspecting and testing of LPG containers. LPG containers shall be inspected and tested as required by chapter 296-24 WAC.

(30) Spinners on steering wheels. The use of spinners on steering wheels shall be prohibited unless an antikick device is installed or the equipment has a hydraulic steering system.

(31) The hearing conservation requirements of the general occupational health standards, WAC 296-62-09015, shall be applicable for mobile equipment operation.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-090, filed 7/6/88.]

WAC 296-59-095 Requirements for cranes and hoists—General safety and health standards to prevail. All applicable rules for design, construction, maintenance, operation, and testing of cranes and hoists contained in the General safety and health standards, chapter 296-24 WAC, shall be met.

(1999 Ed.)

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-095, filed 7/6/88.]

WAC 296-59-100 Avalanche control. (1) General.

(a) During periods of high avalanche danger, slopes and trails in avalanche paths shall not be opened for use until trained personnel have evaluated conditions and determined whether avalanche control work is necessary.

(b) When avalanche control work is deemed necessary, slopes and trails in the potential avalanche path shall not be opened until the work is completed.

(c) An avalanche shall not be purposely released until the avalanche path and potential runout zone are clear of personnel.

(d) Avalanche guards, signs, and/or barricades shall be positioned at normal entrances to the avalanche path if there is any chance that personnel will enter the danger zone during intentional release activities.

(e) During very unstable snow conditions, release of one avalanche may trigger sympathetic releases over a wide area. Avalanche workers shall consider such possibility and clear the appropriate areas of personnel.

(2) Personnel and equipment.

(a) The avalanche control crew shall be adequately trained and physically capable for tasks which can be anticipated in their individual job assignments.

(b) No person shall accept or be given a job assignment which is beyond the individual's physical ability or training.

(c) On-slope assignments which include potential exposure to avalanche hazards shall only be conducted by fully qualified and fully equipped control crew members.

(d) The control crew may be split up into smaller groups (teams) to work on multiple areas simultaneously provided that each team consists of at least two qualified members.

(e) Each avalanche control crew or team shall have one or more designated rescue coordinators as is deemed necessary to maintain communications. Compliance with this requirement may be achieved by designating control crew teams to serve as each others' rescue coordinator provided that the teams are reasonably proximate to each other and do in fact maintain frequent communications.

(f) Each avalanche control crew member shall be equipped for continuous two-way communications to the avalanche crew coordinators.

(g) The avalanche crew or teams shall not be assigned to on-slope areas where they cannot maintain communications with their designated coordinator. This requirement may be met by the use of a relay person, however, if any team completely loses communications they shall return directly to base via the safest route available.

(h) Each person on an avalanche control team shall be equipped with a shovel and an electronic transceiver before commencing on-slope control work. The transceiver shall be in the transmit position whenever personnel are performing on-slope job assignments.

(3) Avalanche rescue plan. Each ski area shall have a written avalanche rescue plan. The plan shall require:

(a) All rescue personnel who will be assigned to on-slope activities shall:

(i) Be competent skiers;

- (ii) Have a current first-aid card;
- (iii) Be thoroughly trained in the rescue plan details;
- (b) A specific list of required equipment for rescue crew

personnel including:

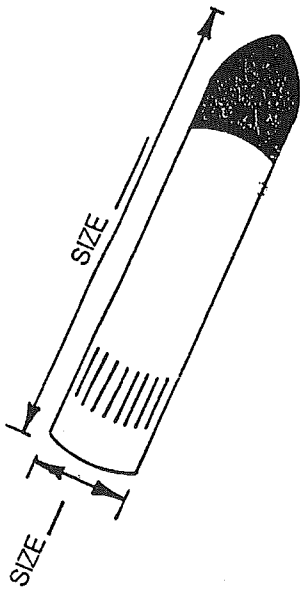
- (i) Probes;
- (ii) Belaying rope;
- (iii) Shovels;
- (iv) Two-way communication radios;
- (v) Electronic transceivers;
- (c) A list of rescue equipment locations;
- (d) Specific rescue procedures to be followed.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-100, filed 7/6/88.]

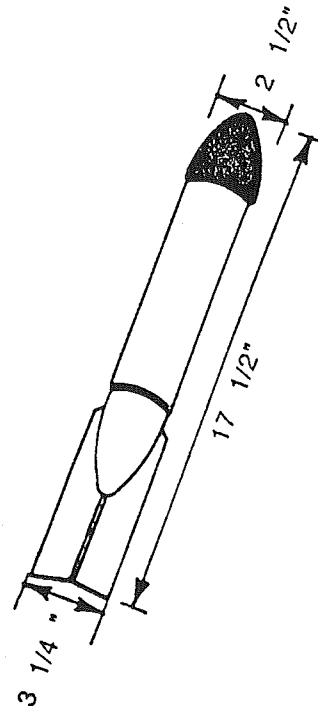
WAC 296-59-102 Acceptable warning signs for typical avalanche control explosive device(s) duds.

DANGER
EXPLOSIVES ON THE MOUNTAIN

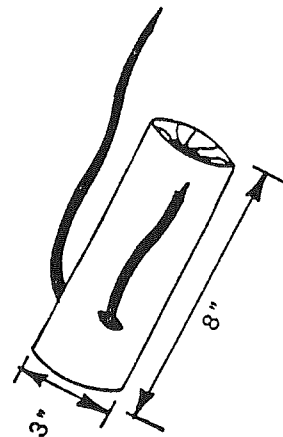
Unexploded warheads, projectiles, or handcharges used in avalanche control may be found in target areas or in avalanche runout zones.



UNEXPLODED WARHEADS
WARHEAD MAY BE DISTORTED
FROM IMPACT.



AVALANCHER PROJECTILE
RED OPAQUE BODY,
RED TRANSLUCENT FINS.



DYNAMITE HANDCHARGE
BROWN COLOR WRAPPING,
WILL USUALLY HAVE FUSE.

If you find an unexploded (dud) charge, do the following:

1. Do not disturb or touch!
2. Mark the location within 5 to 10 feet.
3. Immediately report the location to the nearest lift operator, ski patrolman or U.S. Forest Service employee.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-102, filed 7/6/88.]

WAC 296-59-103 Storage, makeup, and use of explosives for avalanche control blasting. (1) General.

(a) The storage, handling, and use of explosives and blasting agents used in avalanche control practices shall comply with this chapter unless stored, handled, and used in compliance with chapter 70.74 RCW and chapter 296-52 WAC.

(b) The minimum requirements published in WAC 296-59-103 through 296-59-111 (inclusive) shall only be applicable to the storage, handling, and use of explosives and blasting agents in the endeavor of avalanche control. The use of explosives for conventional purposes such as but not limited to demolition, site clearing, or construction shall be regulated by chapter 70.74 RCW and chapter 296-52 WAC.

(2) Management responsibility.

(a) Explosives and blasting agents shall not be stored, kept, or had in any regularly occupied areas or buildings except in compliance with either chapter 296-52 WAC or this chapter.

(b) Explosives and blasting agents shall not be assembled or combined to form armed charges in any regularly occupied area or building except in compliance with this chapter.

(3) Personnel.

(a) Only fully qualified and licensed blasters shall be permitted to assemble or arm explosives components.

(b) Training shall include avalanche blasting experience so that the problems encountered in cold weather blasting are known factors.

(c) All training activities shall be conducted under the attended supervision of a fully qualified and licensed blaster.

(4) General requirements.

(a) Detonating systems for hand-placed or hand-thrown charges.

(i) The ignition system on single-unit handcharges shall consist of a nonelectrical cap, safety fuse, and a fuse igniter.

(ii) Multiple units combined to form a single handcharge may use the above system or an approved detonating cord system. No other ignition system shall be permissible without specific approval by the department.

(b) Multiple charge blasts.

(i) Detonating cord shall be used in lieu of blasting wire to connect multiple charge blasts.

(ii) After all charges are placed, connected to the detonating cord, and the charges are ready to be ignited, a safety fuse and cap shall be attached to the detonating cord. A fuse igniter may then be attached to ignite the safety fuse.

(c) Blasting caps shall be no larger than No. 8 except when recommended by the explosives manufacturer for a particular explosive used within a specific application.

(d) Electric blasting caps are not permitted.

(e) Only the highest quality safety fuse with excellent water resistance and flexibility shall be used.

(f) Fuse length.

(i) Safety fuse length shall be selected to permit the control team adequate escapement time from the blast area under all reasonable contingencies (falls, release of bindings, etc.).

(ii) In no instance shall a fuse length with less than seventy seconds burn time be permitted.

(iii) The burn time of each roll of safety fuse shall be checked prior to use.

(iv) Checked rolls shall be marked with the tested burn time.

(v) It is recommended that all handcharges be prepared for ignition with one safety fuse and igniter.

Note: Standard safety fuse burns at a rate of 0.5 meters ($\pm 10\%$) per seventy seconds at two thousand five hundred meters elevation. This rate equates to approximately nineteen and three-quarter inches fuse length for seventy second handcharge fuses at normal ski area elevations.

(5) Explosives.

(a) Explosives chosen shall have a safe shelf life of at least one operating season in the storage facilities in which it will be stored.

(b) Explosives chosen shall have excellent water and freezing resistance.

(c) Industrial primers (or boosters) that consist mainly of TNT or gelatin are the recommended explosives.

(6) Transporting explosives and handcharges.

(a) Handcharges or explosives components shall be transported in approved type avalanche control packs, in United States Department of Transportation approved shipping containers or in licensed magazines.

(b) Criteria for avalanche control packs.

(i) The pack shall be constructed of water resistant material.

(ii) Packs shall be constructed with sufficient individual compartments to separate handcharges or explosives components from tools or other equipment or supplies which may be carried in the pack.

(iii) Each compartment used for handcharges or explosives components shall have an independent closure means.

(iv) If fuse igniters will be permitted to be carried on the avalanche control pack, a separate compartment with individual closure means shall be attached to the outside of the exterior of the pack.

(c) Use of avalanche control packs.

(i) Packs shall be inspected daily, prior to loading, for holes or faulty compartment closures. Defective packs shall not be used until adequately repaired.

(ii) Tools or other materials shall not be placed in any compartment which contains handcharges or explosives components.

(iii) Fuse igniters shall never be placed anywhere inside the pack when the pack contains handcharges or other explosives components.

(iv) Fuse igniters may be carried in a separate compartment attached to the outside of the pack exterior but preferably in a compartment attached to the front of the carrying harness. Another acceptable alternative is to carry the igniters in a jacket pocket completely separate from the pack.

(v) Handcharges or explosives components shall not be stored or left unattended in avalanche control packs. Unused handcharges shall be promptly disassembled at the end of individual control routes and all components returned to approved storage.

(vi) Individual control team members shall not carry more than thirty-five pounds of handcharges in avalanche control packs.

(vii) A handcharge or cap and fuse assembly which has a fuse igniter attached shall never be placed in an avalanche control pack for any reason.

(d) Whenever explosives or explosives components are transported in or on any vehicle powered by an internal combustion engine, provisions shall be made to ensure that said explosives or containers cannot come into contact with the hot exhaust system.

(e) Handcharges or explosives components shall not be transported in spark-producing metal containers.

(f) Handcharges shall not be transported on public roads and highways when such roads or highways are open to the public. Explosives components shall only be transported on public roads or highways in compliance with United States Department of Transportation regulations.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-103, filed 7/6/88.]

WAC 296-59-105 Handcharge makeup methods.

General. The department shall recognize two permissible methods concerning handcharges for avalanche control blasting. The descriptions and requirements for each method are contained in this section. Every ski area operation which conducts avalanche control blasting should use Method II "Hand charge makeup room." A well designed and constructed handcharge makeup room can enhance the correct assembly of components which will maintain the best possible control over explosives and components, reduce the probability of an explosives incident, and reduce the incidence of misfires from incorrect makeup or moisture.

(1) Method I. Makeup at the blast site.

(a) The ignition system shall consist of a nonelectrical blasting cap and highest quality water resistant safety fuse, or detonating cord, assembled as recommended by the manufacturer.

(b) Detonating cord (i.e., primacord) shall be used to connect separated multiple-charge blasts.

(c) No other ignition system shall be permissible on hand-placed or hand-thrown avalanche control charges unless variance is granted by the department.

(d) Caps shall be installed on correct length fuses prior to being transported out onto control routes.

(e) Caps shall only be crimped with a crimper tool approved for that purpose.

(f) Assembling caps and fuses shall be done in a warm, dry, well-lighted environment. The location used for assembly shall not have flammable fuels, flammable gases, or explosives present where accidental detonation of the caps could create a secondary ignition or detonation hazard.

(g) Each cap shall be protected by a styrofoam shield or the equivalent before being placed in an avalanche control pack for transportation.

(h) A fuse igniter shall never be attached to a fuse until the fuse and cap assembly is installed in the handcharge at the blast site and the control crew is fully prepared to ignite the charge.

(i) All class A explosives shall be attended as defined in WAC 296-59-007 at all times when the explosive is out of the class 1 storage magazine.

(j) Disbursement of explosive charges from the class 1 storage magazine into avalanche control packs shall be done outside the storage magazine. Records shall be maintained for all explosives disbursed.

(k) Caps, cap and fuse assemblies, armed handcharges, or fuse igniters shall not be carried into or stored in a class 1 magazine which contains class A explosives.

(2) Method II. Handcharge makeup room. This method is different from method I primarily in that the fuse and cap assembly is installed in the explosive charge while inside a special makeup room. The assembly procedure shall be as follows:

(a) Install caps on correct length fuses with an approved crimper tool before explosives are brought into the makeup room.

(b) The cap and fuse assemblies shall not be combined with explosives to form handcharges until just before the intended time of distribution.

(c) Only nonsparking skewers shall be used to punch holes in an explosives cartridge.

(d) The fuse shall be laced or taped in position after inserting the cap in the charge.

(e) Each handcharge shall be placed in an explosives box or avalanche control pack immediately after assembly is completed.

(f) No spark-producing metal tools shall be used to open explosives containers.

(g) Fuse igniters shall never be attached to a fuse or a handcharge until the handcharge is at the blast site and the control crew is fully prepared to ignite the charge.

(3) Makeup room requirements, procedures.

(a) Construction requirements.

(i) Makeup rooms located in accordance with the American Standard Quantity and Distance Tables for storage shall not require construction of reinforced concrete walls, floors, and doors. All other requirements of this chapter shall be applicable for such facilities.

(ii) Floors and walls. The floor and walls shall be constructed of reinforced concrete not less than eight inches thick. The rebar shall be not less than one-half inch diameter and shall be spaced on twelve-inch vertical and horizontal centers. The rebar shall be bent at a ninety degree angle and extend a minimum of twenty-four inches into the adjoining floor or wall to secure each floor and wall joint.

(iii) Roof. The roof is not limited to specific materials but shall provide both weather protection and standard snow loading protection for the region.

(iv) Access door(s).

(A) If a hinged door mounting is utilized, the hinge shall be mounted on the inside so that the door opens into the makeup room. In the fully closed position, in position to be locked, the door shall be a minimum of two inches larger than the access opening on all sides.

(B) If a flush door mounting is utilized, the door shall be mounted with a two-inch decreasing taper on all sides of both the door and the concrete access opening to form a wedge seal.

(C) If a sliding door mounting is utilized, the mounting apparatus shall be on the inside of the makeup room and the

door shall be a minimum of two inches larger than the access opening when the door is fully closed.

(D) Makeup room door may be either:

(I) Constructed to the same structural integrity and mounting requirements of (a)(iii)(A) through (C) of this subsection; or

(II) Constructed of plywood not less than two inches thick and overlaid on the outside with a steel plate not less than one-eighth inch thick.

(III) If a door which complies with (iii)(D)(II) of this subsection is used, a berm or barricade shall be installed within six feet of the door. The berm or barricade shall extend at least as high as the top of the door and shall be a minimum of two feet wider than the door on both sides of the door.

(E) For security purposes, one steel padlock having at least five tumblers and a case hardened shackle of at least three-eighths inch diameter is sufficient for locking purposes. Hinges and hasps shall be attached so that they cannot be removed from the outside when in the closed position and with the lock in place.

(v) Interior finish. The inside of all makeup rooms shall be finished and equipped to the following minimum requirements:

(A) Construction shall be fire resistant and nonsparking up to the top of the walls. Nails or screws shall be countersunk, blind nailed, or covered.

(B) Lighting shall be by N.E.C. explosion-proof rated fixtures and all wiring shall be in sealed conduit.

(C) Control switches shall be outside the makeup room.

(D) No electrical outlet boxes are permissible inside the room.

(b) Restrictions.

(i) Smoking, matches, open flames, or flame or spark-producing devices shall not be permitted inside the makeup room.

(ii) Flammable liquids or flammable compressed gases shall not be stored in the makeup room.

(iii) Signs limiting entry to authorized personnel shall be posted on the door(s).

(iv) A sign stating the occupancy rules shall be posted inside the makeup room where it is clearly legible upon entering the room. The sign shall post the following rules:

(A) Occupancy shall be restricted to specifically authorized personnel;

(B) Smoking, matches, flame or spark-producing devices, tools or equipment shall not be permitted in the room at any time when explosives or explosive components are present; and

(C) Flammable fuels or compressed gases shall not be permitted inside the room nor stored within fifty feet of the room.

(v) Heating units shall be limited to:

(A) Forced air systems with the heating unit located outside the room.

(B) Steam systems of 15 psig or less.

(C) Hot water systems of 130°F or less.

(D) The radiant heating coils and piping for steam or hot water systems shall be protected so that explosives cannot come into contact with them.

(E) Heating ducts shall be installed so that the hot air does not discharge directly on explosives.

(F) The heating system used in a makeup room shall have controls which prevent the ambient room temperature from exceeding 130°F.

(vi) The makeup room shall be equipped with a portable fire extinguisher of at least 2A-20BC rating.

(vii) Ventilation.

(A) The makeup room shall be equipped with a ventilation system capable of maintaining a minimum rate of three air exchanges per hour during all times when explosives are present in the room.

(B) Fans and controls shall be located outside the makeup room and shall be of a type approved for this service.

(C) The lighting circuit control shall also activate the ventilation fan and the ventilation fan shall be operated whenever personnel are in the room.

(D) Exhaust ventilation shall be arranged to discharge into outside air, not into an enclosed structure.

(viii) The floor or exterior walls may be constructed with duct openings for heating and ventilation purposes provided that:

(A) Each duct opening is not greater in volume than seventy-two square inches;

(B) The combined number of duct openings shall not exceed three;

(C) Duct openings shall be located within twelve inches of the floor or ceiling;

(D) The exhaust duct opening shall not be located on the wall above the makeup workbench.

(c) Practices and procedures.

(i) When explosives are present in the makeup room, entry into the makeup room shall be restricted to trained and authorized personnel.

(ii) The access door(s) to the makeup room shall be kept locked or bolted from the inside while employees are assembling explosives.

(iii) The entire makeup room shall be kept clean, orderly, and free of burnable rubbish.

(iv) Brooms and other cleaning utensils shall not have any spark-producing metal parts if used when explosives are present.

(v) Sweepings and empty explosives containers shall be disposed of as recommended by the explosives supplier.

(vi) Repair activities which utilize spark-producing tools shall not be conducted on any part of the makeup room while explosives are present.

(d) Storage of explosives.

(i) A makeup room shall not be used for the unattended storage of class A explosives.

(ii) A makeup room which meets all requirements of this chapter may contain a class 3 storage facility, for one thousand or less blasting caps.

(iii) A class 3 storage facility shall be constructed to meet the following minimum requirements:

(A) A class 3 storage facility shall be fire resistant and theft resistant. It does not need to be bullet resistant and weather resistant if the locked makeup room provides protection from weather and bullet penetration.

(B) Sides, bottoms, and covers shall be constructed of not less than number twelve gauge metal and lined with a nonsparking material.

(C) Hinges and hasps shall be attached so that they cannot be removed from the outside.

(D) One steel padlock having at least five tumblers and a case-hardened shackle of at least three-eighths inch diameter is sufficient for locking purposes. The lock and hasp is not required to be equipped with a steel hood.

(e) Location.

(i) The makeup room shall be located in accordance with the American Quantity and Distance Separation Tables as adopted in chapter 70.74 RCW "Washington State Explosives Act" and chapter 296-52 WAC "Safety standards for the possession and handling of explosives," except under conditions as indicated in this section.

(ii) Where locating the makeup room in accordance with the quantity and distance separation table is impractical because of bad weather accessibility, rough terrain, or space availability:

(A) Upon application the department will issue a variance enabling location of the makeup room, by mutual agreement, at the safest possible location within the limitation of the individual base area.

(B) The safest possible location will be the location most isolated from assembly areas and buildings that are inhabited with application of additional protection measures such as:

(I) Berming.

(II) Locating natural obstructions or buildings that are not inhabited between the makeup room and assembly areas and buildings that are inhabited.

(III) Limitations on the total quantity of explosives in the makeup room at any one time.

(iii) Makeup rooms designed to hold the boxes of explosives awaiting makeup and the madeup explosives in avalanche control packs awaiting distribution may be located using the total quantity of explosives allowed at the makeup table at any one time as the referenced quantity of explosives provided.

(A) The makeup room is located in accordance with the American Quantity and Distance Separation Tables as adopted in chapter 70.74 RCW "Washington State Explosives Act" and chapter 296-52 WAC "Safety standards for the possession and handling of explosives" for the referenced quantity of explosives at the makeup table.

(I) This separation shall apply only to human proximity to the makeup room and only at such time as there are explosives in the makeup room.

(II) When the makeup room does not contain explosives the separation tables shall not apply.

(B) The concrete walls of the room are designed to withstand the explosion of the total amount of the referenced explosives.

(I) The concrete walls must be constructed in accordance with specifications designed and certified by a licensed engineer; or

(II) The concrete walls must be constructed to the specifications of Department of the Army TM5-1300 "Structures to Resist the Effects of Accidental Explosions" designed to

produce walls which will withstand explosion of the referenced quantity explosives.

(C) The boxes of explosives awaiting makeup and the madeup explosives in avalanche control packs awaiting distribution are located behind separate concrete debris barrier walls which will ensure that detonation of these explosives will not occur if the explosives at the makeup table detonate.

(I) The concrete debris barrier wall must be constructed in accordance with specifications designed and certified by a licensed engineer; or

(II) The concrete debris barrier wall must be constructed to the specifications of Department of the Army TM5-1300 "Structures to Resist the Effects of Accidental Explosions" to produce a barrier which will not allow detonation of the explosives awaiting makeup and distribution should the referenced quantity of explosives detonate.

(III) Access from the makeup table to the area behind the concrete debris barrier walls shall not be doored. The concrete debris barrier walls will be designed so that the access way from the makeup table to the area behind the concrete debris barrier wall will deflect debris from an explosive blast by inherent design.

(D) The roof shall be designed so that the resistance to an interior explosive blast will be negligible.

(iv) A full containment makeup room may be located anywhere and must meet the following requirements:

(A) The makeup room must be constructed in accordance with a licensed explosive engineer's approved design.

(B) The total amount of explosives in the room at any time must not exceed the design limit of the room.

(C) The makeup room cannot be used for storage.

(v) This section shall become effective December 1, 1989.

Note: Explosives shall be stored in licensed magazines only. All magazines must be located in compliance with the American Quantity and Distance Separation Tables until the United States Treasury Department Bureau of Alcohol, Tobacco and Firearms approves full containment class 1 magazines for storage at distances less than those specified in the American Standard Quantity and Distance Separation Tables and the Washington state department of labor and industries adopts corresponding amendments.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-105, filed 7/6/88.]

WAC 296-59-107 Avalanche control blasting. (1) The employer shall ensure that all members of avalanche control blasting crews are competent ski mountaineers in good physical and mental condition.

(2) Each avalanche control blasting crew or team shall consist of a qualified and licensed blaster and at least one trained assistant.

(3) Untrained personnel may accompany blasting crews for training purposes but shall not participate in actual firing of charges until trained and authorized.

(4) The blaster in charge of each crew or team shall be responsible for all phases of preparation and placement of charges.

(5) Avalanche control blasting should be conducted during daylight hours whenever possible.

(6) Escape route.

(a) The avalanche control crew or team shall preplan the escape route before igniting any charge.

(b) The escape route shall be as safe and foolproof as possible and shall culminate behind a terrain barrier or at least one hundred feet from the blast site by the time of detonation.

(7) Hand-thrown charges.

(a) A blaster shall only work with one charge at a time.

(b) Before attaching the igniter, the blaster must:

(i) Be at the start of the escape route;

(ii) Check the runout zone for personnel;

(iii) Check the blast area for personnel.

(c) After the blaster attaches and activates the igniter:

(i) The blaster shall check to see that the fuse is ignited;

(ii) If the fuse did not ignite, the blaster may reclip the fuse and attempt to light the fuse again with another igniter;

(iii) As soon as the fuse is ignited, the blaster shall promptly throw the charge into the target area;

(iv) All personnel shall proceed immediately along the escape route as soon as an ignited charge is thrown.

(d) Where hand-thrown charges will slide down the hill on hard frozen snow or ice surface, charges shall be belayed with light cord.

(8) Handcharges thrown from ski lifts or trams.

(a) The number of charges thrown from ski lifts or trams shall be kept to a minimum.

(b) The lift operating crew shall be informed of the blasting plans.

(c) The lift crew shall stand by for emergency procedures such as transfer of lift onto auxiliary power, evacuation, etc.

(d) The lift crew and the blaster in charge shall be in direct radio contact at all times during the blasting operations.

(e) Only the avalanche control blasting crew and the essential lift operating personnel shall be on a lift or tram during blasting operations.

(f) The avalanche control blasting crew shall be traveling up-slope when a charge is thrown.

(g) A charge shall always be thrown down slope and to the side, away from towers, haulropes and other equipment or facilities.

(h) The minimum distance from the blast target to the closest point of the lift shall be sixty feet.

(i) Handcharges shall not exceed 4.5 pounds of TNT equivalent.

(j) Fuses shall be timed and cut to such length that all personnel on the lift will have moved a minimum of three hundred feet from the blast target by the time of detonation.

(k) Precautions shall be taken to avoid tossing charges into any of the lift equipment, moving chairs, cables, towers, etc.

(9) Handcharges thrown from aircraft.

(a) Blasting from aircraft shall require a written program approved by the Federal Aviation Administration and the director of the department of labor and industries.

(b) A written program shall include the following:

(i) Written procedures to be followed including provisions for safety in the avalanche runout zone and emergency rescue plans.

(ii) Handcharge makeup and handling procedures.

(iii) The type of explosives to be used.

(iv) The qualifications of all personnel involved.

(v) The specific locations where aircraft blasting is to take place.

Note: Requests for blasting from aircraft will not be granted unless it is determined that conventional methods are not feasible or are more hazardous.

(10) Avalancher requirements.

(a) Management shall develop a written training program and ensure that every person who will be authorized to work on an avalancher firing team is thoroughly trained. Training shall include:

(i) All operating instructions;

(ii) Safety precautions;

(iii) Emergency procedures;

(iv) Securing requirements for the equipment.

(b) Authorized operators shall be listed on a posted operator's list.

(c) Only trained and authorized personnel shall be permitted to point and fire an avalancher with explosive rounds.

(d) During firing of explosive loaded rounds, the firing team shall consist of two qualified operators and not more than one adequately trained helper.

(e) Operators must have a current state blasting license.

(f) Each operator shall individually check the elevation, pointing and pressure settings of the gun before each shot is fired.

(g) Operators shall attempt to determine and record whether or not each round which is fired actually explodes on contact.

(h) The approximate location of all known duds shall be recorded.

(i) Initial shooting coordinates for each avalancher mount shall be made during periods of good visibility.

(j) Testing shall include test firing in various wind conditions.

(k) The correct coordinates for the various conditions encountered shall be carefully recorded.

(l) When spotter personnel are used in the target area, shooting shall be conducted with nonexplosive projectiles.

(m) Firing of explosive avalancher rounds shall only be conducted when personnel are not in the target area.

(n) The avalancher apparatus shall be stored in a non-functional condition when not in use. This shall be accomplished by:

(i) Locking out the firing mechanism or gas source in accordance with the lockout requirements of this chapter; or

(ii) Disassembly of functional components rendering the gun inoperable and separate storage of components removed; or

(iii) Removal of the entire gun to secure storage.

(o) With established avalancher mounts, each autumn when reinstalling guns, the following procedures shall be accomplished before the gun is considered operable:

(i) All components shall be carefully inspected by qualified personnel;

(ii) After assembly and installation, the gun shall first be test fired using a nonexplosive projectile;

(iii) The established firing coordinates shall be checked by test firing.

(11) Cornice control requirements.

(a) Cornice buildup hazards shall be evaluated regularly by qualified personnel, particularly after heavy snowfall periods which are accompanied by high wind or other snow transport weather conditions.

(b) Cornice hazards shall be controlled whenever the buildup appears to offer potential hazard to areas accessible by personnel.

(c) The control team shall establish the tension breakline of the cornice roof as accurately as conditions permit before starting any other control work on the cornice.

(d) The tension breakline shall be marked when necessary.

(e) Small lightly packed cornices may be kicked off with a ski, ski pole, or shovel by an unbelayed control team member if the ridgeline can be clearly established and all work can be done from the safe side of the ridgeline.

(f) When working along an anticipated cornice breakline, control team members shall retreat back from the breakline to change work positions rather than traverse along the breakline.

(g) The following factors shall be given careful consideration before commencing control activities on any relatively larger cornice:

(i) The older and larger a cornice becomes the more densely it compacts. Densely packed cornices release into larger blocks offering a higher level of danger to an extended runout zone. The control team leader shall therefore take highest level of precautions to assure that the runout zone is clear of personnel;

(ii) Larger size cornices result in increased suspended weight and leverage which may cause the breakline release fracture to occur behind the actual ridgeline. The actual ridgeline may also be obscured by the simple mass of larger cornices. Control team members shall stay off the cornice roof and must be protected by a secure belay when working near the suspected breakline;

(iii) All large cornices shall be released by explosives. Explosives shall be transported, made up and fired in accordance with the following requirements:

(A) The ignition system for single charge blasts shall be safety fuse and cap.

(B) Detonating cord shall be used to connect multiple charge blasts.

(C) When detonating cord is used, one end shall be securely anchored where premature cornice collapse will not disturb the anchor. The fuse and cap shall be attached to the free end of the detonating cord after all charges are connected to the detonating cord.

(D) Safety fuse length shall be sufficient to permit adequate escapement time for all personnel from the area influenced by the blast. Safety fuse shall be not less than three feet long, approximately two minutes and twenty seconds, in all instances.

(h) Cornice control work on large cornices shall be conducted during daylight hours and preferably during favorable weather conditions. As a minimum, clear visibility shall exist across the full length of any cornice which the control team is attempting to release.

(12) Belaying practices.

(a) Belay rope shall be standard 11 mm mountaineering rope or the equivalent.

(i) Belay rope shall be inspected at not less than thirty day intervals and maintained in excellent condition.

(ii) Defective belay rope shall not be used for belaying purposes.

(b) Adequate trees or other suitable natural belay anchors shall be used in preference to a human belay anchor when such natural anchors are available.

(c) The belay anchor position shall be as near to ninety degrees from the tension breakline as the terrain conditions will permit.

(d) With either a natural belay anchor or human belay anchor, the belay line shall be tended to keep slack out of the line.

(e) When either the belayed person or belay anchor needs to change position, the belayed person shall retreat back from the cornice to a safe position until the belay anchor is reestablished.

(f) When a human belay anchor is used:

(i) The belay anchor person shall establish the anchor position as far back away from the cornice as conditions permit;

(ii) The anchor person shall remain in a seated position with their legs pointed toward the belayed person until such time as the belayed person has retreated back from the cornice to a position considered to be safe.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-107, filed 7/6/88.]

WAC 296-59-109 Retrieving misfires or duds. (1) The following requirements shall apply to all kinds of avalanche control blasting:

(a) Each person who ignites a charge or propels a charged projectile with any kind of apparatus shall note whether or not the charge actually detonates.

(b) A conscientious effort shall be made to promptly retrieve any misfire or dud.

(i) If conditions make it impractical or dangerous to promptly retrieve a dud, a search shall be conducted as soon as conditions permit.

(ii) Any area which contains a dud shall be closed to entry to all personnel except the search team until such time as the area has been searched and pronounced safe by the designated search leader.

(c) When searching for a dud on an uncontrolled avalanche slope (a slope which has not released), the procedures used shall be consistent with good mountaineering practices.

(d) A handcharge dud shall not be approached for at least fifteen minutes.

(e) Any dud which is aflame or emitting smoke shall not be approached for at least one hour after evidence of combustion ceases.

(f) A handcharge or avalancher dud may be blown up with a secondary charge where they are found or may be disarmed at that location by fully trained and qualified personnel.

(g) Military warhead duds shall not be moved. They shall be blown up where they are found by secondary charges except that trained military personnel may disarm and trans-

port such duds when approved by the governmental branch having jurisdiction.

(2) Records.

(a) Accurate records shall be maintained for every explosive device which does not detonate.

(b) Dud records shall include the following information:

- (i) The suspected location;
- (ii) A description of the dud;
- (iii) The date the dud was lost;
- (iv) The date the dud was found and disposed of.

(3) Dud frequency.

(a) Dud frequency should be maintained below one dud for every five hundred detonating attempts.

(b) Any employer who does not maintain a dud frequency below one dud per five hundred detonation attempts shall investigate all aspects of the blasting program and take prompt corrective actions as indicated.

(4) Dud warning signs.

(a) Ski area operations which use any form of explosive device for avalanche control shall display warning and information placards and/or signs.

(b) Signs shall be posted at readily visible locations and in such a manner as to give both employees and the public ample opportunity to be informed of the potential existence of dud avalanche charges. Locations may include but are not limited to:

- (i) Ticket sales and lift loading areas;
- (ii) Food and beverage service facilities;
- (iii) Restrooms and locker rooms;
- (iv) Safety bulletin boards;
- (v) Along general access routes.

(c) Signs shall be distinctive in appearance from the surrounding background where they are posted.

(d) Signs shall be maintained in legible condition.

(e) Signs shall include the following information:

(i) The word "WARNING" or "DANGER" at the top of the sign in the largest lettering on the sign;

(ii) The words "Explosives on the mountain";

(iii) A colored pictorial illustration which also provides information on dimensions of each type of explosive device used in the area;

(iv) The sign wording shall conclude with specific instructions to be followed by anyone who locates an unexploded explosive device.

Note: An example dud warning sign is illustrated in Appendix 1.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-109, filed 7/6/88.]

WAC 296-59-115 Ski lift facilities and structures. (1)

Existing ski lift facilities and structures shall not be required to be retrofitted with standard construction work platforms, walkways, stairs or guardrails on exterior surfaces when such features would add significantly to snow loading considerations. When such standard protective features are omitted, alternative personal protective measures shall be used where possible. Examples include but are not limited to: Safety belt and lanyard, ladder climbing safety devices, temporary work platforms or scaffolds, temporary or removable handrails, guardrails, or walkways.

(2) Snow removal.

(a) During the operating season, standard guardrails which would interfere with snow removal may be omitted in areas where it can be anticipated that frequent snow removal will be necessary to maintain operability of ski lift apparatus. Examples could include but are not limited to the motor house roof or loading and unloading areas.

(b) Personnel barricades, signs, or other devices shall be used to deflect traffic or warn personnel of existing fall hazards.

(3) All ski lift towers installed after the effective date of this standard shall be equipped with permanent ladders or steps which meet the following minimum requirements:

(a) The minimum design live load shall be a single concentrated load of two hundred pounds.

(b) The number and position of additional concentrated live load units of two hundred pounds each as determined from anticipated usage of the ladder shall be considered in the design.

(c) The live loads imposed by persons occupying the ladder shall be considered to be concentrated at such points as will cause the maximum stress in the structural member being considered.

(d) The weight of the ladder and attached appurtenances together with the live load shall be considered in the design of rails and fastenings.

(e) All rungs shall have a minimum diameter of three-fourths inch.

(f) The distance between rungs on steps shall not exceed twelve inches and shall be uniform throughout the ladder length. The top rung shall be located at the level of the landing or equipment served by the ladder.

(g) The minimum clear length of rungs or steps shall be sixteen inches on new installations.

(h) Rungs, cleats, and steps shall be free of sharp edges, burrs, or projections which may be a hazard.

(i) The rungs of an individual-rung ladder shall be so designed that the foot cannot slide off the end. (A suggested design is shown in Figure D-1, at the end of this section.)

(j) Side rails which might be used as a climbing aid shall be of such cross sections as to afford adequate gripping surface without sharp edges or burrs.

(k) Fastenings. Fastenings shall be an integral part of fixed ladder design.

(l) All splices made by whatever means shall meet design requirements as noted in (a) of this subsection. All splices and connections shall have smooth transition with original members and with no sharp or extensive projections.

(m) Adequate means shall be employed to protect dissimilar metals from electrolytic action when such metals are joined.

(n) Welding. All welding shall be in accordance with the "Code for Welding in Building Construction" (AWS D1.0-1966).

(o) Protection from deterioration. Metal ladders and appurtenances shall be painted or otherwise treated to resist corrosion and rusting when location demands.

(4) Installation and clearance.

(a) Pitch.

(i) The preferred pitch of fixed ladders is between the range of seventy-five degrees and ninety degrees with the horizontal (Figure D-4).

(ii) Substandard pitch. Fixed ladders shall be considered as substandard if they are installed within the substandard pitch range of forty-five and seventy-five degrees with the horizontal. Substandard fixed ladders are permitted only where it is found necessary to meet conditions of installation. This substandard pitch range is considered as a critical range to be avoided, if possible.

(iii) Pitch greater than ninety degrees. Ladders having a pitch in excess of ninety degrees with the horizontal are prohibited.

(b) Clearances.

(i) The perpendicular distance from the centerline of the rungs to the nearest permanent object on the climbing side of the ladder shall be thirty-six inches for a pitch of seventy-six degrees, and thirty inches for a pitch of ninety degrees (Figure D-2), with minimum clearances for intermediate pitches varying between these two limits in proportion to the slope.

(ii) A clear width of at least fifteen inches shall be provided each way from the centerline of the ladder in the climbing space.

(iii) The side rails of through or side-step ladder extensions shall extend three and one-half feet above parapets and landings.

(A) For through ladder extensions, the rungs shall be omitted from the extension and shall have not less than eighteen nor more than twenty-four inches clearance between rails.

(B) For side-step or offset fixed ladder sections, at landings, the side rails and rungs shall be carried to the next regular rung beyond or above the three and one-half feet minimum.

(iv) Grab bars shall be spaced by a continuation of the rung spacing when they are located in the horizontal position. Vertical grab bars shall have the same spacing as the ladder side rails. Grab bar diameters shall be the equivalent of the round-rung diameters.

(v) Clearance in back of ladder. The distance from the centerline of rungs, cleats, or steps to the nearest permanent object in back of the ladder shall be not less than seven inches, except that when unavoidable obstructions are encountered, minimum clearances as shown in Figure D-3 shall be provided.

(vi) Clearance in back of grab bar. The distance from the centerline of the grab bar to the nearest permanent object in back of the grab bars shall be not less than four inches. Grab bars shall not protrude on the climbing side beyond the rungs of the ladder which they serve.

(c) The step-across distance from the nearest edge of a ladder to the nearest edge of the equipment or structure shall be not more than twelve inches, or less than two and one-half inches. However, the step-across distance may be as much as twenty inches provided:

(i) The climber is wearing a safety belt and lanyard; and

(ii) The lanyard is attached to the tower structure before the climber steps off the ladder.

(5) Ski lift towers are not required to be equipped with ladder cages, platforms or landings.

(6) Maintenance and use.

(a) All ladders shall be maintained in a safe condition. All ladders shall be inspected regularly, with the intervals between inspections being determined by use and exposure.

(b) When ascending or descending, the climber must face the ladder.

(c) Personnel shall not ascend or descend ladders while carrying tools or materials which could interfere with the free use of both hands.

(7) Personnel shall be provided with and shall use ladder safety devices or safety belt and lanyard whenever feasible.

(8) Personnel shall not place mobile equipment or personal equipment such as skis, ski poles, or large tools within the falling radius of the lift tower while climbing or working on the lift tower.

(9) Ski lift towers and terminals are not required to be equipped with sheave guards on the haulrope wheels.

(10) Ski lift towers are not required to be equipped with work platforms.

(11) Personnel shall use personal protective equipment such as a safety belt and lanyard when working at unprotected elevated locations. Exception to this requirement shall only be permitted for emergency rescue or emergency inspection if a safety belt and lanyard is not immediately available. Required personal protective equipment shall be made available as quickly as possible.

(12) When fixed ladders on towers do not reach all the way down to the ground or snow level, a specifically designed and constructed portable ladder shall be used for access to and from the fixed ladder. Portable ladders shall be constructed and maintained to the following requirements:

(a) The portable ladder shall be constructed in accordance with applicable provisions of subsection (3) of this section.

(b) The portable ladder shall be constructed with a minimum of two attachment hooks near the top to be utilized for securing the portable ladder onto the fixed ladder.

(c) The attachment hooks shall be installed to support the portable ladder near the fixed ladder siderails.

(d) Rungs or steps on the portable ladder shall be spaced to be identical with rungs or steps on the fixed ladder when the portable ladder is attached for use. The design criteria shall be to achieve a horizontal plane relationship on the top (walking surface) portion of both steps when overlapping is necessary.

(e) The portable ladder shall be equipped with a hold-out device near the bottom to assure clearance behind the steps as required by subsection (4)(b)(v) of this section.

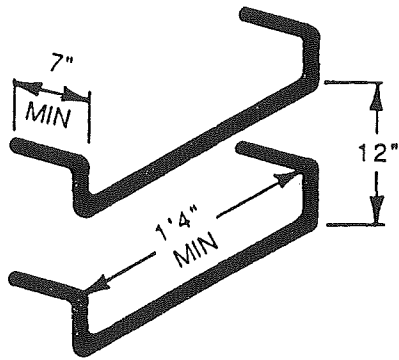


FIGURE D-1

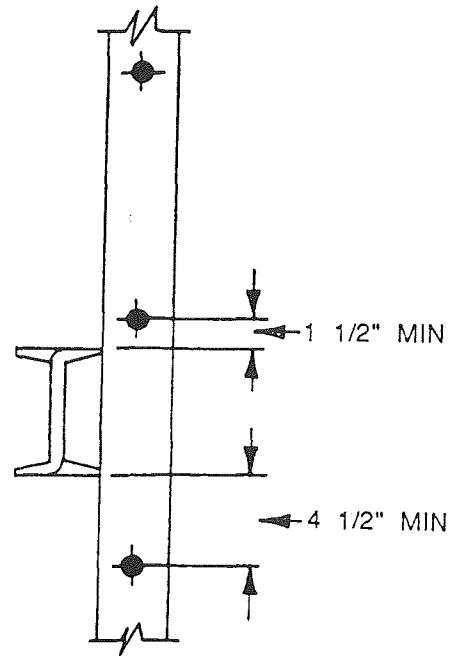


FIGURE D-3
Clearance for Unavoidable Obstruction
at Rear of Fixed Ladder.

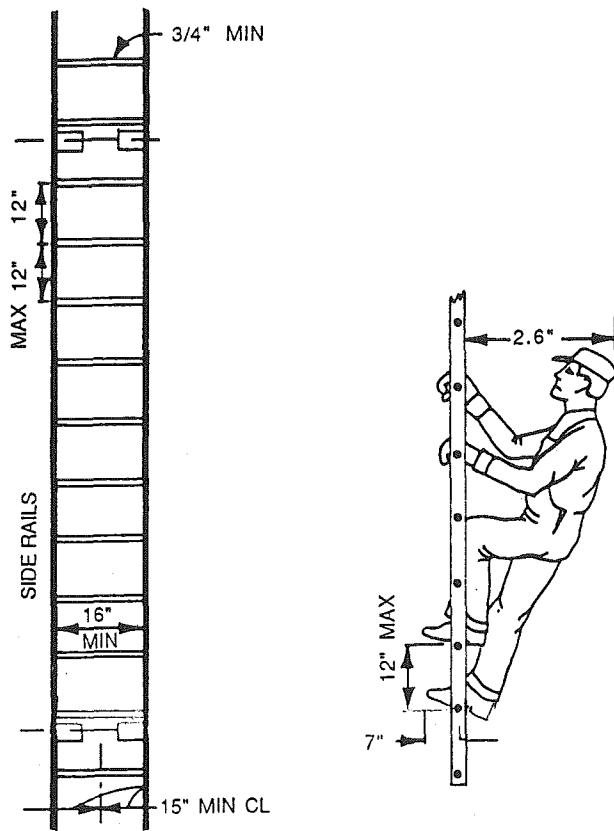


FIGURE D-2
Minimum Ladder Clearance

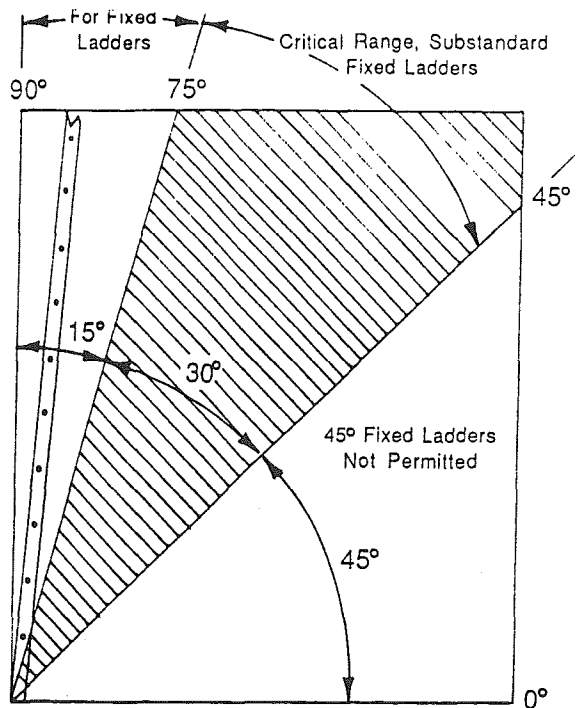


FIGURE D-4
Fixed Ladder Range

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-115, filed 7/6/88.]

WAC 296-59-120 Ski lift operations. (1) Operators.

(a) Only trained and qualified lift operators shall be permitted to operate any lift while it is carrying passengers.

(b) Management designated trainees shall only be permitted to operate a lift while under the direct supervision of a qualified operator or trainer.

(c) Initial training of operators shall be accomplished when the lift is not carrying passengers.

(d) Operator training shall include:

(i) Standard and emergency start-up procedures;

(ii) Standard and emergency stopping procedures;

(iii) Lockout procedures;

(iv) Corrective actions for operating malfunctions;

(v) Specific instructions on who to contact for different kinds of rescue emergencies;

(vi) Specific instructions on standard operating procedures with respect to the hazard of loading or unloading passengers proximate to the moving lift chairs.

(2) Operators and helpers shall prepare and maintain the loading and unloading work stations in a leveled condition and, to the extent possible, free from slipping hazards caused by ice, ruts, excessive snow accumulation, tools, etc.

(3) Daily start-up procedure.

(a) Loading station operators shall test all operating controls and stopping controls before permitting any personnel or passengers to load on the lift.

(b) The lift must travel a distance of two times the longest tower span before any employee can load on a chair to go to the remote station.

(c) A qualified operator shall be the first passenger on each lift each day.

Exception:

The avalanche control team and the emergency rescue team may use any operable lift at anytime for that work. They may use lifts without a remote operator provided that direct communications are maintained to the operator and the operator has successfully completed normal daily safety and operating control checks at the operating station in use.

(d) Enroute to the remote station, the remote operator shall visually inspect each tower as the chair or gondola proceeds to the remote station.

(e) The remote operator shall stop the system when he/she has reached the remote control station. The operator shall then conduct the daily safety and operating control checks on the remote station.

(f) The remote operator shall ensure that the unloading area is groomed to adequately accommodate normal unloading.

(g) When all controls are checked and functioning correctly and the unloading area is prepared, the remote operator shall communicate to the operator that the system can be placed in normal operation.

(4) Operators shall report to their work station wearing adequate clothing for inclement weather which may be encountered. This requirement shall include reasonably water resistant footwear which shall have a slip resistant sole tread.

(5) While the lift is in operation and carrying passengers, operators shall not permit any activity in the loading/unloading areas which could distract their attention from the principle duty of safely loading or unloading passengers.

(6) Means of communication shall be maintained between the top operator and bottom operator stations.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-120, filed 7/6/88.]

WAC 296-59-125 Ski lift aerial work platforms. (1) Construction and loading.

(a) All aerial work platforms shall be constructed to sustain the permissible loading with a safety factor of four. The load permitted shall be calculated to include:

(i) The weight of the platform and all suspension components;

(ii) The weight of each permitted occupant calculated at two hundred fifty pounds per person including limited hand-tools;

(iii) The weight of any additional heavy tools, equipment, or supplies for tasks commonly accomplished from the work platform.

(b) The floor of the platform shall not have openings larger than two inches in the greatest dimension.

(c) The platform shall be equipped with toeboards at least four inches high on all sides.

(d) Guardrails.

(i) The platform shall be equipped with standard height and strength guardrails where such guardrails will pass through the configuration of all lifts on which it is intended to be used.

(ii) Where guardrails must be less than thirty-six inches high in order to clear carriages, guideage, etc., guardrails shall be as high as will clear the obstructions but never less than twelve inches high.

(iii) If the work platform is equipped with an upper work level, the upper level platform shall be equipped with a toeboard at least four inches high.

(iv) Each platform shall be equipped with a lanyard attachment ring for each permissible occupant to attach a safety belt lanyard.

(v) Each lanyard attachment ring shall be of such strength as to sustain five thousand four hundred pounds of static loading for each occupant permitted to be attached to a specific ring.

(vi) Attachment rings shall be permanently located as close to the center balance point of the platform as is practical.

(vii) The rings may be movable, for instance, up and down a central suspension rod, but shall not be completely removable.

(e) Platform attachment.

(i) The platform shall be suspended by either a standard wire rope four part bridle or by solid metal rods, bars, or pipe.

(ii) The attachment means chosen shall be of a type which will prevent accidental displacement.

(iii) The attachment means shall be adjusted so that the platform rides level when empty.

(f) Maintenance.

(i) Every aerial work platform shall be subjected to a complete annual inspection by qualified personnel.

(ii) The inspection shall include all structural members, welding, bolted or treaded fittings, and the suspension components.

(iii) Any defect noted shall be repaired before the platform is placed back in service.

(iv) A written record shall be kept for each annual inspection. The record shall include:

(A) The inspector identification;

(B) All defects found;

(C) The identity of repair personnel;

(D) Identity of the post-repair inspector who accepted the platform for use.

(g) The platform shall be clearly identified as to the number of permissible passengers and the weight limit of additional cargo permitted.

(i) Signs shall be applied on the outside of each side panel.

(ii) Signs shall be maintained in clearly legible condition.

(h) Unless the side guardrail assembly is at least thirty-six inches high on all sides, signs shall be placed on the inside floor or walls to clearly inform all passengers that they must use a safety belt and lanyard at all times when using the platform.

(2) Work platform use.

(a) Platforms shall be attached to the haulrope with an attachment means which develops a four to one strength factor for the combined weight of the platform and all permissible loading.

(b) The haulrope attachment means shall be designed to prevent accidental displacement.

(c) Trained and competent personnel shall attach and inspect the platform before each use.

(d) Passengers shall be provided with and shall use the correct safety harness and lanyard for the intended work.

(e) Any time a passenger's position is not protected by a standard guardrail at least thirty-six inches high, the individual shall be protected by a short lanyard which will not permit free-fall over the platform edge.

(f) When personnel are passengers on a work platform and their work position requires the use of a safety harness and lanyard, the lanyard shall be attached to the work platform, not to the haulrope or tower.

(g) Work platform passengers shall face in the direction of travel when the lift is moving.

(h) Tools, equipment and supplies shall be loaded on the platform in such a fashion that the loaded platform can safely pass all towers and appurtenances.

(i) Heavy tools, equipment or supplies shall be secured in place if they could fall over or roll within the platform and create a hazard for passengers.

(j) When the work crew is traveling on the work platform, the lift shall be operated at a speed which is safe for that particular system and the conditions present.

Note: See Appendix 2 for operating procedure requirements.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-125, filed 7/6/88.]

WAC 296-59-130 Ski lift machinery guarding. (1) Moving machine parts that are located within normal reach shall be fitted with safety guards in compliance with WAC 296-24-150 through 296-24-20533, Machinery and machine guarding.

(1999 Ed.)

(a) The coupling apparatus for the ski lift emergency drive may be provided with a removable or swing guard.

(b) When removable or swing guards are used, the guard and mounting means shall be so designed and constructed as to sustain a two hundred fifty pound weight loading without displacement.

(2) All guards shall be maintained in good condition and shall be secured in place when the equipment is in operation except for inspection and adjustment purposes.

(3) The drive machinery and primary control apparatus shall be installed in a facility which can prevent access by unauthorized personnel. The access door shall have a sign which states that entry is restricted to authorized personnel.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-59-130, filed 7/6/88.]

WAC 296-59-135 Appendix 1—Nonmandatory alternative lock-out procedure for ski lifts and tows. (1) To ensure the safety of all personnel engaged in lift maintenance activities, we insist that the following procedure be strictly adhered to.

(a) Criteria.

(i) Equipment shall be deactivated and locked or tagged out before an employee is placed in a position where there is a hazard created by exposure to the components of ski lift or tows, equipment and/or systems.

(ii) This procedure relies on positive communication to indicate when lock-out safety is assured. At any time this crew is working at a location remote from the control station, this procedure shall be used by only one work crew whose members are working in close proximity to one another.

(iii) The operator and all potentially exposed employees shall have a positive means of communication at all times. If anyone loses the communication means, it shall be restored before exposure can occur or lock-out or tag-out can be broken.

(iv) Other radio transmissions breaking in or overriding the communications between control operator and remote work crew, if not controlled, can be a problem. There are considerations that should be followed:

(A) The first preferred method is to provide an isolated radio channel for communications between operator and remote work crew.

(B) If an isolated radio frequency is not possible, the entire area crew should be trained to recognize the radio conversation characteristics of this type of work to be notified when the work is in progress and be required to restrict use of their radios.

(v) All personnel working under this procedure shall be thoroughly trained in the specific procedures to be followed and their individual requirements. The ski lift or tow controls shall be under control of a fully qualified operator at all times.

(vi) Signs shall be posted in motor rooms on the control panel or the master disconnect stating "men working on lifts."

(vii) The control operator shall not leave the close proximity of the control station unless the master disconnect is thrown to the off position and padlocked.

(viii) The "standby drive" shall be locked out of service in such a manner that precludes the operation of the lift by jumping ignition, throwing a clutch, or hooking up a cou-

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pling, etc., whenever work is being performed on the equipment or system.

Methods for securing "standby drive" may be, but are not limited to the following:

(A) Removal to secure a location or locking up "standby" drive coupling chain, belts, etc.;

(B) Denying access to the standby motor by locking motor room door.

(ix) When the crew is working at either terminal in proximity of bullwheels, shafts, guideage, gears, belts, chains, etc., the master disconnect shall be thrown to the off position and padlocked.

(b) Work chair.

(i) Prior to crew loading on work chair, controls and communications shall be thoroughly checked to confirm that they are in good working condition.

(ii) The operator and work crew shall discuss and determine the safe speed for that particular lift. At no time shall the work chair travel around either terminal bullwheel except at a very slow speed.

(iii) Employees riding in the work chair shall face the direction of travel when chair is in motion.

(iv) Employees in work chair shall pay special attention to ensure that equipment or tools, etc., will not be entangled on towers, ramps, or terminals as work chair passes by.

(v) Safety belts are required and there is a designated device on each work chair to hook onto. At no time will it be allowed to hook onto the tower or tower equipment while in the work chair, or hook onto a moving part of the lift if standing on the tower.

(c) Operator and controls.

(i) Manual reset stop switches are required on all lifts. The operator shall check and confirm that the lift cannot be started from any control location when the stop switch is depressed. The operator will leave the stop switch depressed until remote crew directs that they are ready to move.

(ii) Communications between operator and remote work crew will be on name basis. This is especially important if there are other radio communications or other crews working on other lifts.

(2) Summation.

(a) If all these rules are adhered to, the operator can use the control circuit stop switch for repetitive type maintenance on towers. If the remote crew is to be at the location for some time, it is recommended that the operator throw the master disconnect switch to the off position and padlock it.

(b) A padlock on the disconnect switch is required when anybody is working on either terminal.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-59-135, filed 11/14/88.]

296-62-07507	Mixtures.	296-62-07719	Hygiene facilities and practices.
296-62-07509	Nuisance dusts.	296-62-07721	Communication of hazards to employees.
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		296-62-07737	Appendix B—Detailed procedure for asbestos sampling and analysis—Nonmandatory.
		296-62-07739	Appendix C—Qualitative and quantitative fit testing procedures—Mandatory.
		296-62-07741	Appendix D—Medical questionnaires—Mandatory.
		296-62-07743	Appendix E—Interpretation and classification of chest roentgenograms—Mandatory.
		296-62-07745	Appendix F—Work practices and engineering controls for automotive brake and clutch inspection, disassembly, repair and assembly—Mandatory.
		296-62-07747	Appendix G—Substance technical information for asbestos—Nonmandatory.
		296-62-07749	Appendix H—Medical surveillance guidelines for asbestos—Nonmandatory.
		296-62-07751	Appendix I—Work practices and engineering controls for Class I asbestos operations—Nonmandatory.
		296-62-07753	Appendix J—Polarized light microscopy of asbestos—Nonmandatory.
		296-62-07755	Appendix K—Smoking cessation program information for asbestos, tremolite, anthophyllite, and actinolite—Nonmandatory.
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296-62-14503	General requirements.	296-62-40001	Scope and application.
296-62-14505	Permit-required confined space program (permit space program).	296-62-40003	Definitions applicable to all sections of this chapter.
296-62-14507	Permit system.	296-62-40005	Permissible exposure limits.
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296-62-14521	Appendix A—Permit-required confined space decision flow chart.	296-62-40021	Start-up date.
296-62-14523	Appendix B—Procedures for atmospheric testing.	296-62-40023	Appendices.
296-62-14525	Appendix C—Examples of permit-required confined space programs.	296-62-40025	Appendix A—National Research Council recommendations concerning chemical hygiene in laboratories (nonmandatory).
296-62-14527	Appendix D—Sample permits.	296-62-40027	Appendix B—References (nonmandatory).
296-62-14529	Appendix E—Sewer system entry.		DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER
	PART N—COTTON DUST	296-62-030	Revisions. [Order 70-8, § 296-62-030, filed 7/31/70, effective 9/1/70; Rule 3.010, effective 8/1/63.] Repealed by Order 73-3, filed 5/7/73.
296-62-14533	Cotton dust.	296-62-07007	Labeling of chemical agents. [Order 73-3, § 296-62-07007, filed 5/7/73.] Repealed by 90-09-026 (Order 90-01), filed 4/10/90, effective 5/25/90. Statutory Authority: Chapter 49.17 RCW.
296-62-14535	Appendix A—Air sampling and analytical procedures for determining concentrations of cotton dust.	296-62-07301	4-Nitrobiphenyl. [Order 74-35, § 296-62-07301, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-14537	Appendix B-I through B-III—Respiratory questionnaire.	296-62-07303	Alpha-Naphthylamine. [Order 74-35, § 296-62-07303, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-14539	Appendix C—Spirometry prediction tables for normal males and females.	296-62-07305	4,4'-Methylene bis (2-chloroaniline). [Order 74-35, § 296-62-07305, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-14541	Appendix D—Pulmonary function standards for cotton dust standard.	296-62-07307	Methyl chloromethyl ether. [Order 74-35, § 296-62-07307, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-14543	Appendix E—Vertical elutriator equivalency protocol.	296-62-07309	3,3'-Dichlorobenzidine (and its salts). [Order 74-35, § 296-62-07309, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
	PART O—COKE OVENS	296-62-07311	Bis-Chloromethyl ether. [Order 74-35, § 296-62-07311, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-200	Coke oven emissions.	296-62-07313	Beta-Naphthylamine. [Order 74-35, § 296-62-07313, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-20001	Definitions.	296-62-07315	Benzidine. [Order 74-35, § 296-62-07315, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.
296-62-20003	Permissible exposure limit.		
296-62-20005	Regulated areas.		
296-62-20007	Exposure monitoring and measurement.		
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296-62-20019	Employee information and training.		
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296-62-20023	Recordkeeping.		
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296-62-20027	Appendix A—Coke oven emissions substance information sheet.		
296-62-20029	Appendix B—Industrial hygiene and medical surveillance guidelines.		
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296-62-300	Scope, application, and definitions.		
296-62-3010	Safety and health program.		
296-62-3020	Site characterization and analysis.		
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296-62-3070	Monitoring.		
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	11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.		
296-62-07317	4-Aminodiphenyl. [Order 74-35, § 296-62-07317, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-07729	Observation of monitoring. [Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07729, filed 4/27/87.] Repealed by 87-24-051 (Order 87-24), filed 11/30/87. Statutory Authority: Chapter 49.17 RCW.
296-62-07319	Ethyleneimine. [Order 76-6, § 296-62-07319, filed 3/1/76.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-07731	Dates. [Statutory Authority: Chapter 49.17 RCW, 91-03-044 (Order 90-18), § 296-62-07731, filed 1/10/91, effective 2/12/91; 89-11-035 (Order 89-03), § 296-62-07731, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07731, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07731, filed 4/27/87.] Repealed by 97-01-079, filed 12/17/96, effective 3/1/97. Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060.
296-62-07321	Beta-Propiolactone. [Order 74-35, § 296-62-07321, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-07761	Nonasbestiform tremolite, anthophyllite, and actinolite. [Statutory Authority: Chapter 49.17 RCW, 87-24-051 (Order 87-24), § 296-62-07761, filed 11/30/87.] Repealed by 97-19-014, filed 9/5/97, effective 11/5/97. Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060.
296-62-07323	2-Acetylaminofluorene. [Order 74-35, § 296-62-07323, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-09011	Occupational noise exposure. [Statutory Authority: RCW 49.17.040 and 49.17.050, 82-03-023 (Order 82-1), § 296-62-09011, filed 1/15/82. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240, 81-16-016 (Order 81-19), § 296-62-09011, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-09011, filed 8/8/80; Order 73-3, § 296-62-09011, filed 5/7/73.] Repealed by 83-24-013 (Order 83-34), filed 11/30/83. Statutory Authority: RCW 49.17.040 and 49.17.050.
296-62-07325	4-Dimethylaminoazobenzene. [Order 74-35, § 296-62-07325, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-120	Respiratory protection. [Order 70-8, § 296-62-120 filed 7/31/70, effective 9/1/70; Rule 12.010, effective 8/1/63.] Repealed by Order 73-3, filed 5/7/73.
296-62-07327	N-Nitrosodimethylamine—Carcinogen standard report form. [Order 74-35, § 296-62-07327 and Carcinogen Standard Report Form, filed 9/20/74.] Repealed by 80-17-014 (Order 80-20), filed 11/13/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW.	296-62-140	Industrial sanitation. [Order 70-8, § 296-62-140, filed 7/31/70, effective 9/1/70; Rule 14.010, effective 8/1/63.] Repealed by Order 73-3, filed 5/7/73.
296-62-07335	Benzene. [Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30, and 43.22 RCW. 78-09-092 (Order 78-16), § 296-62-07335, filed 8/31/78.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.	296-62-14531	Exposure to cotton dust in cotton gins. [Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240, 81-18-029 (Order 81-21), § 296-62-14531, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-14531, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-14531, filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.150 and 49.17.240. 79-02-037 (Order 79-1), § 296-62-14531, filed 1/23/79.] Repealed by 87-24-051 (Order 87-24), filed 11/30/87. Statutory Authority: Chapter 49.17 RCW.
296-62-07341	Acrylonitrile. [Statutory Authority: RCW 49.17.040 and 49.17.050, 86-16-009 (Order 86-28), § 296-62-07341, filed 7/25/86. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240, 81-18-029 (Order 81-21), § 296-62-07341, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07341, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-07341, filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30, and 43.22 RCW. 78-07-052 (Order 78-10), § 296-62-07341, filed 6/28/78.] Repealed by 88-11-021 (Order 88-04), filed 5/11/88. Statutory Authority: Chapter 49.17 RCW.	296-62-146	Appendices. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-146, filed 8/27/81.] Repealed by 87-24-051 (Order 87-24), filed 11/30/87. Statutory Authority: Chapter 49.17 RCW.
296-62-07345	1,2-Dibromo-3-chloropropane. [Statutory Authority: RCW 49.17.040 and 49.17.050, 86-16-009 (Order 86-28), § 296-62-07345, filed 7/25/86. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240, 81-18-029 (Order 81-21), § 296-62-07345, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07345, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-07345, filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240, chapters 42.30, and 43.22 RCW. 78-07-052 (Order 78-10), § 296-62-07345, filed 6/28/78.] Repealed by 88-11-021 (Order 88-04), filed 5/11/88. Statutory Authority: Chapter 49.17 RCW.	296-62-14601	Appendix A—Requirements for classification and respiratory use of workers exposed to cotton dust in gins. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-14601, filed 8/27/81.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
296-62-07349	Lead. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-07349, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07349, filed 7/27/81; 80-11-009 (Order 80-16), § 296-62-07349, filed 8/8/80.] Decodified by 82-13-045 (Order 82-22), filed 6/11/82. Statutory Authority: RCW 49.17.040 and 49.17.050. Later promulgation, see WAC 296-62-07521.	296-62-14603	Appendix B-1—Respiratory questionnaire. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-14603, filed 8/27/81.] Repealed by 87-24-051 (Order 87-24), filed 11/30/87. Statutory Authority: Chapter 49.17 RCW.
296-62-07353	Ethylene oxide. [Statutory Authority: RCW 49.17.050(2) and 49.14.040 [49.17.040], 87-07-022 (Order 87-01), § 296-62-07353, filed 3/12/87. Statutory Authority: RCW 49.17.040 and 49.17.050, 86-16-009 (Order 86-28), § 296-62-07353, filed 7/25/86; 85-10-004 (Order 85-09), § 296-62-07353, filed 4/19/85; 85-01-022 (Order 84-24), § 296-62-07353, filed 12/11/84.] Repealed by 87-24-051 (Order 87-24), filed 11/30/87. Statutory Authority: Chapter 49.17 RCW.	296-62-14605	Appendix C—Spirometry prediction tables for normal males and females. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-14605, filed 8/27/81.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
296-62-07707	Identification. [Statutory Authority: Chapter 49.17 RCW, 89-21-018 (Order 89-10), § 296-62-07707, filed 10/10/89, effective 11/24/89; 87-24-051 (Order 87-24), § 296-62-07707, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07707, filed 4/27/87.] Repealed by 97-01-079, filed 12/17/96, effective 3/1/97. Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060.	296-62-14607	Appendix D—Pulmonary function standards for cotton dust standard. [Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-14607, filed 8/27/81.] Repealed by 88-23-054 (Order 88-25), filed 11/14/88. Statutory Authority: Chapter 49.17 RCW.
		296-62-150	Appendix I—Threshold limit values for 1969. [Order 70-8, § 296-62-150, filed 7/31/70, effective 9/1/70; Rules (part), effective 12/1/63.] Repealed by Order 73-3, filed 5/7/73.
		296-62-155	Appendix I—Adopted values. [Order 70-8, § 296-62-155, filed 7/31/70, effective 9/1/70; Rules (part), effective 12/1/63.] Repealed by Order 73-3, filed 5/7/73.

- 296-62-157 Threshold limit values of physical agents for 1969. [Order 70-8, § 296-62-157, filed 7/31/70, effective 9/1/70.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-160 Appendix II—Levels of illumination currents. [Appendix II, effective 12/1/63.] Repealed by Order 70-8, filed 7/31/70, effective 9/1/70. Also repealed by Order 73-3, filed 5/7/73.
- 296-62-165 Appendix III—Nonionizing radiation. [Order 70-8, § 296-62-165, filed 7/31/70, effective 9/1/70; Appendix III, effective 8/1/63.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-170 Appendix IV—Temperature, radiant heat, humidity, or air velocity combinations. [Order 70-8, § 296-62-170, filed 7/31/70, effective 9/1/70; Appendix IV, effective 8/1/63.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-175 References. [Order 70-8, § 296-62-175, filed 7/31/70, effective 9/1/70.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-180 Appendix V—Use and care of respiratory protective equipment, compressed air supply for respirators. [Order 70-8, § 296-62-180, filed 7/31/70, effective 9/1/70.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-185 References. [Order 70-8, § 296-62-185, filed 7/31/70, effective 9/1/70.] Repealed by Order 73-3, filed 5/7/73.
- 296-62-3150 Start-up dates. [Statutory Authority: Chapter 49.17 RCW, 88-21-002 (Order 88-23), § 296-62-3150, filed 10/6/88, effective 11/7/88.] Repealed by 89-21-018 (Order 89-10), filed 10/10/89, effective 11/24/89. Statutory Authority: Chapter 49.17 RCW.
- 296-62-900 Note on application of appendices A through H. [Order 73-3, Note (codified as WAC 296-62-900), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-901 Appendix A. [Order 73-3, Appendix A (codified as WAC 296-62-901), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-902 Appendix B. [Order 73-3, Appendix B (codified as WAC 296-62-902), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-903 Appendix C—Threshold limit values for mixtures. [Order 73-3, Appendix C (codified as WAC 296-62-903), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-904 Appendix D—Permissible excursions for time-weighted average (TWA) limits. [Order 73-3, Appendix D (codified as WAC 296-62-904), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-905 Appendix E—Some nuisance particulates (see note q). [Order 73-3, Appendix E (codified as WAC 296-62-905), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-906 Appendix F. [Order 73-3, Appendix F (codified as WAC 296-62-906), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-907 Appendix G—Notice of intended changes (for 1972). [Order 73-3, Appendix G (codified as WAC 296-62-907), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.
- 296-62-908 Appendix H—Notice of intent to change the TLV for lasers-1972. [Order 73-3, Appendix H (codified as WAC 296-62-908), filed 5/7/73.] Repealed by 80-11-010 (Order 80-14), filed 8/8/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240.

PART A—GENERAL

WAC 296-62-005 Occupational health and environmental control—Foreword. (1) Foreword.

(a) Modern industry is changing at an ever-increasing pace. New inventions, discoveries and developments cause changes in every facet of the industrial process. In keeping with this changing technology is the necessity to provide an

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adequate guide for the protection of working men and women. This chapter is for the guidance of both labor and management and to call particular attention to the way in which modernization and updating of the standards can be accomplished.

(b) This chapter is intended to cover as fully as is practical the environment in which work is performed. In addition to the suggestions made herein, the services of modern occupational medicine must also be considered. Occupational medicine with its specialized techniques for examination, diagnosis, and treatment adds another protection for the worker as he encounters newly-developed materials and methods.

(c) With the full realization that close cooperation between government and industry, labor and management, and all the health sciences, is essential, this chapter is promulgated for the health of all the workmen coming under the jurisdiction of the department of labor and industries.

(d) This chapter is promulgated in accordance with the applicable requirements as outlined in the Washington State Administrative Procedure Act (chapter 34.04 RCW) and other applicable statutes.

[Order 73-3, § 296-62-005, filed 5/7/73; Order 70-8, § 296-62-005, filed 7/31/70, effective 9/1/70.]

WAC 296-62-010 Purpose and scope. (1) Purpose. The purpose of this chapter is:

(a) To protect the health of workmen by prescribing minimum requirements for the prevention or control of conditions in industry hazardous to health.

(b) Assist in the provision of a healthful working environment.

(2) Scope. This chapter shall apply to all industry coming under the jurisdiction of the department of labor and industries.

[Order 73-3, § 296-62-010, filed 5/7/73; Order 70-8, § 296-62-010, filed 7/31/70, effective 9/1/70; Section I, effective 8/1/63.]

WAC 296-62-020 Definitions applicable to all sections of this chapter. Unless the context indicates otherwise, words used in this chapter shall have the meaning given in this section.

(1) "Adequate" or "effective" means compliance with terms and intent of these standards.

(2) "Appendix" means references or recommendations to be used as guides in applying the provisions of this chapter.

(3) "Approved" means approved by the director of the department of labor and industries or his authorized representative: *Provided, however,* That should a provision of this chapter state that approval by an agency or organization other than the department of labor and industries is required, such as Underwriters' Laboratories or the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health, the provision of WAC 296-24-006 shall apply.

(4) "Authorized person" means a person approved or assigned by the employer to perform a specific type of duty or duties or to be at a specific location or locations at the job site.

(5) "Coal tar pitch volatiles" as used in WAC 296-62-07515, Table I, include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum, (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the "coal tar pitch volatiles" standard.

(6) "Competent person" means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective action to eliminate them.

(7) "Department" means the department of labor and industries.

(8) "Director" means the director of the department of labor and industries, or his designated representative.

(9) "Employer" means any person, firm, corporation, partnership, business trust, legal representative, or other business entity which engages in any business, industry, profession, or activity in this state and employs one or more employees or who contracts with one or more persons, the essence of which is the personal labor of such person or persons and includes the state, counties, cities, and all municipal corporations, public corporations, political subdivisions of the state[,] and charitable organizations: *Provided*, That any persons, partnership, or business entity not having employees, and who is covered by the industrial insurance act shall be considered both an employer and an employee.

(10) "Hazard" means that condition, potential or inherent, which can cause injury, death, or occupational disease.

(11) "Occupational disease" means such disease or infection as arises naturally and proximately out of employment.

(12) "Qualified" means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated ability to solve or resolve problems relating to the subject matter, the work, or the project.

(13) "Shall" or "must" means mandatory.

(14) "Should" or "may" means recommended.

(15) "Suitable" means that which fits, or has the qualities or qualifications to meet a given purpose, occasion, condition, function, or circumstance.

(16) "Worker," "personnel," "person," "employee," and other terms of like meaning, unless the context of the provision containing such term indicates otherwise, mean an employee of an employer who is employed in the business of their employer whether by way of manual labor or otherwise and every person in this state who is engaged in the employment of or who is working under an independent contract the essence of which is their personal labor for an employer whether by manual labor or otherwise.

(17) "Work place" means any plant, yard, premises, room, or other place where an employee or employees are employed for the performance of labor or service over which the employer has the right of access or control[,] and includes, but is not limited to, all work places covered by industrial insurance under Title 51 RCW, as now or hereafter amended.

(18) Abbreviations used in this chapter:

(a) "ANSI" means American National Standards Institute.

(b) "ASHRE" means American Society of Heating and Refrigeration Engineers.

(c) "BTU" means British thermal unit.

(d) "BTUH" means British thermal unit per hour.

(e) "CFM" means cubic feet per minute.

(f) "CFR" means Code of Federal Register.

(g) "CGA" means Compressed Gas Association.

(h) "ID" means inside diameter.

(i) "MCA" means Manufacturing Chemist Association or Chemical Manufacturer Association (CMA).

(j) "NEMA" means National Electrical Manufacturing Association.

(k) "NFPA" means National Fire Protection Association.

(l) "OD" means outside diameter.

(m) "WAC" means Washington Administrative Code.

(n) "WISHA" means Washington Industrial Safety and Health Act (chapter 80, Laws of 1973).

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-020, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-020, filed 11/30/83. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 43.22 and 42.30 RCW. 80-17-015 (Order 80-21), § 296-62-020, filed 11/13/80; Order 73-3, § 296-62-020, filed 5/7/73; Order 70-8, § 296-62-020, filed 7/31/70, effective 9/1/70; Section II, effective 8/1/63.]

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

WAC 296-62-040 Unconstitutionality clause. In the event that any section, paragraph, sentence, clause, phrase or work of this chapter is declared unconstitutional or invalid for any reason the remainder of said standard or this chapter shall not be affected thereby.

[Order 73-3, § 296-62-040, filed 5/7/73; Order 70-8, § 296-62-040, filed 7/31/70, effective 9/1/70; Rule 4.010, effective 8/1/63.]

WAC 296-62-050 Application for waiver or variances. See WAC 296-24-010 **Variance and procedure.**

[Order 73-3, § 296-62-050, filed 5/7/73; Order 70-8, § 296-62-050, filed 7/31/70, effective 9/1/70; Rule 5.010, effective 8/1/63.]

PART B—ACCESS TO RECORDS

WAC 296-62-052 Access to employee exposure and medical records.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-052, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-052, filed 8/27/81.]

WAC 296-62-05201 Purpose. The purpose of this section is to provide employees and their designated representatives a right of access to relevant exposure and medical records, and to provide representatives of the director of labor and industries a right of access to these records in order to fulfill responsibilities under the Washington Industrial Safety and Health Act. Access by employees, their representatives, and the director of labor and industries is necessary to yield both direct and indirect improvements in the detection, treatment and prevention of occupational disease. Each employer is responsible for assuring compliance with this section, but the activities involved in complying with the access to medi-

cal records provisions can be carried out, on behalf of the employer, by the physician or other health care personnel in charge of employee medical records. Except as expressly provided, nothing in this section is intended to affect existing legal and ethical obligations concerning the maintenance and confidentiality of employee medical information, the duty to disclose information to a patient/employee or any other aspect of the medical-care relationship, or affect existing legal obligations concerning the protection of trade secret information.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05201, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05201, filed 8/27/81.]

WAC 296-62-05203 Scope and application. (1) This section applies to every employer, except as provided in subsection (4) of this section, who makes, maintains, contracts for, or has access to employee exposure or medical records, or analyses thereof, pertaining to employees exposed to toxic substances or harmful physical agents.

(2) This section applies to all employee exposure and medical records, and analyses thereof, of such employees, whether or not the records are mandated by specific occupational safety and health standards.

(3) This section applies to all employee exposure and medical records, and analyses thereof, made or maintained in any manner, including on an in-house or contractual (e.g., fee-for-service) basis. Each employer shall assure that the preservation and access requirements of this section are complied with regardless of the manner in which records are made or maintained.

(4) This section does not apply to the agricultural operations covered by chapter 296-306 WAC.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05203, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05203, filed 8/27/81.]

WAC 296-62-05205 Definitions. (1) Access - the right and opportunity to examine and copy.

(2) Analysis using exposure or medical records - any compilation of data, or any statistical study based at least in part on information collected from individual employee exposure or medical records or information collected from health insurance claims records, provided that either the analysis has been reported to the employer or no further work is currently being done by the person responsible for preparing the analysis.

(3) Designated representative - any individual or organization to whom an employee gives written authorization to exercise a right of access. For the purposes of access to employee exposure records and analyses using exposure or medical records, a recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

(4) Employee - a current employee, a former employee, or an employee being assigned or transferred to work where there will be exposure to toxic substances or harmful physical agents. In the case of a deceased or legally incapacitated

employee, the employee's legal representative may directly exercise all the employee's rights under this section.

(5) Employee exposure record - a record containing any of the following kinds of information:

(a) Environmental (workplace) monitoring or measuring of a toxic substance or harmful physical agent, including personal, area, grab, wipe, or other form of sampling, as well as related collection and analytical methodologies, calculations, and other background data relevant to interpretation of the results obtained;

(b) Biological monitoring results which directly assess the absorption of a toxic substance or harmful physical agent by body systems (e.g., the level of a chemical in the blood, urine, breath, hair, fingernails, etc.) but not including results which assess the biological effect of a substance or agent or which assess an employee's use of alcohol or drugs;

(c) Material safety data sheets indicating that the material may pose a hazard to human health; or

(d) In the absence of the above, a chemical inventory or any other record which reveals where and when used and the identity (e.g., chemical, common or trade name) of a toxic substance or harmful physical agent.

(6)(a) Employee medical record - a record concerning the health status of an employee which is made or maintained by a physician, nurse, or other health care personnel, or technician, including:

(i) Medical and employment questionnaires or histories (including job description and occupational exposures);

(ii) The results of medical examinations (preemployment, pre-assignment, periodic, or episodic) and laboratory tests (including chest and other x-ray examinations taken for purposes of establishing a base-line or detecting occupational illness, and all biological monitoring not defined as an "employee exposure record");

(iii) Medical opinions, diagnoses, progress notes, and recommendations;

(iv) First-aid records;

(v) Descriptions of treatments and prescriptions; and

(vi) Employee medical complaints.

(b) Employee medical record does not include medical information in the form of:

(i) Physical specimens (e.g., blood or urine samples) which are routinely discarded as a part of normal medical practice; or

(ii) Records concerning health insurance claims if maintained separately from the employer's medical program and its records, and not accessible to the employer by employee name or other direct personal identifier (e.g., Social Security number, payroll number, etc.); or

(iii) Records created solely in preparation for litigation which are privileged from discovery under applicable rules or procedure or evidence; or

(iv) Records concerning voluntary employee assistance programs (alcohol, drug abuse, or personal counseling programs) if maintained separately from the employer's medical program and its records.

(7) Employer - a current employer, a former employer or a successor employer.

(8) Exposure or exposed - an employee is subjected to a toxic substance or harmful physical agent in the course of

employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes past exposure and potential (e.g., accidental or possible) exposure, but does not include situations where the employer can demonstrate that the toxic substance or harmful physical agent is not used, handled, stored, generated, or present in the workplace in any manner different from typical nonoccupational situations.

(9) Health professional - a physician, occupational health nurse, industrial hygienist, toxicologist, or epidemiologist, providing medical or other occupational health services to exposed employees.

(10) Record - any item, collection, or grouping of information regardless of the form or process by which it is maintained (e.g., paper document, microfiche, microfilm, x-ray film, or automated data processing).

(11) Specific chemical identity - the chemical name, chemical abstracts service (CAS) registry number, or any other information that reveals the precise chemical designation of the substance.

(12)(a) Specific written consent - a written authorization containing the following:

(i) The name and signature of the employee authorizing the release of medical information;

(ii) The date of the written authorization;

(iii) The name of the individual or organization that is authorized to release the medical information;

(iv) The name of the designated representative (individual or organization) that is authorized to receive the released information;

(v) A general description of the medical information that is authorized to be released;

(vi) A general description of the purpose for the release of the medical information; and

(vii) A date or condition upon which the written authorization will expire (if less than one year).

(b) A written authorization does not operate to authorize the release of medical information not in existence on the date of written authorization, unless the release of future information is expressly authorized, and does not operate for more than one year from the date of written authorization.

(c) A written authorization may be revoked in writing prospectively at any time.

(13) Toxic substance or harmful physical agent - any chemical substance, biological agent (bacteria, virus, fungus, etc.), or physical stress (noise, heat, cold, vibration, repetitive motion, ionizing and nonionizing radiation, hypo- or hyperbaric pressure, etc.) which:

(a) Is listed in the latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS) (See Appendix B); or

(b) Has yielded positive evidence of an acute or chronic health hazard in testing conducted by, or known to, the employer; or

(c) Is the subject of a material safety data sheet kept by or known to the employer indicating that the material may pose a hazard to human health.

(14) Trade secret - any confidential formula, pattern, process, device, or information or compilation of information

that is used in an employer's business and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05205, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05205, filed 8/27/81.]

WAC 296-62-05207 Preservation of records. (1)

Unless a specific occupational safety and health standard provides a different period of time, each employer shall assure the preservation and retention of records as follows:

(a) Employee medical records. The medical record for each employee shall be preserved and maintained for at least the duration of employment plus thirty years, except that the following types of records need not be retained for any specific period:

(i) Health insurance claims records maintained separately from the employer's medical program and its records;

(ii) First-aid records (not including medical histories) of one-time treatment and subsequent observation of minor scratches, cuts, burns, splinters, and the like which do not involve medical treatment, loss of consciousness, restriction of work or motion, or transfer to another job, if made on-site by a nonphysician and if maintained separately from the employer's medical program and its records; and

(iii) The medical records of employees who have worked for less than one year for the employer need not be retained beyond the term of employment if they are provided to the employee upon the termination of employment.

(b) Employee exposure records. Each employee exposure record shall be preserved and maintained for at least thirty years, except that:

(i) Background data to environmental (workplace) monitoring or measuring, such as laboratory reports and worksheets, need only be retained for one year as long as the sampling results, the collection methodology (sampling plan), a description of the analytical and mathematical methods used, and a summary of other background data relevant to interpretation of the results obtained, are retained for at least thirty years; and

(ii) Material safety data sheets and WAC 296-62-05205(5) records concerning the identity of a substance or agent need not be retained for any specified period as long as some record of the identity (chemical name if known) of the substance or agent, where it was used, and when it was used is retained for at least thirty years; and

(iii) Biological monitoring results designated as exposure records by specific occupational safety and health standards shall be preserved and maintained as required by the specific standard.

(c) Analyses using exposure or medical records. Each analysis using exposure or medical records shall be preserved and maintained for at least thirty years.

(2) Nothing in this section is intended to mandate the form, manner, or process by which an employer preserves a record as long as the information contained in the record is preserved and retrievable, except that chest x-ray films shall be preserved in their original state.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05207, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW

49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05207, filed 8/27/81.]

WAC 296-62-05209 Access to records. (1) General.

(a) Whenever an employee or designated representative requests access to a record, the employer shall assure that access is provided in a reasonable time, place, and manner. If the employer cannot reasonably provide access to the record within fifteen working days, the employer shall within fifteen working days apprise the employee or designated representative requesting the record of the reason for the delay and the earliest date when the record can be made available.

(b) The employer may require of the requester only such information as should be readily known to the requester and which may be necessary to locate or identify the records being requested (e.g., dates and locations where the employee worked during the time period in question).

(c) Whenever an employee or designated representative requests a copy of a record, the employer shall assure that either:

(i) A copy of the record is provided without cost to the employee or representative;

(ii) The necessary mechanical copying facilities (e.g., photocopying) are made available without cost to the employee or representative for copying the record;

(iii) The record is loaned to the employee or representative for a reasonable time to enable a copy to be made; or

(iv) In the case of an original x-ray, the employer may restrict access to on-site examination or make other suitable arrangements for the temporary loan of the x-ray.

(d) Whenever a record has been previously provided without cost to an employee or designated representative, the employer may charge reasonable, nondiscriminatory administrative costs (i.e., search and copying expenses but not including overhead expenses) for a request by the employee or designated representative for additional copies of the record, except that:

(i) An employer shall not charge for an initial request for a copy of new information that has been added to a record which was previously provided; and

(ii) An employer shall not charge for an initial request by a recognized or certified collective bargaining agent for a copy of an employee exposure record or an analysis using exposure or medical records.

(e) Nothing in this section is intended to preclude employees and collective bargaining agents from collectively bargaining to obtain access to information in addition to that available under this section.

(2) Employee and designated representative access.

(a) Employee exposure records. Except as limited by WAC 296-62-05211, each employer shall, upon request, assure the access of each employee and designated representative to employee exposure records relevant to the employee. For the purpose of this section, an exposure record relevant to the employee consists of:

(i) A record which measures or monitors the amount of a toxic substance or harmful physical agent to which the employee is or has been exposed;

(ii) In the absence of such directly relevant records, such records of other employees with past or present job duties or working conditions related to or similar to those of the

employee to the extent necessary to reasonably indicate the amount and nature of the toxic substances or harmful physical agents to which the employee is or has been subjected; and

(iii) Exposure records to the extent necessary to reasonably indicate the amount and nature of the toxic substances or harmful physical agents at workplaces or under working conditions to which the employee is being assigned or transferred.

(iv) Requests by designated representatives for unconsented access to employee exposure records shall be in writing and shall specify with reasonable particularity:

(A) The records requested to be disclosed; and

(B) The occupational health need for gaining access to these records.

(b) Employee medical records.

(i) Each employer shall, upon request, assure the access of each employee to employee medical records of which the employee is the subject, except as provided in (b)(iv) of this subsection.

(ii) Each employer shall, upon request, assure the access of each designated representative to the employee medical records of any employee who has given the designated representative specific written consent. Appendix A to this section contains a sample form which may be used to establish specific written consent for access to employee medical records.

(iii) Whenever access to employee medical records is requested, a physician representing the employer may recommend that the employee or designated representative:

(A) Consult with the physician for the purposes of reviewing and discussing the records requested;

(B) Accept a summary of material facts and opinions in lieu of the records requested; or

(C) Accept release of the requested records only to a physician or other designated representative.

(iv) Whenever an employee requests access to his or her employee medical records, and a physician representing the employer believes that direct employee access to information contained in the records regarding a specific diagnosis of a terminal illness or a psychiatric condition could be detrimental to the employee's health, the employer may inform the employee that access will only be provided to a designated representative of the employee having specific written consent, and deny the employee's request for direct access to this information only. Where a designated representative with specific written consent requests access to information so withheld, the employer shall assure the access of the designated representative to this information, even when it is known that the designated representative will give the information to the employee.

(v) A physician, nurse, or other responsible health care personnel maintaining employee medical records may delete from requested medical records the identity of a family member, personal friend, or fellow employee who has provided confidential information concerning an employee's health status.

(c) Analyses using exposure or medical records.

(i) Each employer shall, upon request, assure the access of each employee and designated representative to each anal-

ysis using exposure or medical records concerning the employee's working conditions or workplace.

(ii) Whenever access is requested to an analysis which reports the contents of employee medical records by either direct identifier (name, address, social security number, payroll number, etc.) or by information which could reasonably be used under the circumstances indirectly to identify specific employees (exact age, height, weight, race, sex, date of initial employment, job title, etc.) the employer shall assure that personal identifiers are removed before access is provided. If the employer can demonstrate that removal of personal identifiers from an analysis is not feasible, access to the personally identifiable portions of the analysis need not be provided.

(3) Department access.

(a) Each employer shall upon request, and without derogation of any rights under the Constitution or the Washington Industrial Safety and Health Act, that the employer chooses to exercise, assure the prompt access of representatives of the director of the department of labor and industries to employee exposure and medical records and to analyses using exposure or medical records. Rules of agency practice and procedures governing WISHA access to employee medical records are contained in this chapter.

(b) Whenever the department seeks access to personally identifiable employee medical information by presenting to the employer a written access order, the employer shall prominently post a copy of the written access order and its accompanying cover letter for at least fifteen working days.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05209, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-05209, filed 11/30/83. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05209, filed 8/27/81.]

WAC 296-62-05211 Trade secrets. (1) Except as provided in subsection (2) of this section, nothing in this section precludes an employer from deleting from records requested by a health professional, employee, or designated representative any trade secret data which discloses manufacturing processes, or discloses the percentage of a chemical substance in a mixture, as long as the health professional, employee, or designated representative is notified that information has been deleted. Whenever deletion of trade secret information substantially impairs evaluation of the place where or the time when exposure to a toxic substance or harmful physical agent occurred, the employer shall provide alternative information which is sufficient to permit the requesting party to identify where and when exposure occurred.

(2) The employer may withhold the specific chemical identity, including the chemical name and other specific identification of a toxic substance from a disclosable record provided that:

(a) The claim that the information withheld is a trade secret can be supported;

(b) All other available information on the properties and effects of the toxic substance is disclosed;

(c) The employer informs the requesting party that the specific chemical identity is being withheld as a trade secret; and

(d) The specific chemical identity is made available to health professionals, employees, and designated representatives in accordance with the specific applicable provisions of this subsection.

(3) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a toxic substance is necessary for emergency or first-aid treatment, the employer shall immediately disclose the specific chemical identity of a trade secret chemical to the treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of subsections (4) and (5) of this section, as soon as circumstances permit.

(4) In nonemergency situations, an employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under subsection (2) of this section, to a health professional, employee, or designated representative if:

(a) The request is in writing;

(b) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(i) To assess the hazards of the chemicals to which employees will be exposed;

(ii) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

(iii) To conduct preassignment or periodic medical surveillance of exposed employees;

(iv) To provide medical treatment to exposed employees;

(v) To select or assess appropriate personal protective equipment for exposed employees;

(vi) To design or assess engineering controls or other protective measures for exposed employees; and

(vii) To conduct studies to determine the health effects of exposure.

(c) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information would not enable the health professional, employee, or designated representative to provide the occupational health services described in (b) of this subsection:

(i) The properties and effects of the chemical;

(ii) Measures for controlling workers' exposure to the chemical;

(iii) Methods of monitoring and analyzing worker exposure to the chemical; and

(iv) Methods of diagnosing and treating harmful exposures to the chemical.

(d) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and

(e) The health professional, employee, or designated representative and the employer or contractor of the services of the health professional or designated representative agree in a written confidentiality agreement that the health professional, employee, or designated representative will not use the trade secret information for any purpose other than the health

need(s) asserted and agree not to release the information under any circumstances other than to WISHA, as provided in subsection (9) of this section, except as authorized by the terms of the agreement or by the employer.

(5) The confidentiality agreement authorized by subsection (4)(d) of this section:

(a) May restrict the use of the information to the health purposes indicated in the written statement of need;

(b) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable preestimate of likely damages; and

(c) May not include requirements for the posting of a penalty bond.

(6) Nothing in this section is meant to preclude the parties from pursuing noncontractual remedies to the extent permitted by law.

(7) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to WISHA, the employer who provided the information shall be informed by the health professional prior to, or at the same time as, such disclosure.

(8) If the employer denies a written request for disclosure of a specific chemical identity, the denial must:

(a) Be provided to the health professional, employee, or designated representative within thirty days of the request;

(b) Be in writing;

(c) Include evidence to support the claim that the specific chemical identity is a trade secret;

(d) State the specific reasons why the request is being denied; and

(e) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(9) The health professional, employee, or designated representative whose request for information is denied under subsection (4) of this section may refer the request and the written denial of the request to WISHA for consideration.

(10) When a health professional, employee, or designated representative refers a denial to WISHA under subsection (9) of this section, WISHA shall consider the evidence to determine if:

(a) The employer has supported the claim that the specific chemical identity is a trade secret;

(b) The health professional, employee, or designated representative has supported the claim that there is a medical or occupational health need for the information; and

(c) The health professional, employee, or designated representative has demonstrated adequate means to protect the confidentiality.

(11)(a) If WISHA determines that the specific chemical identity requested under subsection (4) of this section is not a bona fide trade secret, or that it is a trade secret but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means for complying with the terms of such agreement, the employer will be subject to citation by WISHA.

(b) If an employer demonstrates to WISHA that the execution of a confidentiality agreement would not provide suf-

ficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the director may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health needs are met without an undue risk of harm to the employer.

(12) Notwithstanding the existence of a trade secret claim, an employer shall upon request, disclose to the director or his representative, any information which this section requires the employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the director so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(13) Nothing in this section shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

[Statutory Authority: Chapter 49.17 RCW, 89-11-035 (Order 89-03), § 296-62-05211, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-05211, filed 8/27/81.]

WAC 296-62-05213 Employee information. (1) Upon an employee's first entering into employment, and at least annually thereafter, each employer shall inform current employees covered by this section of the following:

(a) The existence, location and availability of any records covered by this section;

(b) The person responsible for maintaining and providing access to records; and

(c) Each employee's rights of access to these records.

(2) Each employer shall keep a copy of this standard and its appendices, and make copies readily available upon request, to employees. The employer shall also distribute to current employees any informational materials concerning this section which are made available to the employer by the director for the Washington industrial safety and health division.

[Statutory Authority: Chapter 49.17 RCW, 89-11-035 (Order 89-03), § 296-62-05213, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 81-18-029 (Order 81-21), § 296-62-05213, filed 8/27/81.]

WAC 296-62-05215 Transfer of records. (1) Whenever an employer is ceasing to do business, the employer shall transfer all records subject to this section to the successor employer. The successor employer shall receive and maintain these records.

(2) Whenever an employer is ceasing to do business and there is no successor employer to receive and maintain the records subject to this standard, the employer shall notify affected current employees of their rights of access to records at least three months prior to the cessation of the employer's business.

(3) Whenever an employer either is ceasing to do business and there is no successor employer to receive and maintain the records, or intends to dispose of any records required to be preserved for at least thirty years, the employer shall:

(a) Transfer the records to the director of the department of labor and industries if so required by a specific industrial safety and health standard; or

(b) Notify the director of the department of labor and industries in writing of the impending disposal of records at least three months prior to the disposal of the records.

(4) Where an employer regularly disposes of records required to be preserved for at least thirty years, the employer may, with at least three months notice, notify the director of the department of labor and industries on an annual basis of the records intended to be disposed of in the coming year.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05215, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05215, filed 8/27/81.]

WAC 296-62-05217 Appendices. The information contained in the appendices A and B to this section is not intended, by itself, to create any additional obligations not otherwise imposed by this section nor detract from any existing obligation.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05217, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05217, filed 8/27/81.]

WAC 296-62-05219 Effective date. WAC 296-62-052 through 296-62-05223 shall become effective June 30, 1989.

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05219, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05219, filed 8/27/81.]

WAC 296-62-05221 Appendix A—Sample authorization letter for the release of employee medical record information to a designated representative. (Nonmandatory.)

I, (full name of worker/patient) hereby authorize. (individual or organization holding the medical records) to release to (individual or organization authorized to receive the medical information), the following medical information from my personal medical records:

.....
.....
(Describe generally the information desired to be released.)

I give my permission for this medical information to be used for the following purpose:, but I do not give permission for any other use or re-disclosure of this information.

Note: Several extra lines are provided below so that you can place additional restrictions on this authorization letter if you want to. You may, however, leave these lines blank. On the other hand, you may want to (1) specify a particular expiration date for this letter (if less than one year); (2) describe medical information to be created in the future that you intend to be covered by this authorization letter; or (3) describe portions of the medical information in your records which you do not intend to be released as a result of this letter.)

.....
.....
.....
Full Name of Employee or Legal Representative
.....
Signature of Employee or Legal Representative
.....
Date of Signature

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05221, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05221, filed 8/27/81.]

WAC 296-62-05223 Appendix B—Availability of NIOSH Registry of Toxic Effects of Chemical Substances (RTECS). (Nonmandatory.) WAC 296-62-052 applies to all employee exposure and medical records, and analyses thereof, of employees exposed to toxic substances or harmful physical agents (WAC 296-62-05203). The term "toxic substance or harmful physical agent" is defined by WAC 296-62-05205(11) to encompass chemical substances, biological agents, and physical stresses for which there is evidence of harmful health effects. The standard uses the latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS) as one of the chief sources of information as to whether evidence of harmful health effects exists. If a substance is listed in the latest printed RTECS, the standard applies to exposure and medical records (and analyses of these records) relevant to employees exposed to the substance.

It is appropriate to note that the final standard does not require that employers purchase a copy of RTECS, and many employers need not consult RTECS to ascertain whether their employee exposure or medical records are subject to the standard. Employers who do not currently have the latest printed edition of the NIOSH RTECS, however, may desire to obtain a copy. The RTECS is issued in an annual printed edition as mandated by section 20(a)(6) of the Occupational Safety and Health Act (29 U.S.C. 669(a)(6)). The introduction to the 1980 printed edition describes the RTECS as follows:

"The 1980 edition of the Registry of Toxic Effects of Chemical Substances, formerly known as the Toxic Substances List, is the ninth revision prepared in compliance with the requirements of Section 20(a)(6) of the Occupational Safety and Health Act of 1970 (Public Law 91-596). The original list was completed on June 28, 1971, and has been updated annually in book format. Beginning in October 1977, quarterly revisions have been provided in microfiche. This edition of the Registry contains 168,096 listings of chemical substances: 45,156 are names of different chemicals with their associated toxicity data and 122,940 are synonyms. This edition includes approximately 5,900 new chemical compounds that did not appear in the 1979 Registry." (p.xi)

"The Registry's purposes are many, and it serves a variety of users. It is a single source document for basic toxicity information and for other data, such as chemical identifiers and information necessary for the preparation of safety directives and hazard evaluations for chemical substances. The various types of toxic effects linked to literature citations pro-

vide researchers and occupational health scientists with an introduction to the toxicological literature, making their own review of the toxic hazards of a given substance easier. By presenting data on the lowest reported doses that produce effects by several routes of entry in various species, the Registry furnishes valuable information to those responsible for preparing safety data sheets for chemical substances in the workplace. Chemical and production engineers can use the Registry to identify the hazards which may be associated with chemical intermediates in the development of final products, and thus can more readily select substitutes or alternative processes which may be less hazardous. Some organizations, including health agencies and chemical companies, have included the NIOSH Registry accession numbers with the listing of chemicals in their files to reference toxicity information associated with those chemicals. By including foreign language chemical names, a start has been made toward providing rapid identification of substances produced in other countries." (p.xi)

"In this edition of the Registry, the editors intend to identify "all known toxic substances" which may exist in the environment and to provide pertinent data on the toxic effects from known doses entering an organism by any route described." (p.xi)

"It must be reemphasized that the entry of a substance in the Registry does not automatically mean that it must be avoided. A listing does mean, however, that the substance has the documented potential of being harmful if misused, and care must be exercised to prevent tragic consequences. Thus, the Registry lists many substances that are common in everyday life and are in nearly every household in the United States. One can name a variety of such dangerous substances: Prescription and nonprescription drugs; food additives; pesticide concentrates, sprays, and dusts; fungicides; herbicides; paints; glazes, dyes; bleaches and other household cleaning agents; alkalies; and various solvents and diluents. The list is extensive because chemicals have become an integral part of our existence."

The RTECS printed edition may be purchased from the Superintendent of Documents, U.S. Government Printing Office (GPO), Washington, DC 20402 (202-783-3238).

Some employers may desire to subscribe to the quarterly update to the RTECS which is published in a microfiche edition. An annual subscription to the quarterly microfiche may be purchased from the GPO (Order the "Microfiche Edition, Registry of Toxic Effects of Chemical Substances"). Both the printed edition and the microfiche edition of RTECS are available for review at many university and public libraries throughout the country. The latest RTECS editions may also be examined at the OSHA Technical Data Center, Room N2439—Rear, United States Department of Labor, 200 Constitution Avenue, NW., Washington, DC 20210 (202-523-9700), or at any OSHA Regional or Area Office (See, major city telephone directories under United States Government-Labor Department)."

[Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-05223, filed 5/15/89, effective 6/30/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-05223, filed 8/27/81.]

(1999 Ed.)

PART C—HAZARD COMMUNICATION

WAC 296-62-054 Hazard communication purpose.

(1) The purpose of this section is to ensure that the hazards of all chemicals produced or imported are evaluated, and that information concerning their hazards is transmitted to employers and employees. This transmittal of information is to be accomplished by means of comprehensive hazard communication programs, which are to include container labeling and other forms of warning, material safety data sheets and employee training.

(2) This occupational safety and health standard is intended to address comprehensively the issue of evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees. Evaluating the potential hazards of chemicals, and communicating information concerning hazards and appropriate protective measures to employees, may include, for example, but is not limited to, provisions for: Developing and maintaining a written hazard communication program for the workplace, including lists of hazardous chemicals present; labeling of containers of chemicals in the workplace, as well as of containers of chemicals being shipped to other workplaces; preparation and distribution of material safety data sheets to employees and downstream employers; and development and implementation of employee training programs regarding hazards of chemicals and protective measures.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-62-054, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-22-012 (Order 84-22), § 296-62-054, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-054, filed 6/7/84.]

WAC 296-62-05403 Scope and application. (1) This part requires chemical manufacturers or importers to assess the hazards of chemicals which they produce or import, and all employers to provide information to their employees about the hazardous chemicals to which they are exposed, by means of a hazard communication program, labels and other forms of warning, material safety data sheets, and information and training. In addition, this part requires distributors to transmit the required information to employers.

Employers who do not produce or import chemicals need only focus on those parts of this rule that deal with establishing a workplace program and communicating information to their workers. Appendix E of this section is a general guide for such employers to help them determine their compliance obligations under the rule.

Even though the Occupational Safety and Health Administration (OSHA) PELs or American Conference of Governmental Industrial Hygienists (ACGIH) threshold limit values (TLVs) may be printed on the material safety data sheet (MSDS), employers within Washington state are required to use the permissible exposure limits (PELs) established in Washington state as listed in the general occupational health standard, WAC 296-62-075, for evaluation of employee exposures and training.

(2) This part applies to any chemical which is known to be present in the workplace in such a manner that employees may be exposed under normal conditions of use or in a foreseeable emergency.

[Title 296 WAC—p. 1295]

(3) This part applies to laboratories only as follows:

(a) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(b) Employers shall maintain any material safety data sheets that are received with incoming shipments of hazardous chemicals, and ensure that they are readily accessible to laboratory employees when they are in their work areas;

(c) Employers shall ensure that laboratory employees are provided information and training in accordance with WAC 296-62-05415, except for the location and availability of the written hazard communication program under WAC 296-62-05415 (1)(c); and

Note: Laboratories are not required to have a written hazard communication program, but they may be required to have a written chemical hygiene plan under WAC 296-62-400.

(d) Laboratory employers that ship hazardous chemicals are considered to be either a chemical manufacturer or a distributor under this rule, and thus must ensure that any containers of hazardous chemicals leaving the laboratory are labeled in accordance with WAC 296-62-05411, and that a material safety data sheet is provided to distributors and other employers in accordance with WAC 296-62-05413.

(4) In work operations where employees only handle chemicals in sealed containers which are not opened under normal conditions of use (such as are found in marine cargo handling, warehousing, or retail sales), this part applies to these operations only as follows:

(a) Employers shall ensure that labels on incoming containers of hazardous chemicals are not removed or defaced;

(b) Employers shall maintain copies of any material safety data sheets that are received with incoming shipments of the sealed containers of hazardous chemicals, shall obtain a material safety data sheet as soon as possible for sealed containers of hazardous chemicals received without a material safety data sheet if an employee requests the material safety data sheet, and shall ensure that the material safety data sheets are readily accessible during each work shift to employees when they are in their work area(s); and

(c) Employers shall ensure that employees are provided with information and training in accordance with WAC 296-62-05415 (except for the location and availability of the written hazard communication program under WAC 296-62-05415 (1)(c)) to the extent necessary to protect them in the event of a spill or leak of a hazardous chemical from a sealed container.

(5) This part does not require labeling of the following chemicals:

(a) Any pesticide as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when subject to the labeling requirements of that act and labeling regulations issued under that act by the Environmental Protection Agency;

(b) Any chemical substance or mixture as such terms are defined in the Toxic Substance Control Act (15 U.S.C. 2601 et seq.), when subject to the labeling requirements of that act and labeling requirements issued under that act by the Environmental Protection Agency;

(c) Any food, food additive, color additive, drug, cosmetic, or medical or veterinary device or product, including materials intended for use as ingredients in such products

(e.g., flavors and fragrances), as such terms are defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.) or the Virus-Serum Toxin Act of 1913 (21 U.S.C. 151 et seq.) and regulations issued under those acts, when they are subject to the labeling requirements under those acts by either the Food and Drug Administration or the department of agriculture;

(d) Any distilled spirits (beverage alcohols), wine, or malt beverage intended for nonindustrial use, as such terms are defined in the Federal Alcohol Administration Act (27 U.S.C. 201 et seq.) and regulations issued under that act, when subject to the labeling requirements of that act and labeling regulations issued under that act by the Bureau of Alcohol, Tobacco, and Firearms;

(e) Any consumer product or hazardous substance as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substances Act (15 U.S.C. 1261 et seq.) respectively, when subject to a consumer product safety standard or labeling requirement of those acts, or regulations issued under those acts by the Consumer Product Safety Commission; and

(f) Agricultural or vegetable seed treated with pesticides and labeled in accordance with the Federal Seed Act (7 U.S.C. 1551 et seq.) and the labeling requirements issued under that act by the department of agriculture.

(6) This part does not apply to:

(a) Any hazardous waste as such term is defined by the Hazardous Waste Management Act chapter 70.105 RCW, when subject to regulations issued under that act by the department of ecology which describes specific safety, labeling, personnel training and other standards for the accumulation, handling and management of hazardous waste;

(b) Any hazardous waste as such term is defined by the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act of 1976, as amended (42 U.S.C. 6901 et seq.), when subject to regulations issued under that act by the Environmental Protection Agency;

(c) Any hazardous substance as such term is defined by the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 U.S.C. 9601 et seq.), when the hazardous substance is the focus of remedial or removal action being conducted under CERCLA in accordance with Environmental Protection Agency regulations;

(d) Tobacco or tobacco products;

(e) Wood or wood products, including lumber which will not be processed, where the chemical manufacturer or importer can establish that the only hazard they pose to the employees is the potential for flammability or combustibility (wood or wood products which have been treated with hazardous chemicals covered by this standard, and wood which may be subsequently sawed or cut, generating dust, are not exempted);

(f) Articles (as that term is defined in WAC 296-62-05405(1));

(g) Food or alcoholic beverages which are sold, used, or prepared in a retail establishment (such as grocery store, restaurant, or drinking place), and foods intended for personal consumption by employees while in the workplace;

(h) Any drug, as that term is defined in the Federal Food, Drug, and Cosmetic Act (21 U.S.C. 301 et seq.), when it is in

solid, final form for direct administration to the patient (e.g., tablets or pills); drugs which are packaged by the chemical manufacturer for sale to consumers in a retail establishment (e.g., over-the-counter drugs); and drugs intended for personal consumption by employees while in the workplace (e.g., first aid supplies);

(i) Cosmetics which are packaged for sale to consumers in a retail establishment, and cosmetics intended for personal consumption by employees while in the workplace;

(j) Any consumer product or hazardous substance, as those terms are defined in the Consumer Product Safety Act (15 U.S.C. 2051 et seq.) and Federal Hazardous Substance Act (15 U.S.C. 1261 et seq.) respectively, where the employer can show that it is used in the workplace for the purpose intended by the chemical manufacturer or importer of the product, and the use results in a duration and frequency of exposure which is not greater than the range of exposures that could reasonably be experienced by consumers when used for the purpose intended;

(k) Ionizing and nonionizing radiation; and

(l) Biological hazards.

[Statutory Authority: RCW 49.17.010, [49.17].050 and [49.17].060. 95-22-015, § 296-62-05403, filed 10/20/95, effective 1/16/96. Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05403, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05403, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-05403, filed 11/30/87. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05403, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05403, filed 4/19/85; 84-22-012 (Order 84-22), § 296-62-05403, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-05403, filed 6/7/84.]

WAC 296-62-05405 Definitions applicable to this part. (1) Article means a manufactured item other than a fluid or particle:

(a) Which is formed to a specific shape or design during manufacture;

(b) Which has end use function(s) dependent in whole or in part upon its shape or design during end use; and

(c) Which under normal conditions of use does not release more than very small quantities, e.g., minute or trace amounts of a hazardous chemical (as determined under WAC 296-62-05407), and does not pose a physical hazard or health risk to employees.

(2) Chemical means any element, chemical compound or mixture of elements and/or compounds.

(3) Chemical manufacturer means an employer with a workplace where chemical(s) are produced for use or distribution.

(4) Chemical name means the scientific designation of a chemical in accordance with the nomenclature system developed by the International Union of Pure and Applied Chemistry (IUPAC) or the Chemical Abstracts Service (CAS) rules of nomenclature, or a name which will clearly identify the chemical for the purpose of conducting a hazard evaluation.

(5) Combustible liquid means any liquid having a flashpoint at or above 100°F (37.8°C), but below 200°F (93.3°C), except any mixture having components with flashpoints of 200°F (93.3°C), or higher, the total volume of which make up ninety-nine percent or more of the total volume of the mixture.

(6) Commercial account means an arrangement whereby a retail distributor sells hazardous chemical(s) to an employer, generally in large quantities over time and/or at costs that are below the regular retail price.

(7) Common name means any designation or identification such as code name, code number, trade name, brand name or generic name used to identify a chemical other than by its chemical name.

(8) Compressed gas means:

(a) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F (21.1°C); or

(b) A gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F (54.4°C) regardless of the pressure at 70°F (21.1°C); or

(c) A liquid having a vapor pressure exceeding 40 psi at 100°F (37.8°C) as determined by ASTM D-323-72.

(9) Container means any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For purposes of this part, pipes or piping systems are not considered to be containers.

(10) Designated representative means any individual or organization to whom an employee gives written authorization to exercise such employee's rights under this section. A recognized or certified collective bargaining agent shall be treated automatically as a designated representative without regard to written employee authorization.

(11) Director means the director of the department of labor and industries or his/her designee.

(12) Distributor means a business, other than a chemical manufacturer or importer, which supplies hazardous chemicals to other distributors or to employers.

(13) Employee means an employee of an employer who is employed in the business of his or her employer whether by way of manual labor or otherwise and every person in this state who is engaged in the employment of or who is working under an independent contract the essence of which is personal labor for an employer under this standard whether by way of manual labor or otherwise. However, for the purposes of this part, employee shall not mean immediate family members of the officers of any corporation, partnership, sole proprietorship, or other business entity or officers of any closely held corporation engaged in agricultural production of crops or livestock. This part applies to employees who may be exposed to hazardous chemicals under normal operating conditions or in foreseeable emergencies.

(14) Employer means any person, firm, corporation, partnership, business trust, legal representative, or other business entity that engages in any business, industry, profession, or activity in this state and employs one or more employees or who contract with one or more persons, the essence of which is the personal labor of such person or persons and includes the state, counties, cities, and all municipal corporations, public corporations, political subdivisions of the state, and charitable organizations. This part applies to employers engaged in a business where chemicals are either used, distributed, or are produced for use or distribution, including a contractor or subcontractor.

(15) Explosive means a chemical that causes a sudden, almost instantaneous release of pressure, gas, and heat when subjected to sudden shock, pressure, or high temperature.

(16) Exposure or exposed means that an employee is/ was subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.), and includes potential (e.g., accidental or possible) exposure.

(17) Flammable means a chemical that falls into one of the following categories:

(a) Aerosol flammable means an aerosol that, when tested by the method described in 16 CFR 1500.45 yields a flame projection exceeding eighteen inches at full valve opening, or a flashback (a flame extending back to the valve) at any degree of valve opening;

(b) Gas, flammable means:

(i) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of thirteen percent by volume or less; or

(ii) A gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than twelve percent by volume, regardless of the lower limit;

(c) Liquid, flammable means any liquid having a flashpoint below 100°F (37.8°C), except any mixture having components with flashpoints of 100°F (37.8°C) or higher, the total of which make up ninety-nine percent or more of the total volume of the mixture.

(d) Solid, flammable means a solid, other than a blasting agent or explosive as defined in WAC 296-52-417 or 29 CFR 1910.109(a), that is liable to cause fire through friction, absorption of moisture, spontaneous chemical change, or retained heat from manufacturing or processing, or which can be ignited readily and when ignited burns so vigorously and persistently as to create a serious hazard. A chemical shall be considered to be a flammable solid if, when tested by the method described in 16 CFR 1500.44, it ignites and burns with a self-sustained flame at a rate greater than one-tenth of an inch per second along its major axis.

(18) Flashpoint means the minimum temperature at which a liquid gives off a vapor in sufficient concentration to ignite when tested as follows:

(a) Tagliabue closed tester: (See American National Standard Method of Test for Flash Point by Tag Closed Tester, Z11.24-1979 (ASTM D 56-79)) for liquids with a viscosity of less than 45 Saybolt Universal Seconds (SUS) at 100°F (37.8°C), that do not contain suspended solids and do not have a tendency to form a surface film under test; or

(b) Pensky-Martens closed tester: (See American National Standard Method of Test for Flash Point by Pensky-Martens Closed Tester, Z11.7-1979 (ASTM D 93-79)) for liquids with a viscosity equal to or greater than 45 SUS at 100°F (37.8°C), or that contain suspended solids, or that have a tendency to form a surface film under test; or

(c) Setaflash closed tester: (See American National Standard Method of Test for Flash Point by Setaflash Closed Tester (ASTM D 3278-78)).

Note: Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified above.

(19) Foreseeable emergency means any potential occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which could result

in an uncontrolled release of a hazardous chemical into the workplace.

(20) Hazardous chemical means any chemical which is a physical hazard or a health hazard.

(21) Hazard warning means any words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which convey the specific physical and health hazard(s), including target organ effects, of the chemical(s) in the container(s). (See definition for "physical hazard" and "health hazard" to determine the hazards which must be covered.)

(22) Health hazard means a chemical for which there is statistically significant evidence based on at least one study conducted in accordance with established scientific principles that acute or chronic health effects may occur in exposed employees. The term "health hazard" includes chemicals which are carcinogens, toxic or highly toxic agents, reproductive toxins, irritants, corrosives, sensitizers, hepatotoxins, nephrotoxins, neurotoxins, agents which act on the hematopoietic system, and agents which damage the lungs, skin, eyes, or mucous membranes. Appendix A provides further definitions and explanations of the scope of health hazards covered by this part, and Appendix B describes the criteria to be used to determine whether or not a chemical is to be considered hazardous for purposes of this standard.

(23) Identity means any chemical or common name which is indicated on the material safety data sheet (MSDS) for the chemical. The identity used shall permit cross-references to be made among the required list of hazardous chemicals, the label and the MSDS.

(24) Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

(25) Importer means the first business within the Customs Territory of the United States which receives hazardous chemicals produced in other countries, for the purpose of supplying them to distributors or employers within the United States.

(26) Label means any written, printed, or graphic material displayed on or affixed to containers of hazardous chemicals.

(27) Material safety data sheet (MSDS) means written or printed material concerning a hazardous chemical which is prepared in accordance with WAC 296-62-05413.

(28) Mixture means any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

(29) Organic peroxide means an organic compound that contains the bivalent-O-O-structure and which may be considered to be a structural derivative of hydrogen peroxide where one or both of the hydrogen atoms has been replaced by an organic radical.

(30) Oxidizer means a chemical other than a blasting agent or explosive as defined in WAC 296-52-417 or CFR 1910.109(a), that initiates or promotes combustion in other materials, thereby causing fire either of itself or through the release of oxygen or other gases.

(31) Permissible exposure limits (PELs) refer to airborne concentrations of substances without regard to the use of res-

piratory protection and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. The permissible exposure limits (PELs) shall include the following four categories:

(a) Permissible exposure limits - Time-weighted average (PEL-TWA) is the time weighted average airborne exposure to any 8-hour work shift of a 40-work week which shall not be exceeded.

(b) Permissible exposure limits - Short-term exposure limit (PEL-STEL) is the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day unless another time limit is specified in a parenthetical notation below the limit. If another time period is specified, the time weighted average exposure over that time period shall not be exceeded at any time during the working day.

(c) Permissible exposure limits - Ceiling (PEL-C) is the employee's exposure which shall not be exceeded during any part of the work day. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time over a working day.

(d) "Skin" notation is the potential contribution to the overall employee exposure by the cutaneous route including mucous membranes and eye, either by airborne, or more particularly, by direct contact with the substance. These substances are identified as having a "skin" notation in the OSHA and WISHA PEL tables (29 CFR Part 1910 Subpart Z and WAC 296-62-075, respectively).

(32) Physical hazard means a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable (reactive) or water-reactive.

(33) Produce means to manufacture, process, formulate, blend, extract, generate, emit, or repackage.

(34) Purchaser means an employer with a workplace who purchases a hazardous chemical for use within that workplace.

(35) Pyrophoric means a chemical that will ignite spontaneously in air at a temperature of 130°F (54.4°C) or below.

(36) Responsible party means someone who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(37) Specific chemical identity means the chemical name, Chemical Abstracts Service (CAS) registry number, or any other information that reveals the precise chemical designation of the substance.

(38) Threshold limit values (TLVs) refer to airborne concentrations of substances without regard to the use of respiratory protection and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. The TLV includes the TLV-Time weighted average (TLV-TWA), TLV-Short term exposure limit (TLV-STEL), TLV-Ceiling (TLV-Ceiling) and "skin" notation as stated in the most recent edition of the *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices* from the American Conference of Governmental Industrial Hygienists (ACGIH).

(1999 Ed.)

(39) Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. WAC 296-62-05427, Appendix D, provides a legal definition of trade secret and WAC 296-62-05417 sets out the criteria to be used in evaluating trade secrets.

(40) Unstable (reactive) means a chemical which in the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure or temperature.

(41) Use means to package, handle, react, emit, extract, generate as a by-product, or transfer.

(42) Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

(43) Work area means a room or defined space in a workplace where hazardous chemicals are produced or used, and where employees are present.

(44) Workplace means an establishment, job site, or project, at one geographical location containing one or more work areas.

[Statutory Authority: RCW 49.17.010, [49.17].050 and [49.17].060. 95-22-015, § 296-62-05405, filed 10/20/95, effective 1/16/96. Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05405, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05405, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-05405, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-05405, filed 4/27/87. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05405, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05405, filed 4/19/85; 84-22-012 (Order 84-22), § 296-62-05405, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-05405, filed 6/7/84.]

WAC 296-62-05407 Hazard determination. (1) Chemical manufacturers and importers shall evaluate chemicals produced in their workplaces or imported by them to determine if they are hazardous. Employers are not required to evaluate chemicals unless they choose not to rely on the evaluation performed by the chemical manufacturer or importer for the chemical to satisfy this requirement.

(2) Chemical manufacturers, importers or employers evaluating chemicals shall identify and consider the available scientific evidence concerning physical and health hazards. For health hazards, evidence which is statistically significant and which is based on at least one positive study conducted in accordance with established scientific principles is considered to be sufficient to establish a hazardous effect if the results of the study meet the definitions of health hazards in this part. WAC 296-62-05421, Appendix A, shall be consulted for the scope of health hazards covered, and WAC 296-62-05423, Appendix B, shall be consulted for the criteria to be followed with respect to the completeness of the evaluation, and the data to be reported.

(3) The chemical manufacturer, importer or employer evaluating chemicals shall treat the following sources as establishing that the chemicals listed in them are hazardous:

(a) Chapter 296-62 WAC, General occupational health standard;

(b) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA); or

(c) *Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment*, American Conference of Governmental Industrial Hygienists (ACGIH) (latest edition).

(d) The chemical manufacturer, importer, or employer is responsible for evaluating the hazards associated with the chemicals in these source lists in accordance with this requirement of the standard.

(4) Chemical manufacturers, importers and employers evaluating chemicals shall treat the following sources as establishing that a chemical is a carcinogen or potential carcinogen for hazard communication purposes:

(a) National Toxicology Program (NTP), Annual Report on Carcinogens (latest edition);

(b) International Agency for Research on Cancer (IARC) Monographs (latest editions);

(c) Chapter 296-62 WAC, General occupational health standards; or

(d) 29 CFR Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration.

Note: The *Registry of Toxic Effects of Chemical Substances* published by the National Institute for Occupational Safety and Health indicates whether a chemical has been found by NTP or IARC to be a potential carcinogen.

(5) The chemical manufacturer, importer or employer shall determine the hazards of mixtures of chemicals as follows:

(a) If a mixture has been tested as a whole to determine its hazards, the results of such testing shall be used to determine whether the mixture is hazardous;

(b) If a mixture has not been tested as a whole to determine whether the mixture is a health hazard, the mixture shall be assumed to present the same health hazards as do the components which comprise one percent (by weight or volume) or greater of the mixture, except that the mixture shall be assumed to present a carcinogenic hazard if it contains a component in concentrations of 0.1 percent or greater which is considered to be a carcinogen under WAC 296-62-05407(4);

(c) If a mixture has not been tested as a whole to determine whether the mixture is a physical hazard, the chemical manufacturer, importer, or employer may use whatever scientifically valid data is available to evaluate the physical hazard potential of the mixture; and

(d) If the chemical manufacturer, importer, or employer has evidence to indicate that a component present in the mixture in concentrations of less than one percent (or in the case of carcinogens, less than 0.1 percent) could be released in concentrations which would exceed an established WISHA or OSHA permissible exposure limit or ACGIH threshold limit value, or could present a health risk to employees in those concentrations, the mixture shall be assumed to present the same hazard.

(6) Chemical manufacturers, importers, or employers evaluating chemicals shall describe in writing the procedures they use to determine the hazards of the chemical they evaluate. The written procedures are to be made available, upon request, to employees, their designated representatives, the

director or his/her designee and the National Institute of Occupational Safety and Health (NIOSH). The written description may be incorporated into the written hazard communication program required under WAC 296-62-05409.

[Statutory Authority: RCW 49.17.010, [49.17].050 and [49.17].060, 95-22-015, § 296-62-05407, filed 10/20/95, effective 1/16/96. Statutory Authority: Chapter 49.17 RCW, 94-16-145, § 296-62-05407, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05407, filed 7/6/88. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240, 86-12-004 (Order 86-22), § 296-62-05407, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050, 84-13-001 (Order 84-14), § 296-62-05407, filed 6/7/84.]

WAC 296-62-05409 Written hazard communication program. (1) Employers shall develop, implement, and maintain at the workplace a written hazard communication program for their workplaces which at least describes how the criteria specified in WAC 296-62-05411, 296-62-05413 and 296-62-05415, for labels and other forms of warning, material safety data sheets, and employee information and training will be met, and which also includes the following:

(a) A list of the hazardous chemicals known to be present using an identity that is referenced on the appropriate material safety data sheet (the list may be compiled for the workplace as a whole or for individual work areas); and

(b) The methods the employer will use to inform employees of the hazards of nonroutine tasks (for example, the cleaning of reactor vessels), and the hazards associated with chemicals contained in unlabeled pipes in their work areas.

(2) Multi-employer workplaces. Employers who produce, use, or store hazardous chemicals at a workplace in such a way that the employees of other employer(s) may be exposed (for example, employees of a construction contractor working on site) shall additionally ensure that the hazard communication programs developed and implemented under this part include the following:

(a) The methods the employer will use to provide the other employer(s) with a copy of the material safety data sheet, or to make it available at a central location on the worksite, for each hazardous chemical the other employer(s) employees may be exposed to while working;

(b) The methods the employer will use to inform the other employer(s) of any precautionary measures that need to be taken to protect employees during the workplace's normal operating conditions and in foreseeable emergencies; and

(c) The methods the employer will use to inform the other employer(s) of the labeling system used in the workplace.

(3) The employer may rely on an existing hazard communication program to comply with these requirements, provided that it meets the criteria established in this part.

(4) The employer shall make the written hazard communication program available, upon request, to employees, their designated representatives, the director or his/her designee and the National Institute of Occupational Safety and Health (NIOSH), in accordance with the requirements of WAC 296-62-05209.

(5) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the written hazard communication program may be kept at the primary workplace facility.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05409, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05409, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-13-001 (Order 84-14), § 296-62-05409, filed 6/7/84.]

WAC 296-62-05411 Labels and other forms of warning. (1) The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged or marked with the following information:

- (a) Identity of the hazardous chemical(s);
- (b) Appropriate hazard warnings; and
- (c) Name and address of the chemical manufacturer, importer, or other responsible party.

(2)(a) For solid metal (such as a steel beam or a metal casting), solid wood, or plastic items that are not exempted as articles due to their downstream use, or shipments of whole grain, the required label may be transmitted to the customer at the time of the initial shipment, and need not be included with subsequent shipments to the same employer unless the information on the label changes;

(b) The label may be transmitted with the initial shipment itself, or with the material safety data sheet that is to be provided prior to or at the time of the first shipment; and

(c) This exception to requiring labels on every container of hazardous chemicals is only for the solid material itself and does not apply to hazardous chemicals used in conjunction with, or known to be present with, the material and to which employees handling the items in transit may be exposed (for example, cutting fluids or pesticides in grain).

(3) Chemical manufacturers, importers, or distributors shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked in accordance with this part in a manner which does not conflict with the requirements of the Hazardous Materials Transportation Act (49 U.S.C. 1801 et seq.) and regulations issued under that act by the department of transportation.

(4) If the hazardous chemical is regulated by WISHA or OSHA in a substance-specific health standard, the chemical manufacturer, importer, distributor or employer shall ensure that the labels or other forms of warning used are in accordance with the requirements of that standard.

(5) Except as provided in subsection (6) and (7) of this section, the employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following information:

(a) Identity of the hazardous chemical(s) contained therein; and

(b) Appropriate hazard warnings, or alternatively, words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide the employees with the specific information regarding the physical and health hazards of the hazardous chemical.

(6) The employer may use signs, placards, process sheets, batch tickets, operating procedures, or other such written materials in lieu of affixing labels to individual stationary process containers, as long as the alternative method identifies the containers to which it is applicable and conveys

the information required by subsection (5) of this section to be on a label. The written materials shall be readily accessible to the employees in their work area throughout each work shift.

(7) The employer is not required to label portable containers into which hazardous chemicals are transferred from labeled containers, and which are intended only for the immediate use of the employee who performs the transfer. For purposes of this part, drugs which are dispensed by a pharmacy to a health care provider for direct administration to a patient are exempted from labeling.

(8) The employer shall not remove or deface existing labels on incoming containers of hazardous chemicals, unless the container is immediately marked with the required information.

(9) The employer shall ensure that labels or other forms of warning are legible, in English, and prominently displayed on the container, or readily available in the work area throughout each work shift. Employers having employees who speak other languages may add the information in their language to the material presented, as long as the information is presented in English as well.

(10) The chemical manufacturer, importer, distributor or employer need not affix new labels to comply with this part if existing labels already convey the required information.

(11) Chemical manufacturers, importers, distributors, or employers who become newly aware of any significant information regarding the hazards of a chemical shall revise the labels for the chemical within three months of becoming aware of the new information. Labels on containers of hazardous chemicals shipped after that time shall contain the new information. If the chemical is not currently produced or imported, the chemical manufacturer, importer, distributor, or employer shall add the information to the label before the chemical is shipped or introduced into the workplace again.

(12) Retention of DOT markings, placards and labels.

(a) Any employer who receives a package of hazardous material which is required to be marked, labeled or placarded in accordance with the U.S. Department of Transportation's Hazardous Materials Regulations (49 CFR Parts 171 through 180) shall retain those markings, labels and placards on the package until the packaging is sufficiently cleaned of residue and purged of vapors to remove any potential hazards.

(b) Any employer who receives a freight container, rail freight car, motor vehicle, or transport vehicle that is required to be marked or placarded in accordance with the Hazardous Materials Regulations shall retain those markings and placards on the freight container, rail freight car, motor vehicle or transport vehicle until the hazardous materials which require the marking or placarding are sufficiently removed to prevent any potential hazards.

(c) Markings, placards and labels shall be maintained in a manner that ensures that they are readily visible.

(d) For nonbulk packages which will not be reshipped, the provision of this section are met if a label or other acceptable marking is affixed in accordance with the Hazard Communication Standard chapter 296-62 WAC.

(e) For the purposes of this section, the term "hazardous material" and any other terms not defined in this section have

the same definition as in the Hazardous Materials Regulations (49 CFR Parts 171 through 180).

[Statutory Authority: Chapter 49.17 RCW. 95-04-006, § 296-62-05411, filed 1/18/95, effective 3/10/95; 94-16-145, § 296-62-05411, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05411, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05411, filed 4/19/85; 84-13-001 (Order 84-14), § 296-62-05411, filed 6/7/84.]

WAC 296-62-05413 Material safety data sheets. (1) Chemical manufacturers and importers shall obtain or develop a material safety data sheet (MSDS) for each hazardous chemical they produce or import. Employers shall have a material safety data sheet in the workplace for each hazardous chemical which they use.

(2) Each material safety data sheet shall be in English (although the employer may maintain copies in other languages) and shall contain at least the following information:

(a) The identity used on the label, and, except as provided for in WAC 296-62-05417 on trade secrets:

(i) If the hazardous chemical is a single substance, its chemical and common name(s);

(ii) If the hazardous chemical is a mixture which has been tested as a whole to determine its hazards, the chemical and common name(s) of the ingredients which contribute to these known hazards, and the common name(s) of the mixture itself; or

(iii) If the hazardous chemical is a mixture which has not been tested as a whole:

(A) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise 1% or greater of the composition, except that chemicals identified as carcinogens under WAC 296-62-05407(4) shall be listed if the concentrations are 0.1% or greater; and

(B) The chemical and common name(s) of all ingredients which have been determined to be health hazards, and which comprise less than one percent (0.1% for carcinogens) of the mixture, if there is evidence that the ingredient(s) could be released from the mixture in concentrations which would exceed an established WISHA or OSHA permissible exposure limit or ACGIH Threshold Limit Value, or could present a health risk to employees; and

(C) The chemical and common name(s) of all ingredients which have been determined to present a physical hazard when present in the mixture;

(b) Physical and chemical characteristics of the hazardous chemical (such as vapor pressure, flash point);

(c) The physical hazards of the hazardous chemical, including the potential for fire, explosion, and reactivity;

(d) The acute and chronic health hazards of the hazardous chemical, including signs and symptoms of exposure, and any medical conditions which are generally recognized as being aggravated by exposure to the chemical;

(e) The primary route(s) of entry;

(f) The WISHA or OSHA permissible exposure limit, ACGIH threshold limit value, and any other exposure limit used or recommended by the chemical manufacturer, importer, or employer preparing the material safety data sheet (the PELs and TLVs include the 8-hour TWA, STEL, ceiling

value and skin notation defined in WAC 296-62-05405), where available;

(g) Whether the hazardous chemical is listed in the National Toxicology Program (NTP) Annual Report on Carcinogens (latest edition) or has been found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions), or by WISHA or OSHA;

(h) Any generally applicable precautions for safe handling and use which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, including appropriate hygienic practices, protective measures during repair and maintenance of contaminated equipment, and procedures for clean-up of spills and leaks;

(i) Any generally applicable control measures which are known to the chemical manufacturer, importer or employer preparing the material safety data sheet, such as appropriate engineering controls, work practices, or personal protective equipment;

(j) Emergency and first aid procedures;

(k) The date of preparation of the material safety data sheet or the last change to it; and

(l) The name, address and telephone number of the chemical manufacturer, importer, employer or other responsible party preparing or distributing the material safety data sheet, who can provide additional information on the hazardous chemical and appropriate emergency procedures, if necessary.

(3) If no relevant information is found for any given category on the material safety data sheet, the chemical manufacturer, importer or employer preparing the material safety data sheet shall mark it to indicate that no applicable information was found.

(4) Where complex mixtures have similar hazards and contents (i.e. the chemical ingredients are essentially the same, but the specific composition varies from mixture to mixture), the chemical manufacturer, importer or employer may prepare one material safety data sheet to apply to all of these similar mixtures.

(5) The chemical manufacturer, importer or employer preparing the material safety data sheet shall ensure that the information recorded accurately reflects the scientific evidence used in making the hazard determination. If the chemical manufacturer, importer or employer preparing the material safety data sheet becomes newly aware of any significant information regarding the hazards of a chemical, or ways to protect against the hazards, this new information shall be added to the material safety data sheet within three months. If the chemical is not currently being produced or imported the chemical manufacturer or importer shall add the information to the material safety data sheet before the chemical is introduced into the workplace again.

(6)(a) Chemical manufacturers or importers shall ensure that distributors and employers are provided an appropriate material safety data sheet with their initial shipment, and with the first shipment after a material safety data sheet is updated;

(b) The chemical manufacturer or importer shall either provide material safety data sheets with the shipped containers or send them to the distributor or employer prior to or at the time of the shipment;

(c) If the material safety data sheet is not provided with a shipment that has been labeled as a hazardous chemical, the distributor or employer shall obtain one from the chemical manufacturer or importer as soon as possible; and

(d) The chemical manufacturer or importer shall also provide distributors or employers with a material safety data sheet upon request.

(7)(a) Distributors shall ensure that material safety data sheets, and updated information, are provided to other distributors and employers with their initial shipment and with the first shipment after a material safety data sheet is updated;

(b) The distributor shall either provide material safety data sheets with the shipped containers, or send them to the other distributor or employer prior to or at the time of the shipment;

(c) Retail distributors selling hazardous chemicals to employers having a commercial account shall provide a material safety data sheet to such employers upon request, and shall post a sign or otherwise inform them that a material safety data sheet is available;

(d) Wholesale distributors selling hazardous chemicals to employers over-the-counter may also provide material safety data sheets upon request of the employer at the time of the over-the-counter purchase, and shall post a sign or otherwise inform such employers that a material safety data sheet is available;

(e) If an employer without a commercial account purchases a hazardous chemical from a retail distributor not required to have material safety data sheets on file (i.e., the retail distributor does not have a commercial account and does not use the materials), the retail distributor shall provide the employer, upon request, with the name, address, and telephone number of the chemical manufacturer, importer, or distributor from which a material safety data sheet can be obtained;

(f) Wholesale distributors shall also provide material safety data sheets to employers or other distributors upon request; and

(g) Chemical manufacturers, importers, and distributors need not provide material safety data sheets to retail distributors that have informed them that the retail distributor does not sell the product to commercial accounts or open the sealed container to use it in their own workplaces.

(8) The employer shall maintain in the workplace copies of the required material safety data sheets for each hazardous chemical, and shall ensure that they are readily accessible during each work shift to employees when they are in their work area(s). (Electronic access, microfiche, and other alternatives to maintaining paper copies of the material safety data sheets are permitted as long as no barriers to immediate employee access in each workplace are created by such options.)

(9) Where employees must travel between workplaces during a workshift, i.e., their work is carried out at more than one geographical location, the material safety data sheets may be kept at a central location at the primary workplace facility. In this situation, the employer shall ensure that employees can immediately obtain the required information in an emergency.

(10) Material safety data sheets may be kept in any form, including operating procedures, and may be designed to cover groups of hazardous chemicals in a work area where it may be more appropriate to address the hazards of a process rather than individual hazardous chemicals. However, the employer shall ensure that in all cases the required information is provided for each hazardous chemical, and is readily accessible during each work shift to employees when they are in their work area(s).

(11) Material safety data sheets shall also be made readily available, upon request, to designated representatives and to the director or his/her designee in accordance with the requirements of WAC 296-62-05209. NIOSH shall also be given access to material safety data sheets in the same manner.

(12) If a purchaser has not received a material safety data sheet within thirty calendar days after making a written request to the chemical manufacturer, importer, or distributor in accordance with WAC 296-62-05413(6), he/she may make a written request for assistance to the Department of Labor and Industries, Right-to-Know Program, P.O. Box 44610, Olympia, Washington 98504-4610. Such written request shall include:

(a) A copy of the purchaser's written request to the chemical manufacturer, importer, or distributor;

(b) The name of the product suspected of containing a hazardous chemical;

(c) The identification number of the product if available;

(d) A copy of the product label if available; and

(e) The name and address of the chemical manufacturer, importer, or distributor from whom the product was obtained.

Upon receipt of a written request for material safety data sheet, the department shall attempt to procure the material safety data sheet from the chemical manufacturer, importer or distributor and upon procurement, shall forward a copy of the material safety data sheet at no cost to the purchaser. In providing this service priority will be given to small employers.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-11-055, § 296-62-05413, filed 5/20/97, effective 8/1/97. Statutory Authority: RCW 49.17.010, [49.17.]050 and [49.17.]060. 95-22-015, § 296-62-05413, filed 10/20/95, effective 1/16/96. Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05413, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05413, filed 7/6/88. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05413, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05413, filed 4/19/85; 84-22-012 (Order 84-22), § 296-62-05413, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-05413, filed 6/7/84.]

WAC 296-62-05415 Employee information and training. (1) Employers shall provide employees with effective information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new physical or health hazard the employees have not previously been trained about is introduced into their work area. Such information and training shall be tailored to the types of hazards to which the employees will be exposed. Information and training may be designed to cover categories of hazards (e.g., flammability, carcinogenicity) or specific chemicals. Chemical-specific information must always be available through labels and material safety data sheets.

Note: See Appendix E for guidelines.

(2) Information. Employees shall be informed of:

- (a) The requirements of this part;
- (b) Any operations in their work area where hazardous chemicals are present; and
- (c) The location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by this part.

Note: Laboratories are not required to have a written hazard communication program, but it is recommended.

(3) Training. Employee training shall include at least:

- (a) Methods and observations that may be used to detect the presence or release of a hazardous chemical in the work area (such as monitoring conducted by the employer, continuous monitoring devices, visual appearance or odor of hazardous chemicals when being released, etc.);
- (b) The physical and health hazards of the chemicals in the work area including the likely physical symptoms or effects of overexposure;
- (c) The measures employees can take to protect themselves from these hazards, including specific procedures the employer has implemented to protect employees from exposure to hazardous chemicals, such as appropriate work practices, emergency procedures, and personal protective equipment to be used; and
- (d) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and the material safety data sheet, and how employees can obtain and use the appropriate hazard information.

(4) Upon receipt of a written or verbal request, the department shall prepare and make available (within available resources) to employers or the public a translation in Cambodian, Chinese, Korean, Spanish, or Vietnamese any of the following:

- (a) An employer's written hazard communication program;
- (b) A material safety data sheet; or
- (c) Written materials prepared by the department to inform employees of their rights relating to hazard communication, WAC 296-62-054 through 296-62-05429.

Note: Written requests should be directed to the Department of Labor and Industries, Right-to-know Program, P.O. Box 44610, Olympia, Washington 98504-4610.

(5) An employer employing employees who have trouble communicating in English shall make reasonable efforts to post notices in the employees' native languages as provided by the department.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05415, filed 8/3/94, effective 9/12/94. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05415, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-13-001 (Order 84-14), § 296-62-05415, filed 6/7/84.]

WAC 296-62-05417 Trade secrets. (1) The chemical manufacturer, importer, or employer may withhold the specific chemical identity, including the chemical name and other specific identification of a hazardous chemical, from the material safety data sheet, provided that:

(a) The claim that the information withheld is a trade secret can be supported;

(b) Information contained in the material safety data sheet concerning the properties and effects of the hazardous chemical is disclosed;

(c) The material safety data sheet indicates that the specific chemical identity is being withheld as a trade secret; and

(d) The specific chemical identity is made available to health professionals, employees, and designated representatives, in accordance with the applicable provisions of this section.

(2) Where a treating physician or nurse determines that a medical emergency exists and the specific chemical identity of a hazardous chemical is necessary for emergency or first-aid treatment, the chemical manufacturer, importer, or employer shall immediately disclose the specific chemical identity of a trade secret chemical to that treating physician or nurse, regardless of the existence of a written statement of need or a confidentiality agreement. The chemical manufacturer, importer, or employer may require a written statement of need and confidentiality agreement, in accordance with the provisions of subsections (3) and (4) of this section, as soon as circumstances permit.

(3) In nonemergency situations, a chemical manufacturer, importer, or employer shall, upon request, disclose a specific chemical identity, otherwise permitted to be withheld under subsection (1) of this section, to a health professional (i.e. physician, registered nurse, industrial hygienist, toxicologist, epidemiologist or occupational health nurse) providing medical or other occupational health services to exposed employee(s), and to employees or designated representatives, if:

(a) The request is in writing;

(b) The request describes with reasonable detail one or more of the following occupational health needs for the information:

(i) To assess the hazards of the chemicals to which employees will be exposed;

(ii) To conduct or assess sampling of the workplace atmosphere to determine employee exposure levels;

(iii) To conduct preassignment or periodic medical surveillance of exposed employees;

(iv) To provide medical treatment to exposed employees;

(v) To select or assess appropriate personal protective equipment for exposed employees;

(vi) To design or assess engineering controls or other protective measures for exposed employees; and

(vii) To conduct studies to determine the health effects of exposure.

(c) The request explains in detail why the disclosure of the specific chemical identity is essential and that, in lieu thereof, the disclosure of the following information to the health professional, employee, or designated representatives, would not satisfy the purposes described in (b) of this subsection:

(i) The properties and effects of the chemical;

(ii) Measures for controlling workers' exposure to the chemical;

(iii) Methods of monitoring and analyzing worker exposure to the chemical; and

(iv) Methods of diagnosing and treating harmful exposures to the chemical;

(d) The request includes a description of the procedures to be used to maintain the confidentiality of the disclosed information; and

(e) The health professional, and the employer or contractor of the services of the health professional (i.e., downstream employer, labor organization, or individual employee), employee, or designated representative, agree in a written confidentiality agreement that the health professional employee, or designated representative, will not use the trade secret information for any purpose other than the health need(s) asserted and agree not to release the information under any circumstances other than to the department, as provided in subsection (6) of this section, except as authorized by the terms of the agreement or by the chemical manufacturer, importer, or employer.

(4) The confidentiality agreement authorized by subsection (3)(e) of this section:

(a) May restrict the use of the information to the health purposes indicated in the written statement of need;

(b) May provide for appropriate legal remedies in the event of a breach of the agreement, including stipulation of a reasonable preestimate of likely damages; and

(c) May not include requirements for the posting of a penalty bond.

(5) Nothing in this part is meant to preclude the parties from pursuing noncontractual remedies to the extent permitted by law.

(6) If the health professional, employee, or designated representative receiving the trade secret information decides that there is a need to disclose it to the department, the chemical manufacturer, importer, or employer who provided the information shall be informed by the health professional, employee, or designated representative prior to, or at the same time as, such disclosure.

(7) If the chemical manufacturer, importer, or employer denies a written request for disclosure of a specific chemical identity, the denial must:

(a) Be provided to the health professional, employee, or designated representative, within thirty days of the request;

(b) Be in writing;

(c) Include evidence to support the claim that the specific chemical identity is a trade secret;

(d) State the specific reasons why the request is being denied; and

(e) Explain in detail how alternative information may satisfy the specific medical or occupational health need without revealing the specific chemical identity.

(8) The health professional, employee, or designated representative, whose request for information is denied under subsection (3) of this section may refer the request and the written denial of the request to the department for consideration.

(9) When a health professional, employee, or designated representative refers the denial to the department under subsection (8) of this section, the director or his/her designee shall consider the evidence to determine if:

(a) The chemical manufacturer, importer, or employer has supported the claim that the specific chemical identity is a trade secret;

(b) The health professional, employee, or designated representative, has supported the claim that there is a medical or occupational health need for the information; and

(c) The health professional, employee, or designated representative, has demonstrated adequate means to protect the confidentiality.

(10) If the director or his/her designee determines that the specific chemical identity requested under subsection (3) of this section is not a bona fide trade secret, or that it is a trade secret but the requesting health professional, employee, or designated representative has a legitimate medical or occupational health need for the information, has executed a written confidentiality agreement, and has shown adequate means to protect the confidentiality of the information, the chemical manufacturer, importer, or employer will be subject to citation by the department.

(11) If a chemical manufacturer, importer, or employer demonstrates to the department that the execution of a confidentiality agreement would not provide sufficient protection against the potential harm from the unauthorized disclosure of a trade secret specific chemical identity, the director or his/her designee may issue such orders or impose such additional limitations or conditions upon the disclosure of the requested chemical information as may be appropriate to assure that the occupational health services are provided without an undue risk of harm to the chemical manufacturer, importer, or employer.

(12) If, following the issuance of a citation and any protective orders, the chemical manufacturer, importer, or employer continues to withhold the information, further action may be taken by the department in accordance with chapter 49.17 RCW.

(13) Notwithstanding the existence of a trade secret claim, a chemical manufacturer, importer, or employer shall, upon request, disclose to the director or his/her designee any information which this section requires the chemical manufacturer, importer, or employer to make available. Where there is a trade secret claim, such claim shall be made no later than at the time the information is provided to the director or his/her designee so that suitable determinations of trade secret status can be made and the necessary protections can be implemented.

(14) Nothing in this section shall be construed as requiring the disclosure under any circumstances of process or percentage of mixture information which is a trade secret.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05417, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05417, filed 7/6/88. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05417, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-22-012 (Order 84-22), § 296-62-05417, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-05417, filed 6/7/84.]

WAC 296-62-05419 Effective dates. Reserved.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05419, filed 8/3/94, effective 9/12/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-13-001 (Order 84-14), § 296-62-05419, filed 6/7/84.]

WAC 296-62-05421 Appendix A—Health hazard definitions (mandatory). Although safety hazards related to the physical characteristics of a chemical can be objectively defined in terms of testing requirements (e.g., flammability), health hazard definitions are less precise and more subjective. Health hazards may cause measurable changes in the body—such as decreased pulmonary function. These changes are generally indicated by the occurrence of signs and symptoms in the exposed employees—such as shortness of breath, a nonmeasurable, subjective feeling. Employees exposed to such hazards must be apprised of both the change in body function and the signs and symptoms that may occur to signal that change.

The determination of occupational health hazards is complicated by the fact that many of the effects or signs and symptoms occur commonly in nonoccupationally exposed populations, so that effects of exposure are difficult to separate from normally occurring illnesses. Occasionally, a substance causes an effect that is rarely seen in the population at large, such as angiosarcomas caused by vinyl chloride exposure, thus making it easier to ascertain that the occupational exposure was the primary causative factor. More often, however, the effects are common, such as lung cancer. The situation is further complicated by the fact that most chemicals have not been adequately tested to determine their health hazard potential, and data do not exist to substantiate these effects.

There have been many attempts to categorize effects and to define them in various ways. Generally, the terms "acute" and "chronic" are used to delineate between effects on the basis of severity or duration. "Acute" effects usually occur rapidly as a result of short-term exposures, and are of short duration. "Chronic" effects generally occur as a result of long-term exposure, and are of long duration.

The acute effects referred to most frequently are those defined by the American National Standards Institute (ANSI) standard for Precautionary Labeling of Hazardous Industrial Chemicals (Z129.1-1988)—irritation, corrosivity, sensitization and lethal dose. Although these are important health effects, they do not adequately cover the considerable range of acute effects which may occur as a result of occupational exposure, such as, for example, narcosis.

Similarly, the term chronic effect is often used to cover only carcinogenicity, teratogenicity, and mutagenicity. These effects are obviously a concern in the workplace, but again, do not adequately cover the area of chronic effects, excluding, for example, blood dyscrasias (such as anemia), chronic bronchitis and liver atrophy.

The goal of defining precisely, in measurable terms, every possible health effect that may occur in the workplace as a result of chemical exposures cannot realistically be accomplished. This does not negate the need for employees to be informed of such effects and protected from them.

Appendix B, which is also mandatory, outlines the principles and procedures of hazard assessment.

For purposes of this part, any chemicals which meet any of the following definitions, as determined by the criteria set forth in Appendix B are health hazards. However, this is not intended to be an exclusive categorization scheme. If there are available scientific data that involve other animal species

or test methods, they must also be evaluated to determine the applicability of the HCS.

(1) Carcinogen: A chemical is considered to be a carcinogen if:

(a) It has been evaluated by the International Agency for Research on Cancer (IARC), and found to be a carcinogen or potential carcinogen; or

(b) It is listed as a carcinogen or potential carcinogen in the Annual Report on Carcinogens published by the National Toxicology Program (NTP) (latest edition); or

(c) It is regulated by WISHA as a carcinogen.

(2) Corrosive: A chemical that causes visible destruction of, or irreversible alterations in, living tissue by chemical action at the site of contact. For example, a chemical is considered to be corrosive if, when tested on the intact skin of albino rabbits by the method described by the U.S. Department of Transportation in Appendix A to 49 CFR Part 173, it destroys or changes irreversibly the structure of the tissue at the site of contact following an exposure period of four hours. This term shall not refer to action on inanimate surfaces.

(3) Highly toxic: A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of 50 milligrams or less per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD_{50}) of 200 milligrams or less per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of 200 parts per million by volume or less of gas or vapor, or 2 milligrams per liter or less of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

(4) Irritant: A chemical, which is not corrosive, but which causes a reversible inflammatory effect on living tissue by chemical action at the site of contact. A chemical is a skin irritant if, when tested on the intact skin of albino rabbits by the methods of 16 CFR 1500.41 for four hours exposure or by other appropriate techniques, it results in an empirical score of five or more. A chemical is an eye irritant if so determined under the procedure listed in 16 CFR 1500.42 or other appropriate techniques.

(5) Sensitizer: A chemical that causes a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

(6) Toxic: A chemical falling within any of the following categories:

(a) A chemical that has a median lethal dose (LD_{50}) of more than 50 milligrams per kilogram but not more than 500 milligrams per kilogram of body weight when administered orally to albino rats weighing between 200 and 300 grams each.

(b) A chemical that has a median lethal dose (LD_{50}) of more than 200 milligrams per kilogram but not more than 1,000 milligrams per kilogram but not more than 1,000 milli-

grams per kilogram of body weight when administered by continuous contact for 24 hours (or less if death occurs within 24 hours) with the bare skin of albino rabbits weighing between two and three kilograms each.

(c) A chemical that has a median lethal concentration (LC_{50}) in air of more than 200 parts per million but not more than 2,000 parts per million by volume of gas or vapor, or more than two milligrams per liter but not more than 20 milligrams per liter of mist, fume, or dust, when administered by continuous inhalation for one hour (or less if death occurs within one hour) to albino rats weighing between 200 and 300 grams each.

(7) Target organ effects: The following is a target organ categorization of effects which may occur, including examples of signs and symptoms and chemicals which have been found to cause such effects. These examples are presented to illustrate the range and diversity of effects and hazards found in the workplace, and the broad scope employers must consider in this area, but are not intended to be all-inclusive.

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|---|---|
| (a) Hepatotoxins: | Chemicals which produce liver damage. |
| Signs & symptoms: | Jaundice, liver enlargement. |
| Chemicals: | Carbon tetrachloride, nitrosamines. |
| (b) Nephrotoxins: | Chemicals which produce kidney damage. |
| Signs & symptoms: | Edema; proteinuria. |
| Chemicals: | Halogenated hydrocarbons; uranium. |
| (c) Neurotoxins: | Chemicals which produce their primary toxic effects on the nervous system. |
| Signs & symptoms: | Narcosis; behavioral changes; decrease in motor functions. |
| Chemicals: | Mercury, carbon disulfide. |
| (d) Agents which act on the blood or hemato-poietic system: | Decrease hemoglobin function; deprive the body of oxygen. |
| Signs & symptoms: | Cyanosis; loss of consciousness. |
| Chemicals: | Carbon monoxide; cyanides. |
| (e) Agents which damage the lung: | Chemicals which irritate or damage the pulmonary tissue. |
| Signs & symptoms: | Cough; tightness in chest; shortness of breath. |
| Chemicals: | Silica; asbestos. |
| (f) Reproductive toxins: | Chemicals which affect the reproductive capabilities including chromosomal damage (mutations) and effects on fetuses (teratogenesis). |
| Signs & symptoms: | Birth defects; sterility. |
| Chemicals: | Lead; DBCP. |

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|------------------------|--|
| (g) Cutaneous hazards: | Chemicals which affect the dermal layer of the body. |
| Signs & symptoms: | Defatting of the skin; rashes; irritation. |
| Chemicals: | Ketones; chlorinated compounds. |
| (h) Eye hazards: | Chemicals which affect the eye or visual capacity. |
| Signs & symptoms: | Conjunctivitis; corneal damage. |
| Chemicals: | Organic solvents; acids. |

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05421, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05421, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05421, filed 4/19/85; 84-22-012 (Order 84-22), § 296-62-05421, filed 10/30/84; 84-13-001 (Order 84-14), § 296-62-05421, filed 6/7/84.]

WAC 296-62-05423 Appendix B—Hazard determination (mandatory). The quality of a hazard communication program is largely dependent upon the adequacy and accuracy of the hazard determination. The hazard determination requirement of this standard is performance-oriented. Chemical manufacturers, importers, and employers evaluating chemicals are not required to follow any specific methods for determining hazards, but they must be able to demonstrate that they have adequately ascertained the hazards of the chemicals produced or imported in accordance with the criteria set forth in this appendix.

Hazard evaluation is a process which relies heavily on the professional judgment of the evaluator, particularly in the area of chronic hazards. The performance-orientation of the hazard determination does not diminish the duty of the chemical manufacturer, importer or employer to conduct a thorough evaluation, examining all relevant data and producing a scientifically defensible evaluation. For purposes of this standard, the following criteria shall be used in making hazard determinations that meet the requirements of this standard.

(1) Carcinogenicity: As described in WAC 296-62-05407(4) and Appendix A of this section, a determination by the National Toxicology Program, the International Agency for Research on Cancer, WISHA or OSHA that a chemical is a carcinogen or potential carcinogen will be considered conclusive evidence for purposes of this part. In addition, however, all available scientific data on carcinogenicity must be evaluated in accordance with the provisions of the appendix and the requirements of this standard.

(2) Human data: Where available, epidemiological studies and case reports of adverse health effects shall be considered in the evaluation.

(3) Animal data: Human evidence of health effects in exposed populations is generally not available for the majority of chemicals produced or used in the workplace. Therefore, the available results of toxicological testing in animal populations shall be used to predict the health effects that may be experienced by exposed workers. In particular, the definitions of certain acute hazards refer to specific animal testing results (see Appendix A).

(4) Adequacy and reporting of data. The results of any studies which are designed and conducted according to estab-

lished scientific principles, and which report statistically significant conclusions regarding the health effects of a chemical, shall be a sufficient basis for a hazard determination and reported on any material safety data sheet. In vitro studies alone generally do not form the basis for a definitive finding of a hazard under the HCS since they have a positive or negative result rather than a statistically significant finding.

The chemical manufacturer, importer, or employer may also report the results of other scientifically valid studies which tend to refute the findings of hazard.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05423, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05423, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 84-13-001 (Order 84-14), § 296-62-05423, filed 6/7/84.]

WAC 296-62-05425 Appendix C—Information sources (advisory). The following is a list of available data sources which the chemical manufacturer, importer, or employer may wish to consult to evaluate the hazards of chemicals they produce or import:

(1) Any information in their own company files, such as toxicity testing results or illness experience of company employees.

(2) Any information obtained from the supplier of the chemical, such as material safety data sheets or product safety bulletins.

(3) Any pertinent information obtained from the following source list (latest editions should be used):

Condensed Chemical Dictionary

Van Nostrand Reinhold Co.
135 West 50th Street
New York, NY 10020

The Merck Index: An Encyclopedia of Chemicals and Drugs

Merck and Company, Inc.
126 E. Lincoln Avenue
Rahway, NJ 07065

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man

Geneva: World Health Organization
International Agency for Research on Cancer,
1972

Present (Multivolume work) Summaries are available in supplement volumes.
49 Sheridan Street
Albany, New York 12210

Industrial Hygiene and Toxicology, by F.A. Patty

John Wiley & Sons, Inc.
New York, NY
(Multivolume work)

Clinical Toxicology of Commercial Products

Gleason, Gosselin, and Hodge

Casarett and Doull's Toxicology; The Basic Science of Poisons

Doull, Klaassen, and Amdur
Macmillan Publishing Co., Inc.
New York, NY

Industrial Toxicology, by Alice Hamilton and Harriet L. Hardy

Publishing Sciences Group, Inc.
Acton, MA

Toxicology of the Eye, by W. Morton Grant

Charles C. Thomas
301-327 East Lawrence Avenue
Springfield, IL

Recognition of Health Hazards in Industry

William A. Burgess
John Wiley and Sons
605 Third Avenue
New York, NY 10158

Chemical Hazards of the Workplace

Nick H. Proctor and James P. Hughes
J.P. Lipincott Company
6 Winchester Terrace
New York, NY 10022

Handbook of Chemistry and Physics

Chemical Rubber Company
18901 Cranwood Parkway
Cleveland, OH 44128

Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment and Biological Exposure Indices with Intended Changes

American Conference of Governmental Industrial Hygienists (ACGIH)
6500 Glenway Avenue, Bldg. D-5
Cincinnati, OH 45211

Note:

Information on the physical hazards of chemicals may be found in publications of the National Fire Protection Association, Boston, MA

National Toxicology Program (NTP) Annual Report on Carcinogens (Latest Edition)

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22101

Note:

The following documents may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

Occupational Health Guidelines

NIOSH/OSHA (NIOSH Pub. No. 81-123)

NIOSH Pocket Guide to Chemical Hazards

NIOSH Pub. No. 90-117

Registry of Toxic Effects of Chemical Substances

(Latest Edition)

Miscellaneous Documents published by the National Institute for Occupational Safety and Health:

- (1) Criteria documents
- (2) Special Hazard Reviews
- (3) Occupational Hazard Assessment
- (4) Current Intelligence Bulletins

WISHA's General Occupational Health Standards, chapter 296-62 WAC

OSHA's General Industry Standards (29 CFR Part 1910)

NTP Annual Report on Carcinogens and Summary of the Annual Report on Carcinogens

bibliographic data bases

Service Provider

Bibliographic Retrieval Services (BRS),
1200 Route 7,
Latham, NY 12110.

Lockheed - DIALOG
Information Service, Inc.,
3460 Hill View Avenue,
Palo Alto, CA 94304.

SDC - Orbit, SDC
Information Service,
2500 Colorado Avenue,
Santa Monica, CA 90406.

National Library of Medicine,
Department of Health and
Human Services, Public
Health Service, National
Institutes of Health,
Bethesda, MD 20209.

Pergamon International
Information Corp.,
1340 Old Chain Bridge, Rd.,
McLean, VA 22101.

File Name

Biosis Previews
CA Search
Medlars
NTIS
Hazardline
American Chemical
Society Journal
Excerpta Medica
IRCS Medical Science
Journal

Pre-Med
Intl. Pharmaceutical
Abstracts

Paper Chem

Biosis Prev. Files
CA Search Files
CAB Abstracts
Chemical Exposure
Chemname

Chemsis Files
Chemzero
Embase Files
Environmental Bibliog-
raphies
Enviroline
Federal Research in
Progress
IRL Life Science Col-
lection
NTIS
Occupational Safety
and Health
(NIOSH)

Paper Chem

CAS Files
Chemdex, 2,3
NTIS

Hazardous Substances
Data Bank (NSDB)
Medline Files
Toxline Files
Cancerlit
RTECS
Chemline

Laboratory Hazard Bul-
letin

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1625 Eye Street, NW,
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Chemical Information System
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[Statutory Authority: Chapter 49.17 RCW, 94-16-145, § 296-62-05425, filed 8/3/94, effective 9/12/94; 88-14-108 (Order 88-11), § 296-62-05425, filed 7/6/88. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240. 86-12-004 (Order 86-22), § 296-62-05425, filed 5/22/86. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-05425, filed 4/19/85; 84-13-001 (Order 84-14), § 296-62-05425, filed 6/7/84.]

WAC 296-62-05427 Appendix D. Definition of "trade secret" (mandatory)

The following is a reprint of the *Restatement of Torts* section 757, comment *b* (1939):

b. Definition of trade secret. A trade secret may consist of any formula, pattern, device or compilation of information which is used in one's business, and which gives him an opportunity to obtain an advantage over competitors who do not know or use it. It may be a formula for a chemical compound, a process of manufacturing, treating or preserving materials, a pattern for a machine or other device, or a list of customers. It differs from other secret information in a business (see § 759 of the *Restatement of Torts* which is not included in this Appendix) in that it is not simply information as to single or ephemeral events in the conduct of the business, as, for example, the amount or other terms of a secret bid for a contract or the salary of certain employees, or the security investments made or contemplated, or the date fixed for the announcement of a new policy or for bringing out a new model or the like. A trade secret is a process or device for continuous use in the operations of the business. Generally it relates to the production of goods, as, for example, a machine or formula for the production of an article. It may, however, relate to the sale of goods or to other operations in the business, such as a code for determining discounts, rebates or other concessions in a price list or catalogue, or a list of specialized customers, or a method of bookkeeping or other office management.

Secrecy. The subject matter of a trade secret must be secret. Matters of public knowledge or of general knowledge in an industry cannot be appropriated by one as his secret. Matters which are completely disclosed by the goods which

CIS/ILO
Cancernet

Structure and Nomen-
clature Search Sys-
tem (SANSS)

Acute Toxicity
(RTECS)

Clinical Toxicology of
Commercial Prod-
ucts

Oil and Hazardous
Materials Techni-
cal Assistance Data
System

CCRIS
CESARS

MSDS
Hazardline

one markets cannot be his secret. Substantially, a trade secret is known only in the particular business in which it is used. It is not requisite that only the proprietor of the business know it. He may, without losing his protection, communicate it to employees involved in its use. He may likewise communicate it to others pledged to secrecy. Others may also know of it independently, as, for example, when they have discovered the process or formula by independent invention and are keeping it secret. Nevertheless, a substantial element of secrecy must exist, so that, except by the use of improper means, there would be difficulty in acquiring the information. An exact definition of a trade secret is not possible. Some factors to be considered in determining whether given information is one's trade secret are: (1) The extent to which the information is known outside of his business; (2) the extent to which it is known by employees and others involved in his business; (3) the extent of measures taken by him to guard the secrecy of the information; (4) the value of the information to him and his competitors; (5) the amount of effort or money expended by him in developing the information; (6) the ease or difficulty with which the information could be properly acquired or duplicated by others.

Novelty and prior art. A trade secret may be a device or process which is patentable; but it need not be that. It may be a device or process which is clearly anticipated in the prior art or one which is merely a mechanical improvement that a good mechanic can make. Novelty and invention are not requisite for a trade secret as they are for patentability. These requirements are essential to patentability because a patent protects against unlicensed use of the patented device or process even by one who discovers it properly through independent research. The patent monopoly is a reward to the inventor. But such is not the case with a trade secret. Its protection is not based on a policy of rewarding or otherwise encouraging the development of secret processes or devices. The protection is merely against breach of faith and reprehensible means of learning another's secret. For this limited protection it is not appropriate to require also the kind of novelty and invention which is a requisite of patentability. The nature of the secret is, however, an important factor in determining the kind of relief that is appropriate against one who is subject to liability under the rule stated in this section. Thus, if the secret consists of a device or process which is a novel invention, one who acquires the secret wrongfully is ordinarily enjoined from further use of it and is required to account for the profits derived from his past use. If, on the other hand, the secret consists of mechanical improvements that a good mechanic can make without resort to the secret, the wrongdoer's liability may be limited to damages, and an injunction against future use of the improvements made with the aid of the secret may be inappropriate.

[Statutory Authority: Chapter 49.17 RCW, 94-16-145, § 296-62-05427, filed 8/3/94, effective 9/12/94. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-05427, filed 4/27/87. Statutory Authority: RCW 49.17.230, 49.70.180, 49.17.040, 49.17.050 and 49.17.240, 86-12-004 (Order 86-22), § 296-62-05427, filed 5/22/86.]

WAC 296-62-05429 Appendix E—Guidelines for employer compliance (advisory). The hazard communication standard (HCS) is based on a simple concept—that employees have both a need and a right to know the hazards

and identities of the chemicals they are exposed to when working. They also need to know what protective measures are available to prevent adverse effects from occurring. The HCS is designed to provide employees with the information they need.

Knowledge acquired under the HCS will help employers provide safer workplaces for their employees. When employers have information about the chemicals being used, they can take steps to reduce exposures, substitute less hazardous materials, and establish proper work practices. These efforts will help prevent the occurrence of work-related illnesses and injuries caused by chemicals.

The HCS addresses the issues of evaluating and communicating hazards to workers. Evaluation of chemical hazards involves a number of technical concepts, and is a process that requires the professional judgment of experienced experts. That is why the HCS is designed so that employers who simply use chemicals, rather than produce or import them, are not required to evaluate the hazards of those chemicals. Hazard determination is the responsibility of the producers and importers of the materials. Producers and importers of chemicals are then required to provide the hazard information to employers that purchase their products.

Employers that do not produce or import chemicals need only focus on those parts of the rule that deal with establishing a workplace program and communicating information to their workers. This appendix is a general guide for such employers to help them determine what is required under the rule. It does not supplant or substitute for the regulatory provisions, but rather provides a simplified outline of the steps an average employer would follow to meet those requirements.

1. Becoming Familiar With The Rule.

WISHA has provided a simple summary of the HCS in a pamphlet entitled "*Hazardous Chemicals - Right to Know - Washington Hazard Communication Standard*" WISHA Publication Number P413-014-000. Some employers prefer to begin to become familiar with the rule's requirements by reading this pamphlet. A copy may be obtained from your local WISHA office.

The standard is long, and some parts of it are technical, but the basic concepts are simple. In fact, the requirements reflect what many employers have been doing for years. You may find that you are already largely in compliance with many of the provisions, and will simply have to modify your existing programs somewhat. WISHA is an OSHA-approved state plan state, and you must comply with the state's requirements, which may be different than those of the federal rule.

The HCS requires information to be prepared and transmitted regarding all hazardous chemicals. The HCS covers both physical hazards (such as flammability), and health hazards (such as irritation, lung damage, and cancer). Most chemicals used in the workplace have some hazard potential, and thus will be covered by the rule.

One difference between this rule and many others adopted by WISHA is that this one is performance-oriented. That means that you have the flexibility to adapt the rule to the needs of your workplace, rather than having to follow specific, rigid requirements. It also means that you have to

exercise more judgment to implement an appropriate and effective program.

The standard's design is simple. Chemical manufacturers and importers must evaluate the hazards of the chemicals they produce or import. Using that information, they must then prepare labels for containers, and more detailed technical bulletins called material safety data sheets (MSDS).

Chemical manufacturers, importers, and distributors of hazardous chemicals are all required to provide the appropriate labels and material safety data sheets to the employers to which they ship the chemicals. The information is to be provided automatically. Every container of hazardous chemicals you receive must be labeled, tagged, or marked with the required information. Your suppliers must also send you a properly completed material safety data sheet (MSDS) at the time of the first shipment of the chemical, and with the next shipment after the MSDS is updated with new and significant information about the hazards.

You can rely on the information received from your suppliers. You have no independent duty to analyze the chemical or evaluate the hazards of it.

Employers that "use" hazardous chemicals must have a program to ensure the information is provided to exposed employees. "Use" means to package, handle, react, or transfer. This is an intentionally broad scope, and includes any situation where a chemical is present in such a way that employees may be exposed under normal conditions of use or in a foreseeable emergency.

The requirements of the rule that deal specifically with the hazard communication program are found in WAC 296-62-05409, Written hazard communication program; WAC 296-62-05411, Labels and other forms of warning; WAC 296-62-05413, Material safety data sheets; and WAC 296-62-05415, Employee information and training. The requirements of these paragraphs should be the focus of your attention. Concentrate on becoming familiar with them, using WAC 296-62-05403, Scope and application, and WAC 296-62-05405, Definitions applicable to this part, as references when needed to help explain the provisions.

There are two types of work operations where the coverage of the rule is limited. These are laboratories and operations where chemicals are only handled in sealed containers (e.g., a warehouse). The limited provisions for these workplaces can be found in WAC 296-62-05403, Scope and application. Basically, employers having these types of work operations need only keep labels on containers as they are received; maintain material safety data sheets that are received, and give employees access to them; and provide information and training for employees. Employers do not have to have written hazard communication programs and lists of chemicals for these types of operations. Some of these employers may have to comply with other similar standards which have requirements for a written program. For example, laboratories may be required to have a written chemical hygiene plan under WAC 296-62-400, Hazardous chemicals in laboratories.

The limited coverage of laboratories and sealed container operations addresses the obligation of an employer to the workers in the operations involved, and does not affect the employer's duties as a distributor of chemicals. For exam-

ple, a distributor may have warehouse operations where employees would be protected under the limited sealed container provisions. In this situation, requirements for obtaining and maintaining MSDSs are limited to providing access to those received with containers while the substance is in the workplace, and requesting MSDSs when employees request access for those not received with the containers. However, as a distributor of hazardous chemicals, that employer will still have responsibilities for providing MSDSs to downstream customers at the time of the first shipment and when the MSDS is updated. Therefore, although they may not be required for the employees in the work operation, the distributor may, nevertheless, have to have MSDSs to satisfy other requirements of the rule.

2. Identify Responsible Staff.

Hazard communication is going to be a continuing program in your facility. Compliance with the HCS is not a "one shot deal." In order to have a successful program, it will be necessary to assign responsibility for both the initial and ongoing activities that have to be undertaken to comply with the rule. In some cases, these activities may already be part of current job assignments. For example, site supervisors are frequently responsible for on-the-job training sessions. Early identification of the responsible employees, and involvement of them in the development of your plan of action, will result in a more effective program design. Evaluation of the effectiveness of your program will also be enhanced by involvement of affected employees.

For any safety and health program, success depends on commitment at every level of the organization. This is particularly true for hazard communication, where success requires a change in behavior. This will only occur if employers understand the program, and are committed to its success, and if employees are motivated by the people presenting the information to them.

3. Identify Hazardous Chemicals in the Workplace.

The standard requires a list of hazardous chemicals in the workplace as part of the written hazard communication program. The list will eventually serve as an inventory of everything for which an MSDS must be maintained. At this point, however, preparing the list will help you complete the rest of the program since it will give you some idea of the scope of the program required for compliance in your facility.

The best way to prepare a comprehensive list is to survey the workplace. Purchasing records may also help, and certainly employers should establish procedures to ensure that in the future purchasing procedures result in MSDSs being received before a material is used in the workplace.

The broadest possible perspective should be taken when doing the survey. Sometimes people think of "chemicals" as being only liquids in containers. The HCS covers chemicals in all physical forms—liquids, solids, gases, vapors, fumes, and mists—whether they are "contained" or not. The hazardous nature of the chemical and the potential for exposure are the factors which determine whether a chemical is covered. If it is not hazardous, it is not covered. If there is no potential for exposure (e.g., the chemical is inextricably bound and cannot be released), the rule does not cover the chemical.

Look around. Identify chemicals in containers, including pipes, but also think about chemicals generated in the work operations. For example, welding fumes, dusts, and exhaust fumes are all sources of chemical exposures. Read labels provided by suppliers for hazard information. Make a list of all chemicals in the workplace that are potentially hazardous. For your own information and planning, you may also want to note on the list the location(s) of the products within the workplace, and an indication of the hazards as found on the label. This will help you as you prepare the rest of your program.

WAC 296-62-05403, Scope and application, includes exemptions for various chemicals or workplace situations. After compiling the complete list of chemicals, you should review paragraph (b) of this section to determine if any of the items can be eliminated from the list because they are exempted materials. For example, food, drugs, and cosmetics brought into the workplace for employee consumption are exempt. So rubbing alcohol in the first aid kit would not be covered.

Once you have compiled as complete a list as possible of the potentially hazardous chemicals in the workplace, the next step is to determine if you have received material safety data sheets for all of them. Check your files against the inventory you have just compiled. If any are missing, contact your supplier and request one. It is a good idea to document these requests, either by copy of a letter or a note regarding telephone conversations. If you have MSDSs for chemicals that are not on your list, figure out why. Maybe you do not use the chemical anymore, or maybe you missed it in your survey. Some suppliers do provide MSDSs for products that are not hazardous. These do not have to be maintained by you.

You should not allow employees to use any chemicals for which you have not received an MSDS. The MSDS provides information you need to ensure proper protective measures are implemented prior to exposure.

4. Preparing and Implementing a Hazard Communication Program.

All workplaces where employees are exposed to hazardous chemicals must have a written plan which describes how the standard will be implemented in that facility. Preparation of a plan is not just a paper exercise—all of the elements must be implemented in the workplace in order to be in compliance with the rule. See WAC 296-62-05409 for the specific requirements regarding written hazard communication programs. The only work operations which do not have to comply with the written plan requirements are laboratories and work operations where employees only handle chemicals in sealed containers. See WAC 296-62-05403, Scope and application, for the specific requirements for these two types of workplaces.

The plan does not have to be lengthy or complicated. It is intended to be a blueprint for implementation of your program—an assurance that all aspects of the requirements have been addressed.

Many trade associations and other professional groups have provided sample programs and other assistance materials to affected employers. These have been very helpful to many employers since they tend to be tailored to the particu-

lar industry involved. You may wish to investigate whether your industry trade groups have developed such materials.

Although such general guidance may be helpful, you must remember that the written program has to reflect what you are doing in your workplace. Therefore, if you use a generic program it must be adapted to address the facility it covers. For example, the written plan must list the chemicals present at the site, indicate who is to be responsible for the various aspects of the program in your facility, and indicate where written materials will be made available to employees.

If WISHA inspects your workplace for compliance with the HCS, the WISHA compliance officer will ask to see your written plan at the outset of the inspection. In general, the following items will be considered in evaluating your program.

The written program must describe how the requirements for labels and other forms of warning, material safety data sheets, and employee information and training, are going to be met in your facility. The following discussion provides the type of information compliance officers will be looking for to decide whether these elements of the hazard communication program have been properly addressed:

A. Labels and Other Forms of Warning.

In-plant containers of hazardous chemicals must be labeled, tagged, or marked with the identity of the material and appropriate hazard warnings. Chemical manufacturers, importers, and distributors are required to ensure that every container of hazardous chemicals they ship is appropriately labeled with such information and with the name and address of the producer or other responsible party. Employers purchasing chemicals can rely on the labels provided by their suppliers. If the material is subsequently transferred by the employer from a labeled container to another container, the employer will have to label that container unless it is subject to the portable container exemption. See WAC 296-62-05411 for specific labeling requirements.

The primary information to be obtained from a WISHA-required label is an identity for the material, and appropriate hazard warnings. The identity is any term which appears on the label, the MSDS, and the list of chemicals, and thus links these three sources of information. The identity used by the supplier may be a common or trade name ("Black Magic Formula"), or a chemical name (1,1,1-trichloroethane). The hazard warning is a brief statement of the hazardous effects of the chemical ("flammable," "causes lung damage"). Labels frequently contain other information, such as precautionary measures ("do not use near open flame"), but this information is provided voluntarily and is not required by the rule. Labels must be legible, and prominently displayed. There are no specific requirements for size or color, or any specified text.

With these requirements in mind, the compliance officer will be looking for the following types of information to ensure that labeling will be properly implemented in your facility:

1. Designation of person(s) responsible for ensuring labeling of in-plant containers;
2. Designation of person(s) responsible for ensuring labeling of any shipped containers;

3. Description of labeling system(s) used;
4. Description of written alternatives to labeling of in-plant containers (if used); and
5. Procedures to review and update label information when necessary.

Employers that are purchasing and using hazardous chemicals—rather than producing or distributing them—will primarily be concerned with ensuring that every purchased container is labeled. If materials are transferred into other containers, the employer must ensure that these are labeled as well, unless they fall under the portable container exemption (WAC 296-62-05411(7)). In terms of labeling systems, you can simply choose to use the labels provided by your suppliers on the containers. These will generally be verbal text labels, and do not usually include numerical rating systems or symbols that require special training. The most important thing to remember is that this is a continuing duty—all in-plant containers of hazardous chemicals must always be labeled. Therefore, it is important to designate someone to be responsible for ensuring that the labels are maintained as required on the containers in your facility, and that newly purchased materials are checked for labels prior to use.

B. Material Safety Data Sheets.

Chemical manufacturers and importers are required to obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Distributors are responsible for ensuring that their customers are provided a copy of these MSDSs. Employers must have an MSDS for each hazardous chemical which they use. Employers may rely on the information received from their suppliers. The specific requirements for material safety data sheets are in WAC 296-62-05413.

There is no specified format for the MSDS under the rule, although there are specific information requirements. OSHA has developed a nonmandatory format, OSHA Form 174, which may be used by chemical manufacturers and importers to comply with the rule. The MSDS must be in English (although the employer may maintain copies in other languages as well). You are entitled to receive from your supplier a data sheet which includes all of the information required under the rule. If you do not receive one automatically, you should request one. If you receive one that is obviously inadequate, with, for example, blank spaces that are not completed, you should request an appropriately completed one. If your request for a data sheet or for a corrected data sheet does not produce the information needed, you should contact your local labor and industries field office for assistance in obtaining the MSDS as stated in WAC 296-62-05413(12).

The role of MSDSs under the rule is to provide detailed information on each hazardous chemical, including its potential hazardous effects, its physical and chemical characteristics, and recommendations for appropriate protective measures. This information should be useful to you as the employer responsible for designing protective programs, as well as to the workers. If you are not familiar with material safety data sheets and with chemical terminology, you may

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need to learn to use them yourself. A glossary of MSDS terms may be helpful in this regard. Generally speaking, most employers using hazardous chemicals will primarily be concerned with MSDS information regarding hazardous effects and recommended protective measures. Focus on the sections of the MSDS that are applicable to your situation.

Because many MSDSs are produced in states other than Washington, there may be a difference between the permissible exposure limit (PEL) listed on the MSDS and the WISHA required PEL. For this reason WISHA will accept the OSHA PEL on the MSDS, but for training and evaluation of employee exposure, within Washington state, the WISHA PEL must be used. Most of the OSHA and WISHA PELs will be identical, but at times some will be different. For example, in April 1994, the OSHA PEL for carbon monoxide was 50 ppm for an 8 hour time-weighted average (TWA) with no short-term exposure limit (STEL) or ceiling value, but the WISHA PEL for carbon monoxide was 35 ppm for an 8 hour TWA, with a ceiling value of 200 ppm and no STEL. The current WISHA PELs are listed in WAC 296-62-075, Air contaminants.

MSDSs must be readily accessible to employees when they are in their work fields during their workshifts. This may be accomplished in many different ways. You must decide what is appropriate for your particular workplace. Some employers keep the MSDSs in a binder in a central location (e.g., in the pickup truck on a construction site). Others, particularly in workplaces with large numbers of chemicals, computerize the information and provide access through terminals. As long as employees can get the information when they need it, any approach may be used. The employees must have access to the MSDSs themselves—simply having a system where the information can be read to them over the phone is only permitted under the mobile worksite provision, WAC 296-62-05413(9) when employees must travel between workplaces during the shift. In this situation, they have access to the MSDSs prior to leaving the primary worksite, and when they return, so the telephone system is simply an emergency arrangement.

In order to ensure that you have a current MSDS for each chemical in the plant as required, and that employee access is provided, the compliance officers will be looking for the following types of information in your written program:

1. Designation of person(s) responsible for obtaining and maintaining the MSDSs;
2. How such sheets are to be maintained in the workplace (e.g., in notebooks in the work area(s) or in a computer with terminal access), and how employees can obtain access to them when they are in their work area during the work shift;
3. Procedures to follow when the MSDS is not received at the time of the first shipment;
4. For producers, procedures to update the MSDS when new and significant health information is found; and
5. Description of alternatives to actual data sheets in the workplace, if used.

For employers using hazardous chemicals, the most important aspect of the written program in terms of MSDSs is

[Title 296 WAC—p. 1313]

to ensure that someone is responsible for obtaining and maintaining the MSDSs for every hazardous chemical in the workplace. The list of hazardous chemicals required to be maintained as part of the written program will serve as an inventory. As new chemicals are purchased, the list should be updated. Many companies have found it convenient to include on their purchase orders the name and address of the person designated in their company to receive MSDSs.

C. Employee Information and Training.

Each employee who may be "exposed" to hazardous chemicals when working must be provided information and trained prior to initial assignment to work with a hazardous chemical, and whenever the hazard changes. "Exposure" or "exposed" under the rule means that "an employee is subjected to a hazardous chemical in the course of employment through any route of entry (inhalation, ingestion, skin contact or absorption, etc.) and includes potential (e.g., accidental or possible) exposure." See WAC 296-62-05415 for specific requirements. Information and training may be done either by individual chemical, or by categories of hazards (such as flammability or carcinogenicity). If there are only a few chemicals in the workplace, then you may want to discuss each one individually. Where there are large numbers of chemicals, or the chemicals change frequently, you will probably want to train generally based on the hazard categories (e.g., flammable liquids, corrosive materials, carcinogens). Employees will have access to the substance-specific information on the labels and MSDSs.

Information and training is a critical part of the hazard communication program. Information regarding hazards and protective measures are provided to workers through written labels and material safety data sheets. However, through effective information and training, workers will learn to read and understand such information, determine how it can be obtained and used in their own workplaces, and understand the risks of exposure to the chemicals in their workplaces as well as the ways to protect themselves. A properly conducted training program will ensure comprehension and understanding. It is not sufficient to either just read material to the workers, or simply hand them material to read. You want to create a climate where workers feel free to ask questions. This will help you to ensure that the information is understood. You must always remember that the underlying purpose of the HCS is to reduce the incidence of chemical source illnesses and injuries. This will be accomplished by modifying behavior through the provision of hazard information and information about protective measures. If your program works, you and your workers will better understand the chemical hazards within the workplace. The procedures you establish regarding, for example, purchasing, storage, and handling of these chemicals will improve, and thereby reduce the risks posed to employees exposed to the chemical hazards involved. Furthermore, your workers' comprehension will also be increased, and proper work practices will be followed in your workplace.

If you are going to do the training yourself, you will have to understand the material and be prepared to motivate the workers to learn. This is not always an easy task, but the benefits are worth the effort. More information regarding appro-

priate training can be found in a booklet entitled "*Understanding Right to Know*," Publication Number P413-012-000. A copy may be obtained from your local labor and industries office.

In reviewing your written program with regard to information and training, the following items need to be considered:

1. Designation of person(s) responsible for conducting training;
2. Format of the program to be used (audiovisuals, classroom instruction, etc.);
3. Elements of the training program (should be consistent with the elements in WAC 296-62-05415; and
4. Procedure to train new employees at the time of their initial assignment to work with a hazardous chemical, and to train employees when a new hazard is introduced into the workplace.

The written program should provide enough details about the employer's plans in this area to assess whether or not a good faith effort is being made to train employees. WISHA does not expect that every worker will be able to recite all of the information about each chemical in the workplace. In general, the most important aspects of training under the HCS are to ensure that employees are aware that they are exposed to hazardous chemicals, that they know how to read and use labels and material safety data sheets, and that, as a consequence of learning this information, they are following the appropriate protective measures established by the employer. WISHA compliance officers will be talking to employees to determine if they have received training, if they know they are exposed to hazardous chemicals, and if they know where to obtain substance-specific information on labels and MSDSs.

The HCS does not require employers to maintain records of employee training, but many employers choose to do so. This may help you monitor your own program to ensure that all employees are appropriately trained. If you already have a training program, you may simply have to supplement it with whatever additional information is required under the HCS.

An employer can provide employees information and training through whatever means are found appropriate and protective. Although there would always have to be some training on-site (such as informing employees of the location and availability of the written program and MSDSs), employee training may be satisfied in part by general training about the requirements of the HCS and about chemical hazards on the job which is provided by, for example, trade associations, unions, colleges, and professional schools. In addition, previous training, education and experience of a worker may relieve the employer of some of the burdens of informing and training that worker. Regardless of the method relied upon, however, the employer is always ultimately responsible for ensuring that employees are adequately trained. If the compliance officer finds that the training is deficient, the employer will be cited for the deficiency regardless of who actually provided the training on behalf of the employer.

D. Other Requirements.

In addition to these specific items, compliance officers will also be asking the following questions in assessing the adequacy of the program:

Does a list of the hazardous chemicals exist in each work area or at a central location?

Are methods the employer will use to inform employees of the hazards of nonroutine tasks outlined?

Are employees informed of the hazards associated with chemicals contained in unlabeled pipes in their work areas?

On multi-employer worksites, has the employer provided other employers with information about labeling systems and precautionary measures where the other employers have employees exposed to the initial employer's chemicals?

Is the written program made available to employees and their designated representatives?

If your program adequately addresses the means of communicating information to employees in your workplace, and provides answers to the basic questions outlined above, it will be found to be in compliance with the rule.

5. Checklist for Compliance.

The following checklist will help to ensure you are in compliance with the rule:

- Obtained a copy of the rule.
- Read and understood the requirements.
- Assigned responsibility for tasks.
- Prepared an inventory of chemicals.
- Ensured containers are labeled.
- Obtained MSDS for each chemical.
- Prepared written program.
- Made MSDSs available to workers.
- Conducted training of workers.
- Established procedures to maintain current program.
- Established procedures to evaluate effectiveness.

6. Further Assistance.

If you have a question regarding compliance with the HCS, you should contact your local labor and industries field office for assistance. All field offices have industrial hygienists who can answer your questions. Free consultation services are also available to assist employers, and information regarding these services can be obtained through the field offices as well.

The telephone number for the labor and industries office closest to you should be listed in your local telephone directory. If you are not able to obtain this information, you may contact labor and industries, office of information and assistance, 1-800-4BE-SAFE for further assistance in identifying the appropriate contacts.

[Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-05429, filed 8/3/94, effective 9/12/94.]

PART D—CONTROLS AND DEFINITIONS

WAC 296-62-060 Control requirements in addition to those specified. (1) In those cases where no acceptable

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standards have been derived for the control of hazardous conditions, every reasonable precaution shall be taken to safeguard the health of the worker whether provided herein or not.

(2) Preservation of records.

(a) Scope and application. This section applies to each employer who makes, maintains or has access to employee exposure records or employee medical records.

(b) Definitions.

(i) "Employee exposure record" - a record of monitoring or measuring which contains qualitative or quantitative information indicative of employee exposure to toxic materials or harmful physical agents. This includes both individual exposure records and general research or statistical studies based on information collected from exposure records.

(ii) "Employee medical record" - a record which contains information concerning the health status of an employee or employees exposed or potentially exposed to toxic materials or harmful physical agents. These records may include, but are not limited to:

(A) The results of medical examinations and tests;

(B) Any opinions or recommendations of a physician or other health professional concerning the health of an employee or employees; and

(C) Any employee medical complaints relating to workplace exposure. Employee medical records include both individual medical records and general research or statistical studies based on information collected from medical records.

(c) Preservation of records. Each employer who makes, maintains, or has access to employee exposure records or employee medical records shall preserve these records.

(d) Availability of records. The employer shall make available, upon request, to the director, department of labor and industries, or his designee, all employee exposure records and employee medical records for examination and copying.

(e) Effective date. This standard shall become effective thirty days after filing with the code reviser.

(3) Monitoring of employees. The department shall use industrial hygiene sampling methods and techniques including but not limited to personal monitoring devices and equipment approved by the director or his designee for the purpose of establishing compliance with chapter 296-62 WAC.

(a) The employer shall permit the director or his designee to monitor and evaluate any workplace or employee in accordance with all provisions of this subsection.

(b) The employer shall not prevent or discourage an employee from cooperating with the department by restricting or inhibiting his/her participation in the use of personal monitoring devices and equipment in accordance with all provisions of this subsection.

[Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 80-11-010 (Order 80-14), § 296-62-060, filed 8/8/80; Order 73-3, § 296-62-060, filed 5/7/73; Order 70-8, § 296-62-060, filed 7/31/70, effective 9/1/70; Rule 6.010, effective 8/1/63.]

WAC 296-62-070 Chemical agents (airborne or contact).

[Order 70-8, § 296-62-070, filed 7/31/70, effective 9/1/70; Section VII, effective 8/1/63.]

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WAC 296-62-07001 Definitions (airborne chemical agents). (1) "Dust" means solid particles suspended in air, generated by handling, drilling, crushing, grinding, rapid impact, detonation, or decrepitation of organic or inorganic materials such as rock, ore, metal, coal, wood, grain, etc.

(2) "Fume" means solid particles suspended in air, generated by condensation from the gaseous state, generally after volatilization from molten metals, etc., and often accompanied by a chemical reaction such as oxidation.

(3) "Gas" means a normally formless fluid which can be changed to the liquid or solid state by the effect of increased pressure or decreased temperature or both.

(4) "Mist" means liquid droplets suspended in air, generated by condensation from the gaseous to the liquid state or by breaking up a liquid into a dispersed state, such as by splashing, foaming or atomizing.

(5) "Vapor" means the gaseous form of a substance which is normally in the solid or liquid state.

[Order 73-3, § 296-62-07001, filed 5/7/73.]

WAC 296-62-07003 Definitions (contact chemical agents). (1) "Corrosives" means substances which in contact with living tissue cause destruction of the tissue by chemical action.

(2) "Irritants" means substances which on immediate, prolonged, or repeated contact with normal living tissue will induce a local inflammatory reaction.

(3) "Toxicants" means substances which have the inherent capacity to produce personal injury or illness to man by absorption through any body surface.

[Order 73-3, § 296-62-07003, filed 5/7/73.]

WAC 296-62-07005 Control of chemical agents. Chemical agents shall be controlled in such a manner that they will not constitute a hazard to the worker, or workers shall be protected from the hazard of contact with or exposure to chemical agents.

[Order 73-3, § 296-62-07005, filed 5/7/73.]

PART E—RESPIRATORY PROTECTION

WAC 296-62-071 Respiratory protection. This section contains the requirements to be followed when establishing a respiratory protection program.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-071, filed 7/27/81.]

WAC 296-62-07101 Scope. This standard sets forth accepted practices when respiratory protection is used in controlling employee exposures to harmful air contaminants to comply with permissible exposure limits or to protect employees in oxygen-deficient atmospheres, or when respirators are utilized for emergency or rescue use.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-08-026 (Order 82-10), § 296-62-07101, filed 3/30/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07101, filed 7/27/81.]

WAC 296-62-07103 Purpose. The purpose of this standard is to provide minimum performance requirements for

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the selection and use of respirators and the implementation of a respirator program.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07103, filed 7/27/81.]

WAC 296-62-07105 Definitions. Abrasive-blasting respirator. See "respirator." A respirator designed to protect the wearer against inhalation of abrasive material and against impact and abrasion from rebounding abrasive material.

Accepted. Reviewed and listed as satisfactory for a specified use by the director or his or her designee.

Aerodynamic diameter. The diameter of a unit density sphere having the same settling velocity as the particle in question of whatever shape and density.

Aerosol. A system consisting of particles, solid or liquid, suspended in air.

Air-line respirator. See "respirator."

Air-purifying respirator. See "respirator."

Air-regulating valve. An adjustable valve used to regulate, but which cannot completely shut off the airflow to the facepiece, helmet, hood, or suit of an air-line respirator.

Air-supply device. A hand- or motor-operated blower for the hose mask, or a compressor or other source of respirable air for the air-line respirator.

Approved. Tested and listed as satisfactory by the Bureau of Mines (BM) of the U.S. Department of Interior, or jointly by the Mining Enforcement and Safety Administration (MESA) of the U.S. Department of Interior and the National Institute for Occupational Safety and Health (NIOSH) of the U.S. Department of Health and Human Services, or jointly by the Mine Safety and Health Administration (MSHA) of the U.S. Department of Labor and NIOSH under the provisions of Title 30, Code of Federal Regulations, Part 11.

Bioassay. A determination of the concentration of a substance in a human body by an analysis of urine, feces, blood, bone, or tissue.

Breathing tube. A tube through which air or oxygen flows to the facepiece, mouthpiece, helmet, hood, or suit.

Canister (air-purifying). A container with a filter, sorbent, or catalyst, or any combination thereof, which removes specific contaminants from the air drawn through it.

Canister (oxygen-generating). A container filled with a chemical which generates oxygen by chemical reaction.

Carcinogen. A substance known to produce cancer in some individuals following a latent period (for example: Asbestos, Chromates, radioactive particulates).

Cartridge (air-purifying). A small canister.

Catalyst. In respirator use, a substance which converts a toxic gas (or vapor) into a less-toxic gas (or vapor).

Ceiling concentration. The concentration of an airborne substance that shall not be exceeded.

Chemical-cartridge respirator. See respirator.

Contaminant. A harmful, irritating, or nuisance material that is foreign to the normal atmosphere.

Corrective lens. A lens ground to the wearer's individual corrective prescription to permit normal visual acuity.

Demand. A type of self-contained breathing apparatus or type of air-line respirator which functions due to the nega-

tive pressure created by inhalation (i.e., air flow into the facepiece on "demand").

Detachable coupling. A device which permits the respirator wearer, without using hand tools, to detach the air-supply line from that part of the respirator worn on the person.

Dust. See WAC 296-62-07001(1).

Emergency respirator use. Wearing a respirator when a hazardous atmosphere suddenly occurs that requires immediate use of a respirator either for escape from the hazardous atmosphere or for entry into the hazardous atmosphere.

Exhalation valve. A device that allows exhaled air to leave a respirator and prevents outside air from entering through the valve.

Eye-piece. A gas-tight, transparent window(s) in a full facepiece, helmet, hood, or suit, through which the wearer may see.

Facepiece. That portion of a respirator that covers the wearer's nose and mouth in quarter-mask (above the chin) or half-mask (under the chin) facepiece or that covers the nose, mouth, and eyes in a full facepiece. It is designed to make a gas-tight or particle-tight fit with the face and includes the headbands, exhalation valve(s), and connections for an air-purifying device or respirable gas source, or both.

Face shield. A device worn in front of the eyes and a portion of, or all of, the face, whose predominant function is protection of the eyes and the face.

Fibrosis-producing dust. Dust which, when inhaled, deposited, and retained in the lungs, may produce findings of fibrotic growth that may cause pulmonary disease.

Filter. A media component used in respirators to remove solid or liquid particles from the inspired air.

Filter respirator. See respirator.

Fog. A mist of sufficient concentration to perceptibly obscure vision.

Full facepiece. See facepiece.

Fume. See WAC 296-62-07001(2).

Gas. An aeriform fluid which is in the gaseous state at ordinary temperature and pressure.

Gas mask. See respirator.

Goggle. A device, with contour-shaped eyecups with glass or plastic lenses, worn over eyes and held in place by a headband or other suitable means for the protection of the eyes and eye sockets.

Half-mask facepiece. See facepiece.

Hazardous atmosphere. Any atmosphere, either immediately or not immediately dangerous to life or health, which is oxygen deficient or which contains a toxic or disease-producing contaminant.

Head harness. That part of a facepiece assembly which secures the facepiece to the wearer.

Helmet. That portion of a respirator which shields the eyes, face, neck, and other parts of the head.

High-efficiency filter. A filter which removes from air 99.97% or more of monodisperse dioctyl phthalate (DOP) particles having a mean particle diameter of 0.3 micrometer.

Hood. That portion of a respirator which completely covers the head, neck, and portions of the shoulders.

Hose mask. See respirator.

Immediately dangerous to life or health (IDLH). Any atmosphere that poses an immediate hazard to life or produces immediate irreversible debilitating effects on health.

Inhalation valve. A device that allows respirable air to enter a respirator and prevents exhaled air from leaving the respirator through the valve.

Irrespirable. Unfit for breathing.

Maximum use limit of filter, cartridge, or canister. The maximum concentration of a contaminant for which an air-purifying filter, cartridge, or canister is approved for use.

Mist. See WAC 296-62-07001(4).

Mouthpiece. That portion of a respirator which is held in the wearer's mouth and is connected to an air-purifying device or respirable gas source, or both. It is designed to make a gas-tight or particle-tight fit with the mouth.

MPCa. Maximum permissible airborne concentration. These concentrations are set by the National Committee on Radiation Protection. They are recommended maximum average concentrations of radionuclides to which a worker may be exposed, assuming that he/she works 8 hours a day, 5 days a week, and 50 weeks a year.

Negative pressure respirator. A respirator in which the air pressure inside the respiratory-inlet covering is positive during exhalation in relation to the air pressure of the outside atmosphere and negative during inhalation in relation to the air pressure of the outside atmosphere.

Nonroutine respirator use. Wearing a respirator when carrying out a special task that occurs infrequently.

Nose clamp. A device used with a respirator equipped with a mouthpiece that closes the nostrils of the wearer (sometimes called a nose clip).

Not immediately dangerous to life or health. Any hazardous atmosphere which may produce physical discomfort immediately, chronic poisoning after repeated exposure, or acute adverse physiological symptoms after prolonged exposure.

Odor threshold limit. The lowest concentration of a contaminant in air that can be detected by the olfactory sense.

Oxygen deficiency - immediately dangerous to life or health. An atmosphere which causes an oxygen partial pressure of 95 millimeters of mercury column or less or has less than 12.5% by volume in the freshly inspired air in the upper portion of the lungs which is saturated with water vapor.

Oxygen deficiency - not immediately dangerous to life or health. An atmosphere having an oxygen concentration below the minimum legal requirement of 19.5% by volume or has a partial pressure of oxygen of 148 millimeters of mercury for respirable air at sea-level conditions, but above that which is immediately dangerous to life or health.

Particulate matter. A suspension of fine solid or liquid particles in air, such as: Dust, fog, fume, mist, smoke, or spray. Particulate matter suspended in air is commonly known as an aerosol.

Permissible exposure limit (PEL). The legally established time-weighted average (TWA) concentration or ceiling concentration of a contaminant that shall not be exceeded.

Permit-required confined space. See chapter 296-62 WAC, Part M.

Pneumoconiosis-producing dust. Dust which, when inhaled, deposited, and retained in the lungs, may produce signs, symptoms, and findings of pulmonary disease.

Positive-pressure respirator. A respirator in which the air pressure inside the respiratory-inlet covering is positive in relation to the air pressure of the outside atmosphere during exhalation and inhalation.

Powered air-purifying respirator. See respirator.

Pressure demand. Similar to a demand type respirator but so designed to maintain positive pressure in the facepiece at all times.

Protection factor. The ratio of the ambient concentration of an airborne substance to the concentration of the substance inside the respirator at the breathing zone of the wearer. The protection factor is a measure of the degree of protection provided by a respirator to the wearer. As used herein, a protection factor is synonymous with the fit factor assigned to a respirator facepiece by the use of qualitative and quantitative fitting tests.

Rescue respirator use. Wearing a respirator for entry into a hazardous atmosphere to rescue a person(s) in the hazardous atmosphere.

Resistance. Opposition to the flow of air, as through a canister, cartridge, particulate filter, orifice, valve, or hose.

Respirable. Suitable for breathing.

Respirator. A device designed to protect the wearer from the inhalation of harmful atmospheres.

Respiratory-inlet covering. That portion of a respirator which connects the wearer's respiratory tract to an air-purifying device or respirable gas source, or both. It may be a facepiece, helmet, hood, suit, or mouthpiece/nose clamp.

Routine respirator use. Wearing a respirator as a normal procedure when carrying out a regular and frequently repeated task.

Sanitization. The removal of dirt and the inhibiting of the action of agents that cause infection or disease.

Self-contained breathing apparatus. See respirator.

Service life. The period of time that a respirator provides adequate protection to the wearer - for example, the period of time that an air-purifying device is effective for removing a harmful substance from inspired air.

Smoke. A system which includes the products of combustion, pyrolysis, or chemical reaction of substances in the form of visible and invisible solid and liquid particles and gaseous products in air. Smoke is usually of sufficient concentration to perceptibly obscure vision.

Sorbent. A material which is contained in cartridge or canister and which removes toxic gases and vapors from the inhaled air.

Spray. A liquid, mechanically produced particle with sizes generally in the visible or macroscopic range.

Supplied-air respirator. See respirator.

Supplied-air suit. A suit that is impermeable to most particulate and gaseous contaminants and that is provided with an adequate supply of respirable air.

Time-weighted average (TWA). The average concentration of a contaminant in air during a specific time period.

Valve (air or oxygen). A device which controls the pressure, direction, or rate of flow of air or oxygen.

Vapor. The gaseous state of a substance that is solid or liquid at ordinary temperature and pressure.

Welding helmet. A device designed to provide protection for the eyes and face against intense radiant energy and molten metal splatter encountered in the welding and cutting of metals.

Window indicator. A device on a cartridge or canister that visually denotes the service life of the cartridge or canister.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-07105, filed 1/18/95, effective 3/1/95; 94-15-096 (Order 94-07), § 296-62-07105, filed 7/20/94, effective 9/20/94; 93-19-142 (Order 93-04), § 296-62-07105, filed 9/22/93, effective 11/1/93; 91-24-017 (Order 91-07), § 296-62-07105, filed 11/22/91, effective 12/24/91. RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07105, filed 7/27/81.]

WAC 296-62-07107 Permissible practice. (1) In the control of those occupational diseases caused by breathing air contaminated with harmful dusts, fumes, sprays, mists, fogs, smokes, vapors, gases, or other airborne contaminants, the primary objective shall be to prevent atmospheric contamination. When effective administrative or engineering controls are not feasible, or while they are being instituted or evaluated, appropriate respirators shall be used pursuant to the following requirements.

(2) Employer responsibility.

(a) Respirators shall be provided at no cost to an employee by the employer and the employer shall ensure the use of such equipment when such equipment is necessary to protect the health of the employee.

(b) The employer shall provide respirators which are applicable and suitable for the purpose intended.

(c) The employer shall be responsible for the establishment and maintenance of a respiratory protection program which shall minimally include the general requirements outlined in WAC 296-62-07109.

(3) Employee responsibility. The employee shall use the provided respiratory protection in accordance with instructions and training received. The employee shall notify a responsible person of any defect.

[Statutory Authority: Chapters 49.17 RCW. 90-09-026 (Order 90-01), § 296-62-07107, filed 4/10/90, effective 5/25/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-07107, filed 1/15/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07107, filed 7/27/81.]

WAC 296-62-07109 Minimal acceptable respirator program. (1) Standard operating procedures. Written standard operating procedures covering a complete respirator program shall be established and implemented in conformance with subsections (2) through (15) of this section. The employer shall, upon request, submit a copy of the written standard operating procedures to the director.

(2) Program administration. Responsibility and authority for the respirator program shall be assigned to a single person. This program administrator shall have sufficient knowledge of respiratory protection to properly supervise the respirator program.

(3) Physiological and psychological limitations for respirator wearers. The respirator program administrator or his or her designee, using guidelines established by a physician, shall determine whether or not a person may be assigned to a

task requiring the use of a respirator. Persons with physical disabilities such as, but not limited to, respiratory impairments, or claustrophobia when wearing a respirator, shall not be assigned to tasks requiring the use of respirators unless it has been determined by a qualified physician that they are physically able to perform the work and use the equipment. All respirator user's medical status should be reviewed annually.

(4) Approved or accepted respirators shall be used. Any modification of an approved respirator that is not authorized by the approving agencies voids the approval.

(5) Respirator selection. Respirators shall be selected on the basis of the hazards to which the worker is exposed. (See WAC 296-62-07113)

(6) Training. Each worker required to wear a respirator shall be given training such that he or she is knowledgeable and proficient with respect to the respirator to be worn. Refresher training shall be given at least annually.

(7) Respirator fit. Each respirator wearer shall be fitted in accordance with WAC 296-62-07113. Each wearer of a respirator equipped with a facepiece shall check the seal of the respirator by appropriate means. This may be done by using procedures recommended by the respirator manufacturer.

(8) Facial hair, contact lenses, and eye and face protective devices. A negative pressure respirator, any self-contained breathing apparatus, or any respirator which is used in an atmosphere immediately dangerous to life or health (IDLH), equipped with a facepiece shall not be worn if facial hair comes between the sealing periphery of the facepiece and the face or if facial hair interferes with valve function. The wearer of a respirator shall not be allowed to wear contact lenses if the risk of eye damage is increased by their use. If a spectacle, goggle, face shield, or welding helmet must be worn with a facepiece, it shall be worn so as not to adversely affect the seal of the facepiece to the face. (See WAC 296-62-07115(3).)

(9) Issue of respirators. The proper type of respirator for each respiratory hazard shall be listed in the written standard operating procedures.

(10) Respirator inspection. The respirator shall be inspected by the wearer prior to each use to ensure that it is in proper working condition. Each respirator stored for emergency or rescue use shall be inspected at least once a month. (See WAC 296-62-07115 and 296-62-07117.)

(11) Monitoring respirator use. Supervisory personnel shall periodically monitor the use of respirators to ensure that they are worn properly. (See WAC 296-62-07115(7).)

(12) Evaluating respiratory hazard. Appropriate surveillance of work area conditions and degree of employee exposure or stress shall be maintained. (See WAC 296-62-07115(8).)

(13) Medical and bioassay surveillance. When appropriate, medical surveillance, including bioassay, shall be carried out to determine if respirator wearers are receiving adequate respiratory protection. A physician shall determine the requirements of the surveillance program.

(14) Respirator maintenance. Respirator maintenance shall be performed regularly. Maintenance shall be carried out on a schedule which ensures that each respirator wearer is provided with a respirator that is clean and in good operating

condition. Maintenance shall include: (a) Washing, sanitizing, rinsing, and drying, (b) inspection for defects, (c) replacement of worn or deteriorated parts, (d) repair if necessary, and (e) storage to protect against dust, sunlight, excessive heat, extreme cold, excessive moisture, damaging chemicals, and physical damage. (See WAC 296-62-07117.)

(15) Respirator program evaluation. An appraisal of the effectiveness of the respirator program shall be carried out at least annually. Action shall be taken to correct defects found in the program.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-13-045 (Order 82-22), § 296-62-07109, filed 6/11/82; 82-03-023 (Order 82-1), § 296-62-07109, filed 1/15/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07109, filed 7/27/81.]

WAC 296-62-07111 Respirable air and oxygen for self-contained breathing apparatus and supplied air respirators. Compressed gaseous air, compressed gaseous oxygen, liquid air, and liquid oxygen used for respiration shall be of high purity. Compressed gaseous or liquid oxygen shall meet the requirements of the United States Pharmacopeia for medical or breathing oxygen. Chemically generated oxygen shall meet the requirements of U.S. Department of Defense Military Specification MIL-E-83252 or Military Specification MIL-O-15633c. Compressed gaseous air shall meet at least the requirements of the specification for Type I - Grade D breathing air, and liquid air shall meet at least the requirements for Type II - Grade B breathing air as described in American National Standard Commodity Specification for Air, ANSI Z86.1-1973 (Compressed Gas Association Commodity Specification for Air, G-7.1, 1973).

(1) Compressed gaseous air may contain low concentrations of oil. If high-pressure oxygen passes through an oil- or grease-coated orifice, an explosion or fire may occur. Therefore, compressed gaseous oxygen shall not be used in supplied-air respirators or in open-circuit-type self-contained breathing apparatus that have previously used compressed air.

(2) Breathing air may be supplied to respirators from cylinders or air compressors. Cylinders shall be tested and maintained in accordance with applicable department of transportation specifications for shipping containers (Title 49, Code of Federal Regulations, Part 173, General Requirements for Shipments and Packagings, and Part 178, Shipping Container Specifications). A compressor shall be constructed and situated so as to avoid entry of contaminated air into the air-supply system and shall be equipped with a suitable in-line particulate filter followed by a bed of activated charcoal and, if necessary, a moisture adsorber to further assure breathing air quality. These filters should be placed before any receiver and after the discharge in the compressor. If an oil-lubricated compressor is used, it shall be equipped with a carbon monoxide alarm or an equally as effective alternative if approved by the department.

(a) If a carbon monoxide alarm is used, it shall be calibrated to activate at or below 20 parts per million carbon monoxide at least once per month. A calibration and maintenance log shall be kept and shall be available for review and copying by the director or his or her designee. The log shall identify the test method, date, time of test, results, and the

name of the person performing the test. The log shall be retained for at least one year from the date of the test.

(b) If the use of an alarm at the compressor will not effectively provide warning to the respirator wearer of a carbon monoxide problem, a remote alarm or other means of warning the wearer shall be used.

(3) Breathing air couplings shall be incompatible with outlets for nonrespirable plant air or other gas systems to prevent inadvertent servicing of air-line respirators with nonrespirable gases.

(4) Breathing gas containers shall be marked in accordance with American National Standard Method of Marking Portable Compressed Gas Containers to Identify the Material Contained, ANSI Z48.1-1954 (R1971); Federal Specification BB-A-1034a, June 21, 1968, Air, Compressed for Breathing Purposes; or Interim Federal Specification GG-B-675d, September 23, 1976, Breathing Apparatus, Self-Contained. Further details on sources of compressed air and its safe use will be found in Compressed Gas Association Pamphlet G-7, 1976, Compressed Air for Human Respiration.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07111, filed 7/27/81.]

WAC 296-62-07113 Selection of respirators. (1) General considerations. Proper selection of respirators shall be made in accordance with the classification, capabilities, and limitations listed in tables I through IV of this section. Additional guidance may be obtained by referring to American National Standard Practices for Respiratory Protection Z88.2 - 1980.

(2) Respirator protection factor (PF). Respirators shall be selected according to the characteristics of the hazards involved, the capabilities and limitations of the respirators, and the ability of each respirator wearer to obtain a satisfactory fit with a respirator. Taking into account the capabilities and limitations of respirators and the results of respirator-fitting tests, a table of respirator protection factors has been prepared (see Table V). A respirator protection factor is a measure of the degree of protection provided by a respirator to a wearer. Multiplying either (a) the permissible time-weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance, or (b) the maximum permissible airborne concentration for a radionuclide by a protection factor assigned to a respirator gives the maximum concentration of the hazardous substance in which the respirator can be used. Limitations of filters, cartridges, and canisters also shall be considered (see Table V).

(3) Respirator-fitting tests. A qualitative or quantitative respirator-fitting test shall be used to determine the ability of each individual respirator wearer to obtain a satisfactory fit with a negative-pressure respirator. The results of qualitative or quantitative respirator fitting-tests shall be used to select specific types, makes, and models of negative-pressure respirators for use by individual respirator wearers. A respirator-fitting test shall be carried out for each wearer of a negative-pressure respirator equipped with a facepiece. Respirator-fitting tests shall not be required for positive-pressure respirators or for mouthpiece respirators.

(a) Qualitative respirator-fitting test - A person wearing a respirator is exposed to an irritant smoke, an odorous vapor,

or other suitable test agent. An air-purifying respirator must be equipped with an air-purifying element(s) which effectively removes the test agent from inspired air. If the respirator wearer is unable to detect penetration of the test agent into the respirator, the respirator wearer has achieved a satisfactory fit with the respirator.

(b) Quantitative respirator-fitting test - A person wears a respirator in a test atmosphere containing a test agent in the form of an aerosol, vapor, or gas. Instrumentation, which samples the test atmosphere and the air inside the respiratory-inlet covering of the respirator, is used to measure quantitatively the penetration of the test agent into the respiratory-inlet covering.

(c) When carrying out a qualitative or quantitative respirator-fitting test, the respirator wearer shall carry out a series of exercises which simulate work movements.

(d) When carrying out respirator-fitting tests, it shall be an acceptable procedure to make the following modifications to respirators provided that such modifications do not affect the seal of the respirators to wearers.

(i) When carrying out a qualitative or quantitative respirator-fitting test which uses an aerosol as the test agent, it shall be acceptable procedure to equip an air-purifying respirator with a high-efficiency filter.

(ii) When carrying out a qualitative or quantitative respirator-fitting test which uses a vapor or gas as the test agent, it shall be acceptable procedure to equip an air-purifying respirator with an appropriate cartridge or canister which removes the vapor or gas from air.

(iii) When carrying out a quantitative respirator-fitting test, it shall be acceptable procedure to attach a sampling probe to the respirator which is connected by flexible tubing to an instrument which measures the penetration of the test agent into the respirator.

(e) If a qualitative respirator-fitting test has been used in respirator selection, a person shall be allowed to use only the specific make(s) and model(s) of respirator(s) for which the person obtained a satisfactory fit, and the respirator protection factor listed under "qualitative test" in Table V shall apply. Under no circumstances shall a person be allowed to use any respirator for which the results of the qualitative respirator fitting test indicate that the person is unable to obtain a satisfactory fit.

(f) If a quantitative respirator-fitting test has been used in selecting a respirator, the test results shall be used to assign a respirator protection factor to each person for each specific make and model of respirator tested. The assigned respirator protection factor shall be applied when the person wears the specific respirator in a hazardous atmosphere, but it shall not exceed the respirator protection factor listed under "quantitative test" in table V for the particular type of respirator.

(4) Respirator-fitting test records. Records of respirator-fitting tests shall be kept for at least the duration of employment. These records shall include the following information:

- (a) Type of respirator-fitting test used;
- (b) Specific make and model of respirator tested;
- (c) Name of person tested;
- (d) Name of test operator;
- (e) Date of test;
- (f) Results of respirator-fitting tests;

(i) Success or failure of person to obtain satisfactory fit if a qualitative respirator-fitting test was carried out.

(ii) Respirator protection factor based upon test results if a quantitative respirator-fitting test was carried out.

(5) Face dimensions and facepiece sizes. The wide range of face dimensions may require more than a single size of res-

pirator facepiece to provide a proper fit to all respirator users. Therefore, respirator facepieces of more than one size should be available in any respirator-selection program involving respirators equipped with facepieces.

Table 1
Classification of Respiratory Hazards According to Their Biological Effect

Oxygen Deficiency	Gas and Vapor Contaminants	Particulate Contaminants (Dust, fog, fume, mist, smoke, and spray)
Minimum legal requirements: 19.5% by volume for respirable air at-sea-level conditions. (See Note 1.)	Asphyxiants: Interfere with utilization of oxygen in the body.	Relatively inert: May cause discomfort and minor irritation, but generally without injury at reasonable concentrations (for example: marble, gypsum).
Occurrence: Confined or unventilated cellars, wells, mines, ship holds, tanks, burning buildings, and enclosures containing inert atmospheres.	Simple asphyxiants: Physiologically inert substances that dilute oxygen in the air (for example: nitrogen, hydrogen, helium, methane). See Oxygen Deficiency, Column 1.	Pulmonary-fibrosis-producing: produce nodulation and fibrosis in the lung, possibly leading to complications (for example: quartz, asbestos).
Atmospheric oxygen content (percent by volume) versus expected conditions:	Chemical asphyxiants: Low concentrations interfere with supply or utilization of oxygen in the body (for example: carbon monoxide, hydrogen cyanide, cyanogen, and nitriles).	Carcinogens: Produce cancer in some individuals after latent period (for example: asbestos, chromates, radioactive particulates).
20.9%: Oxygen content of normal air at sea-level conditions.		Chemical irritants: Produce irritation, inflammation, and ulceration in the upper respiratory tract (for example: acidic mists, alkalies).
Oxygen Volume Percent at Sea Level		Systemic poisons: Produce pathologic reactions in various systems of the body (for example: lead, manganese, cadmium).
Physiological Effects	Irritants: Corrosive in action. May cause irritation and inflammation of parts of the respiratory system (also skin and eyes) and pulmonary edema (for example: ammonia hydrogen chloride, formaldehyde, sulfur dioxide, chlorine, ozone, nitrogen dioxide, phosgene, and arsenic trichloride).	Allergy-producing: Produce reactions such as itching, sneezing, and asthmas (for example: pollens, spices, and animal fur).
16%-12%		
Loss of peripheral vision, increased breathing volume, accelerated heartbeat, impaired attention and thinking, impaired coordination.		
12%-10%	Anesthetics: Causes loss of feeling and sensation with unconsciousness and death possible (for example: nitrous oxide, hydro-carbons and ethers). Some anesthetics injure body organs (for example: carbon tetrachloride (liver and kidneys), chloroform (liver and heart), benzene (bone marrow), and carbon disulfide (nervous system)).	Febrile-reaction-producing: Produce chills followed by fever (for example: fumes of zinc and copper).
Very faulty judgment, very poor muscular coordination, muscular exertion causes fatigue that may cause permanent heart damage, intermittent respiration		
10%-6%		
Nausea, vomiting, inability to perform vigorous movement, unconsciousness followed by death.		
Less than 6%	Sensitizers: Cause increased probability of physiological reactions (for example: isocyanates, epoxy resin systems).	
Spasmodic breathing, convulsive movements, death in minutes.	Systemic poisons: Damage organs and systems in the body (for example: mercury (nervous system and various organs), phosphorus (bone), hydrogen sulfide (respiratory paralysis), and arsine (red blood cells and liver)).	
	Carcinogens: produce cancer in some individuals after a latent period (for example: vinyl chloride, benzene).	

Combination of Gas, Vapor, and Particulate Contaminants

Combinations of contaminants may occur simultaneously in the atmosphere. Contaminants may be entirely different substances (dusts and gases from blasting) or the particulate and vapor forms of the same substance. Synergistic effects (joint action of two or more agents that results in an effect which is greater than the sum of their individual effects) may occur. Such effects may require extraordinary protective measures.

NOTE 1: See definition in WAC 296-62-07105 for "oxygen deficiency - not immediately dangerous to life or health" and "oxygen deficiency - immediately dangerous to life or health."

Table 2
Classification of Respiratory Hazards According to
Their Properties Which Influence Respirator Selection

Gas and Vapor Contaminants	Particulate Contaminants
<p>Inert: Substances that do not react with other substances under most conditions, but create a respiratory hazard by displacing air and producing oxygen deficiency (for example: helium, neon, argon).</p> <p>Acidic: Substances that are acids or that react with water to produce an acid. In water, they produce positively charged hydrogen ions (H⁺) and a pH of less than 7. They taste sour, and many are corrosive to tissues (for example: hydrogen chloride, sulfur dioxide, fluorine, nitrogen dioxide, acetic acid, carbon dioxide, hydrogen sulfide, and hydrogen cyanide).</p> <p>Alkaline: Substances that are alkalis or that react with water to produce an alkali. In water, they result in the production of negatively charged hydroxyl ions (OH⁻) and a pH greater than 7. They taste bitter, and many are corrosive to tissues (for example: ammonia, amines, phosphine, arsine, and stibine).</p> <p>Organic: The components of carbon. Examples are saturated hydrocarbons (methane, ethane, butane) unsaturated hydrocarbons (ethylene, acetylene) alcohols (methyl ether, ethyl ether) aldehydes (formaldehyde), ketones (methyl ketone), organic acids (formic acid, acetic acid), halides (chloroform, carbon tetrachloride), amides (formamide, acetamide), nitriles (acetonitrile), isocyanates (toluene diisocyanate), amines (methylamine), epoxies (epoxyethane, propylene oxide), and aromatics (benzene, toluene, xylene).</p> <p>Organometallic: Compounds in which metals are chemically bonded to organic groups (for example: ethyl silicate, tetraethyl lead, and organic phosphate).</p> <p>Hydrides: Compounds in which hydrogen is chemically bonded to metals and certain other elements (for example: diborane and tetraborane).</p>	<p>Particles are produced by mechanical means by disintegration processes such as grinding, crushing, blasting, and spraying; or by physio-chemical reactions such as combustion, vaporization, distillation, sublimation, calcination, and condensation. Particles are classified as follows:</p> <p>Dust: A solid, mechanically produced particle with sizes varying from submicroscopic to visible or macroscopic. Spray: A liquid, mechanically produced particle with sizes generally in the visible or macroscopic range.</p> <p>Fume: A solid condensation particle of extremely small particle size, generally less than one micrometer in diameter.</p> <p>Mist: A liquid condensation particle with sizes ranging from submicroscopic to visible or macroscopic.</p> <p>Fog: A mist of sufficient concentration to perceptibly obscure vision.</p> <p>Smoke: A system which includes the products of combustion, pyrolysis, or chemical reaction of substances in the form of visible and invisible solid and liquid particles and gaseous products in air. Smoke is usually of sufficient concentration to perceptibly obscure vision.</p>

Table 3
Classification and Description of Respirators by Mode of Operation

Atmosphere-Supplying Respirators	Air-Purifying
<p>A respirable atmosphere independent of the ambient air is supplied to the wearer.</p> <p>Self-Contained Breathing Apparatus (SCBA) A supply of air, oxygen, or oxygen-generated material is carried by the wearer. Normally equipped with full facepiece, but may be equipped with a quarter-mask facepiece, half-mask facepiece, helmet, hood or mouthpiece and nose clamp.</p> <p>Supplied-Air Respirators (1) Hose Mask Equipped with a facepiece, breathing tube, rugged safety harness, and large-diameter heavy-duty non-kinking air-supply hose. The breathing tube and air-supply hose are securely attached to the harness. The facepiece is equipped with an exhalation valve. The harness has provision for attaching a safety line.</p>	<p>Ambient air, prior to being inhaled, is passed through a filter, cartridge, or canister which removes particles, vapors, gases, or a combination of these contaminants. The breathing action of the wearer operates the nonpowered type of respirator. The powered type contains a blower-stationary or carried by the wearer - which passes ambient air through an air-purifying component and then supplies purified air to the respirator-inlet covering. The nonpowered type is equipped with a facepiece or mouth-piece and nose clamp. The powered type is equipped with a facepiece, helmet, hood, or suit.</p> <p>Vapor-and-Gas-Removing Respirators Equipped with cartridge(s) or canister(s) remove a single vapor or gas (for example: chlorine gas), a single class of vapors or gases (for example: organic vapors), or a combination of two or more classes of vapors or gases (for example: organic vapors and acidic gases) from air.</p> <p>Particulate-Removing Respirators Equipped with filter(s) to remove a single type of particulate matter (for example: dust) or a combination of two or more types of particulate matter (for example: dust and fume) from air. Filter may be a replaceable part or a permanent part of the respirator. Filter may be of the single-use or the reusable type.</p>

Atmosphere-Supplying Respirators

Air-Purifying

(1) Closed-Circuit SCBA

(oxygen only, negative pressure^a or positive pressure^b).

(a) Compressed liquid oxygen type. Equipped with a facepiece or mouth-piece and nose clamp. High-pressure oxygen from a gas cylinder passes through a high-pressure reducing valve, and in some designs, through a low-pressure admission valve to a breathing bag or container. Liquid oxygen is converted to low-pressure gaseous oxygen and delivered to the breathing bag. The wearer inhales from the bag through a corrugated tube connected to a mouthpiece or facepiece and a one-way check valve. Exhaled air passes through another check valve and tube into a container of carbon-dioxide removing chemical and reenters the breathing bag. Make-up oxygen enters the bag continuously or as the bag deflates sufficiently to actuate an admission valve. A pressure-relief system is provided, and a manual bypass and saliva trap may be provided depending upon the design.

(b) Oxygen-generating type. Equipped with a facepiece or mouth-piece and nose clamp. Water vapor in the exhaled breath reacts with chemical in the canister to release oxygen to the breathing bag. The wearer inhales from the bag through a corrugated tube and one-way check valve at the facepiece.

Exhaled air passes through a second check valve/breathing tube assembly into the canister. The oxygen-release rate is governed by the volume of exhaled air. Carbon dioxide in the exhaled breath is removed by the canister fill.

(2) Open-Circuit (SCBA) (compressed air, compressed oxygen, liquid air, liquid oxygen). A bypass system is provided in case of regulator failure except on escape-type units.

(a) Demand-type.^c Equipped with a facepiece or mouthpiece and nose clamp. The demand valve permits oxygen or air flow only during inhalation. Exhaled breath passes to ambient atmosphere through a valve(s) in the facepiece.

(a) Hose mask with blower. Air is supplied by a motor-driven or hand-operated blower. The wearer can continue to inhale through the hose if the blower fails. Up to 300 feet (91 meters) of hose length is permissible.

(b) Hose mask without blower. The wearer provides motivating force to pull air through the hose. The hose inlet is anchored and fitted with a funnel or like object covered with a fine mesh screen to prevent entrance of coarse particulate matter. Up to 75 feet (23 meters) of hose length is permissible.

(2) Air-Line Respirator Respirable air is supplied through a small-diameter hose from a compressor or compressed-air cylinder(s). The hose is attached to the wearer by a belt or other suitable means and can be detached rapidly in an emergency. A flow-control valve or orifice is provided to govern the rate of air flow to the wearer. Exhaled air passes to the ambient atmosphere through a valve(s) or opening(s) in the enclosure (facepiece, helmet, hood, or suit). Up to 300 feet (91 meters) of hose length is permissible.

(a) Continuous-flow class. Equipped with a facepiece, hood, helmet, or suit. At least 115 liters (four cubic feet) of air per minute to tight-fitting facepieces and 170 liters (six cubic feet) of air per minute to loose fitting helmets, hoods and suits is required. Air is supplied to a suit through a system of internal tubes to the head, trunk and extremities through valves located in appropriate parts of the suit.

(b) Demand type.^c Equipped with a facepiece only. The demand valve permits flow of air only during inhalation.

Combination Particulate-and Vapor-and Gas-Removing Respirators Equipped with cartridge(s) or canister(s) to remove particulate matter, vapors and gases from air. The filter may be a permanent part or a replaceable part of a cartridge or canister.

Atmosphere-Supplying Respirators	Air-Purifying
<p>(b) Pressure-demand type.^d Equipped with a facepiece only. Positive pressure is maintained in the facepiece. The apparatus may have provision for the wearer to select the demand or pressure-demand mode of operation, in which case the demand mode should be used only when donning or removing the apparatus.</p> <p>Combination Air-Line Respirators with Auxiliary Self-Contained Air Supply Includes an air-line respirator with an auxiliary self-contained air supply. To escape from a hazardous atmosphere in the event the primary air supply falls to operate, the wearer switches to the auxiliary self-contained air supply. Devices approved for both entry into and escape from dangerous atmospheres have a low-pressure warning alarm and contain at least a 15-minute self-contained air supply.</p>	<p>(c) Pressure-demand type.^d Equipped with a facepiece only. A positive pressure is maintained in the facepiece.</p> <p>Combination Atmosphere-Supplying and Air-Purifying Respirators Provide the wearer with the option of using either of two different modes of operation: (1) an atmosphere-supplying respirator with an auxiliary air-purifying attachment which provides protection in the event the air supply fails or (2) an air-purifying respirator with an auxiliary self-contained air supply which is used when the atmosphere may exceed safe conditions for use of an air-purifying respirator.</p>
<p>a</p>	<p>Device produces negative pressure in respiratory-inlet covering during inhalation.</p>
<p>b</p>	<p>Device produces positive pressure in respiratory-inlet covering during both inhalation and exhalation.</p>
<p>c</p>	<p>Equipped with a demand valve that is activated on initiation of inhalation and permits the flow of breathing atmosphere to the facepiece. On exhalation, pressure in the facepiece becomes positive and the demand valve is deactivated.</p>
<p>d</p>	<p>A positive pressure is maintained in the facepiece by a spring-loaded or balanced regulator and exhalation valve.</p>

**Table 4
Capabilities and Limitations of Respirators**

Atmosphere-Supplying Respirators	Air-Purifying Respirators
<p>(See WAC 296-62-07111 for specifications on respirable atmospheres.)</p> <p>Atmosphere-supplying respirators provide protection against oxygen deficiency and toxic atmospheres. The breathing atmosphere is independent of ambient atmospheric conditions.</p> <p>General limitations: Except for some air-line suits, no protection is provided against skin irritation by materials such as ammonia and hydrogen chloride, or against sorption of materials such as hydrogen cyanide, tritium, or organic phosphate pesticides through the skin. Facepieces present special problems to individuals required to wear prescription lenses. Use of atmosphere-supplying respirators in atmospheres immediately dangerous to life or health is limited to specific devices under specified conditions (see Table 5.)</p>	<p>General limitations: Air-purifying respirators do not protect against oxygen-deficient atmospheres nor against skin irritation by, or sorption through the skin of airborne contaminants.</p> <p>The maximum contaminant concentration against which an air-purifying respirator will protect is determined by the design efficiency and capacity of the cartridge, canister, or filter and the facepiece-to-face seal on the user. For gases and vapors, the maximum concentration for which the air-purifying element is designed is specified by the manufacturer or is listed on labels of cartridges and canisters.</p>

Atmosphere-Supplying Respirators

Air-Purifying Respirators

Self-Contained Breathing Apparatus (SCBA)

The wearer carries his own breathing atmosphere.

Limitations: The period over which the device will provide protection is limited by the amount of air or oxygen in the apparatus, the ambient atmospheric pressure (service life of open-circuit devices is cut in half by a doubling of the atmospheric pressure), and the type of work being performed. Some SCBA devices have a short service life (less than 15 minutes) and are suitable only for escape (self-rescue) from an irreparable atmosphere.

Chief limitations of SCBA devices are their weight or bulk, or both, limited service life, and the training requirements for their maintenance and safe use.

(1) Closed-Circuit SCBA The closed-circuit operation conserves oxygen and permits longer service life at reduced weight.

The negative-pressure type produces a negative pressure in the respiratory-inlet covering during inhalation, and this may permit inward leakage of contaminants; whereas the positive-pressure type always maintains a positive pressure in the respiratory-inlet covering and is less apt to permit inward leakage of contaminants.

(2) Open Circuit SCBA.

The demand type produces a negative pressure in the respiratory-inlet covering during inhalation, whereas the pressure-demand type maintains a positive pressure in the respiratory-inlet covering during inhalation and is less apt to permit inward leakage of contaminants.

Supplied-Air Respirators

The respirable air supply is not limited to the quantity the individual can carry, and the devices are lightweight and simple.

Limitations: Limited to use in atmospheres from which the wearer can escape unharmed without the aid of the respirator.

The wearer is restricted in movement by the hose and must return to a respirable atmosphere by retracing his route of entry. The hose is subject to being served or pinched off.

(1) Hose Mask.

The hose inlet or blower must be located and secured in a respirable atmosphere.

(a) Hose mask with blower. If the blower fails, the unit still provides protection, although a negative pressure exists in the facepiece during inhalation.

(b) Hose mask without blower. Maximum hose length may restrict application of device.

(2) Air-Line Respirator (Continuous Flow, Demand and Pressure-Demand Types).

The demand type produces a negative pressure in the facepiece on inhalation, whereas continuous-flow and pressure-demand types maintain a positive-pressure in the respirator-inlet covering and are less apt to permit inward leakage of contaminants.

Air-line suits may protect against atmospheres that irritate the skin or that may be absorbed through the unbroken skin.

Limitations: Air-line respirators provide no protection if the air supply fails. Some contaminants, such as tritium, may penetrate the material of an air-line suit and limit its effectiveness.

Other contaminants, such as fluorine, may react chemically with the material of an air-line suit and damage it.

Nonpowered air-purifying respirators will not provide the maximum design protection specified unless the facepiece or mouthpiece/nose clamp is carefully fitted to the wearer's face to prevent inward leakage (WAC 296-62-07115(4)). The time period over which protection is provided is dependent on canister, cartridge, or filter type; concentration of contaminant; humidity levels in the ambient atmosphere; and the wearer's respiratory rate.

The proper type of canister, cartridge, or filter must be selected for the particular atmosphere and conditions. Nonpowered air-purifying respirators may cause discomfort due to a noticeable resistance to inhalation. This problem is minimized in powered respirators. Respirator facepieces present special problems to individuals required to wear prescription lenses. These devices do have the advantage of being small, light, and simple in operation.

Use of air-purifying respirators in atmospheres immediately dangerous to life or health is limited to specific devices under specified conditions (See Table 5).

Vapor and Gas-Removing Respirators

Limitations: No protection is provided against particulate contaminants. A rise in canister or cartridge temperature indicates that a gas or vapor is being removed from the inspired air.

An uncomfortably high temperature indicates a high concentration of gas or vapor and requires an immediate return to fresh air.

Use should be avoided in atmospheres where the contaminant(s) lack sufficient warning properties (that is: odor, taste, or irritation at a concentration in air at or above the permissible exposure limit). Vapor- and gas-removing respirators are not approved for contaminants that lack adequate warning properties.

Not for use in atmospheres immediately dangerous to life or health unless the device is a powered-type respirator with escape provisions (see Table 5).

(1) Full Facepiece Respirator.

Provides protection against eye irritation in addition to respiratory protection.

(2) Quarter-Mask and Half-Mask Face-piece Respirator. A fabric covering (facelet) available from some manufacturers shall not be used.

(3) Mouthpiece Respirator. Shall be used only for escape application. Mouth breathing prevents detection of contaminant by odor. ¹Nose clamp must be securely in place to prevent nasal breathing.

Particulate-Removing Respirators

Limitations: Protection against non-volatile particles only. No protection against gases and vapors. Not for use in atmospheres immediately dangerous to life or health unless the device is a powered-type respirator with escape provisions (see Table 5).

(1) Full Facepiece Respirator.

Provides protection against eye irritation in addition to respiratory protection.

(2) Quarter-Mask and Half-Mask Facepiece Respirator. A fabric covering (facelet) available from some manufacturers shall not be used unless approved for use with respirator.

(3) Mouthpiece Respirator.

Shall be used only for escape applications. Mouth breathing prevents detection of contaminant by odor. Nose clamp must be securely in place to prevent nasal breathing.

A small, lightweight device that can be donned quickly.

Combination Airline Respirators with Auxiliary SCBA Air Supply

Atmosphere-Supplying Respirators

Air-Purifying Respirators

The auxiliary self-contained air supply on this type of device allows the wearer to escape from a dangerous atmosphere. This device with auxiliary self-contained air supply is approved for escape and may be used for entry when it contains at least 15-minute auxiliary self-contained air supply. (See Table 5).

A small lightweight device that can be donned quickly.

Combination Particulate-and-Vapor-and Gas-Removing Respirators

The advantages and disadvantages of the component sections of the combination respirator as described above apply.

Combination Atmosphere-Supplying and Air-Purifying Respirators

The advantages and disadvantages, expressed above, of the mode of operation being used will govern. The mode with the greater limitations (air-purifying mode) will mainly determine the overall capabilities and limitations of the respirator, since the wearer may for some reason fail to change the mode of operation even though conditions would require such a change.

**Table 5
Respirator Protection Factors^a**

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to Life-or-Health Atmosphere ^f	Qualitative Test	Quantitative Test
Particulate-filter quarter-mask or half-mask facepiece ^{b,c}	No	No	10	As measured on each person with maximum of 100.
Vapor- or gas-removing, quarter-mask or half-mask facepiece ^c	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, which-ever is less	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas ^{i,j} , whichever is less.
Combination particulate-filter and vapor-or gas-removing, quarter-mask or half-mask facepiece ^{b,c}	No	No	10, or maximum use limit of cartridge or canister for vapor or gas, which-ever is less	As measured on each person with maximum of 100, or maximum use limit of cartridge or canister for vapor or gas ^{i,j} , whichever is less.
Particulate-filter, full facepiece ^b	No	No	100	As measured on each person with maximum of 100 if dust, fume, or mist filter is used or maximum of 1,000 if high-efficiency filter is used.
Vapor- or gas-removing, full face-piece	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, which-ever is less	As measured on each person with maximum of 1000, or maximum use limit of cartridge or canister for vapor or gas ^{i,j} , whichever is less.
Combination particulate-filter and vapor-or gas-removing, full face-piece ^b	No	No	100, or maximum use limit of cartridge or canister for vapor or gas, which-ever is less	As measured on each person with maximum of 100 if dust, fume, or mist filter is used and maximum of 1,000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor or gas ^{i,j} , which-ever is less.
Powered particulate-filter, any respiratory-inlet covering ^{b,c,d}	No	No (yes, if escape provisions are provided ^d)	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3,000 if high-efficiency filter is used.	NA

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to-Life-or-Health Atmosphere ^f	Qualitative Test	Quantitative Test
Powered vapor- or gas-removing, any respiratory-inlet covering ^{c,d}	No	No (yes, if escape provisions are provided ^d)	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 3,000 or maximum use limit of cartridge or canister for vapor of gas ^{ij} , whichever is less.	NA
Powered combination particulate-filter and vapor-or gas-removing, any respirator-inlet covering ^{b,c,d}	No	No (yes, if escape provisions are provided ^d)	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 100 if dust, fume, or mist filter is used and 3,000 if high-efficiency filter is used, or maximum use limit of cartridge or canister for vapor of gas ^{ij} , whichever is less.	NA
Air-line, demand, quarter-mask or half-mask facepiece, with or without escape provisions ^{c,e}	Yes ^f	No	10	As measured on each person, but limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Air-line, demand, full face-piece, with or without escape provisions ^e	Yes ^f	No	100	As measured on each person but limited to the use of the respirators in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.
Air-line, continuous-flow or pressure-demand type, any facepiece without escape provisions ^e	Yes ^f	No	NA No tests are required due to positive-pressure operation of respirator. The protection factor provided by the respirator is limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.	NA
Air-line, continuous-flow or pressure-demand type, any facepiece with escape provisions ^{c,e}	Yes ^g	Yes	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus.	NA
Air-line, continuous flow, helmet, hood, or suit, without escape provisions	Yes ^f	No	NA No tests are required due to positive-pressure operation of respirator. The protection factor provided by the respirator is limited to the use of the respirator in concentrations of contaminants below the immediately-dangerous-to-life-or-health (IDLH) values.	NA
Air-line, continuous flow, helmet, hood, or suit, with escape provisions ^e	Yes ^g	No	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus.	NA
Hose mask, with or without blower, full facepiece	Yes ^f	No	10	As measured on each person, but limited to the use of the respirators in concentrations of contaminants below the immediately-dangerous-to-life-or health (IDLH) values.
Self-contained breathing apparatus, demand-type open-circuit, or negative-pressure-type closed-circuit quarter-mask or half-mask facepiece ^c	Yes ^f	No	10	As measured on each person, but limited to the use of the respirators in concentrations of contaminants below the immediately-dangerous-to-life-or health (IDLH) values.

Type of Respirator	Permitted for Use in Oxygen-Deficient Atmosphere	Permitted for Use in Immediately-Dangerous-to-Life-or-Health Atmosphere ^f	Qualitative Test	Quantitative Test
Self-contained breathing apparatus, demand-type open-circuit, or negative-pressure-type closed-circuit, full facepiece or mouth-piece/nose clamp ^c	Yes ^f (Yes ^g , if respirator is used for mine rescue and mine recovery operations.)	No (Yes if respirator is used for mine rescue and mine recovery operations.)	100	As measured on each person, but limited to the use of the respirators in concentrations of contaminants below the immediately-dangerous-to-life-or health (IDLH) values, except when the respirator is used for mine rescue and mine recovery operations.
Self-contained breathing apparatus, pressure-demand type open-circuit, or positive-pressure-type closed-circuit quarter-mask or half-mask facepiece or mouth-piece/nose clamp ^c	Yes ^g	Yes	NA No tests are required due to positive-pressure operation of respirator. The maximum protection factor is 10,000 plus ^h .	NA

Combination respirators. The type and mode of operation having the lowest respirator protection factor shall be applied to the Combination Respirator not listed.

- N/A means not applicable since a respirator-fitting test is not carried out.
- a A respirator protection factor is a measure of the degree of protection provided by a respirator to a respirator wearer. Multiplying the permissible time-weighted average concentration or the permissible ceiling concentration, whichever is applicable, for a toxic substance, or the maximum permissible airborne concentration for a radionuclide, by a protection factor assigned to a respirator gives the maximum concentration of the hazardous substance for which the respirator can be used. Limitations of filters, cartridges, and canisters used in air-purifying respirators shall be considered in determining protection factors.
- b When the respirator is used for protection against airborne particulate matter having a permissible time-weighted average concentration less than 0.05 milligram particulate matter per cubic meter of air or less than 2 million particles per cubic foot of air, or for protection against airborne radionuclide particulate matter, the respirator shall be equipped with a high-efficiency filter(s).
- c If the air contaminant causes eye irritation, the wearer of a respirator equipped with a quarter-mask or half-mask facepiece or mouthpiece and nose clamp shall be permitted to use a protective goggle or to use a respirator equipped with a full facepiece. Mouthpiece and nose clamp respirators are approved by NIOSH only for escape from IDLH atmospheres.
- d If the powered air-purifying respirator is equipped with a facepiece, the escape provision means that the wearer is able to breathe through the filter, cartridge, or canister and through the pump. If the powered air-purifying respirator is equipped with a helmet, hood, or suit, the escape provision shall be an auxiliary self-contained supply of respirable air.
- e The escape provision shall be an auxiliary self-contained supply of respirable air.
- f For definition of "oxygen deficiency-not immediately dangerous to life or health" see WAC 296-62-07105.
- g For definition of "oxygen deficiency-immediately dangerous to life or health" see WAC 296-62-07105.
- h The protection factor measurement exceeds the limit of sensitivity of the test apparatus. Therefore, the respirator has been classified for use in atmospheres having unknown concentrations of contaminants.
- i The service life of a vapor-or-gas removing cartridge canister depends on the specific vapor or gas, the concentration of the vapor or gas in air, the temperature and humidity of the air, the type and quantity of the sorbent in the cartridge or canister, and the activity of the respirator wearer. Cartridges and canisters may provide only very short service lives for certain vapors and gases. Vapor/gas service life testing is recommended to ensure that cartridges and canisters provide adequate service lines. Reference should be made to published reports which give vapor/gas life data for cartridges and canisters.
- j Vapor-and-gas removing respirators are not approved for contaminants that lack adequate warning properties of odor, irritation, or taste at concentrations in air at or above the permissible exposure limits.

Note: Respirator protection factors for air-purifying-type respirators equipped with a mouthpiece/nose clamp form of respirator-inlet covering are not given, since such respirators are approved only for escape purposes.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07113, filed 9/5/97, effective 11/5/97. Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-07113, filed 11/22/91, effective 12/24/91; 88-14-108 (Order 88-11), § 296-62-07113, filed 7/6/88. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07113, filed 7/27/81.]

WAC 296-62-07115 Use of respirators. (1) Standard operating procedures. Written standard operating procedures shall cover a complete respirator program and shall include information necessary for the proper use of respirators, including training of respirator wearers, respirator sealing tests, issuance of respirators, inspection of respirators prior to use, monitoring respirator use, monitoring respiratory hazard, and planning for routine, nonroutine, emergency, and rescue uses of respirators.

(a) The written standard operating procedures shall include plans necessary to ensure the safe routine use and

nonroutine use of respirators. Emergency and rescue uses of respirators shall be anticipated, and the written standard operating procedures shall include plans necessary to ensure the safe emergency and rescue uses of respirators. Persons who wear respirators routinely, who wear respirators nonroutinely, and who may be required to wear respirators for emergency and rescue work shall be given adequate information concerning plans covering these respirator uses to ensure the safe use of respirators.

(b) Standard operating procedures for emergency and rescue use of respirators. It is recognized that it is not possible to foresee every emergency and rescue use of respirators for every kind of operation. Nevertheless, a wide variety of possible conditions requiring the emergency or rescue use of respirators can be envisioned and an adequate emergency and rescue respirator-response capability can be achieved through a serious effort to anticipate the worst possible consequences of particular malfunctions or mishaps.

The written standard operating procedures governing the emergency and rescue uses of respirators shall be developed in the following manner:

(i) An analysis of the emergency and rescue uses of respirators that may occur in each operation shall be made by careful consideration of materials, equipment, processes, and personnel involved. Such an analysis shall be reviewed by the person who is thoroughly familiar with the particular operation. Consideration shall be given to past occurrences requiring emergency or rescue uses of respirators as well as conditions which resulted in such respirator applications. The possible consequences of equipment or power failures, uncontrolled chemical reactions, fire, explosion, or human error shall be given consideration. All potential hazards which may result in emergency or rescue use of respirators shall be listed.

(ii) Based upon the analysis, appropriate types of respirators shall be selected, an adequate number shall be provided for each area where they may be needed for emergency or rescue use, and these respirators shall be maintained and stored so that they are readily accessible and operational when needed.

(iii) In areas where the wearer, with failure of the respirator, could be overcome by a toxic or oxygen-deficient atmosphere, at least one additional person shall be present. Communications (visual, voice, or signal line) shall be maintained between both or all individuals present. Planning shall be such that one individual will be unaffected by any likely incident and have the proper rescue equipment to be able to assist the other(s) in case of emergency.

(iv) When self-contained breathing apparatus or airline respirators with an escape provision are used in atmospheres immediately dangerous to life or health, standby workers must be present at the nearest fresh air base with suitable rescue equipment.

(v) Persons using air line respirators in atmospheres immediately hazardous to life or health shall be equipped with safety harnesses and safety lines for lifting or removing persons from hazardous atmospheres or other and equivalent provisions for the rescue of persons from hazardous atmospheres shall be used. A standby worker or workers with suit-

able self-contained breathing apparatus shall be at the nearest fresh air base for emergency rescue.

(2) Training. The supervisor, the person issuing respirators, and the respirator wearers shall be given adequate training by a qualified person(s) to ensure the proper use of respirators. Written records shall be kept of the names of the persons trained and the dates when training occurred.

(a) Training of supervisor. A supervisor - that is, a person who has the responsibility of overseeing the work activities of one or more persons who must wear respirators - shall be given adequate training to ensure the proper use of respirators.

(b) Training of person issuing respirators. A person assigned the task of issuing respirators to persons who must wear respirators for protection against harmful atmospheres shall be given adequate training to ensure that the correct respirator is issued for each application in accordance with written standard operating procedures.

(c) Training of respirator wearer. To ensure the proper and safe use of a respirator, the minimum training of each respirator wearer shall include the following elements:

(i) The reasons for the need of respiratory protection.

(ii) The nature, extent, and effects of respiratory hazards to which the person may be exposed.

(iii) An explanation of why engineering controls are not being applied or are not adequate and of what effort is being made to reduce or eliminate the need for respirators.

(iv) An explanation of why a particular type of respirator has been selected for a specific respiratory hazard.

(v) An explanation of the operation, and the capabilities and limitations, of the respirator selected.

(vi) Instruction in inspecting, donning, checking the fit of, and wearing the respirator.

(vii) An opportunity for each respirator wearer to handle the respirator, learn how to don and wear it properly, check its seals, wear it in a safe atmosphere, and wear it in a test atmosphere.

(viii) An explanation of how maintenance and storage of the respirator is carried out.

(ix) Instructions in how to recognize and cope with emergency situations.

(x) Instructions as needed for special respirator use.

(xi) Regulations concerning respirator use.

(A) Wearing instructions and training. Wearing instructions and training, including practice demonstrations, shall be given to each respirator wearer and shall cover:

(I) Donning, wearing, and removing the respirator.

(II) Adjusting the respirator so that its respiratory-inlet covering is properly fitted on the wearer and so that the respirator causes a minimum of discomfort to the wearer.

(III) Allowing the respirator wearer to wear the respirator in a safe atmosphere for an adequate period of time to ensure that the wearer is familiar with the operational characteristics of the respirator.

(IV) Providing the respirator wearer an opportunity to wear the respirator in a test atmosphere to demonstrate that the respirator provides protection to the wearer. A test atmosphere is any atmosphere in which the wearer can carry out activities simulating work movements and respirator leakage or respirator malfunction can be detected by the wearer.

(B) Retraining. Each respirator wearer shall be retrained as necessary to assure effective respirator use. Refresher training shall be given at least annually and shall include the provisions of (c)(vii) through (xi)(A)(III) of this subsection.

(3) Respirator sealing problems. Respirators shall not be worn when conditions prevent a seal of the respirator to the wearer.

(a) A person who has hair (stubble, moustache, sideburns, beard, low hairline, bangs) which passes between the face and the sealing surface of the facepiece of the respirator shall not be permitted to wear such a respirator.

(b) A person who has hair (moustache, beard) which interferes with the function of a respirator valve(s) shall not be permitted to wear the respirator.

(c) A spectacle which has temple bars or straps which pass between the sealing surface of a respirator full facepiece and the wearer's face shall not be used.

(d) A head covering which passes between the sealing surface of a respirator facepiece and the wearer's face shall not be used.

(e) The wearing of a spectacle, a goggle, a faceshield, a welding helmet, or other eye and face protective device which interferes with the seal of a respirator to the wearer shall not be allowed.

(f) If scars, hollow temples, excessively protruding cheekbones, deep creases in facial skin, the absence of teeth or dentures, or unusual facial configurations prevent a seal of a respirator facepiece to a wearer's face, the person shall not be permitted to wear the respirator.

(g) If missing teeth or dentures prevent a seal of a respirator mouthpiece in a person's mouth, the person shall not be allowed to wear a respirator equipped with a mouthpiece.

(h) If a person has a nose of a shape or size which prevents the closing of the nose by the nose clamp of a mouthpiece/nose-clamp type of respirator, the person shall not be permitted to wear this type of respirator.

(4) Respirator sealing tests. To ensure proper protection, the wearer of a respirator equipped with a facepiece shall check the seal of the facepiece prior to each entry into a hazardous atmosphere. This may be done using procedures recommended by respirator manufacturers or by approved field tests.

(5) Issuance of respirators. The proper respirator shall be specified for each application and shall be listed in the written standard operating procedures. If a respirator is marked for the worker to whom it is assigned or for other identification purposes, the markings shall not affect the respirator performance in any way.

(6) Respirator inspection prior to use. Each person issued a respirator for routine, nonroutine, emergency, or rescue use shall inspect the respirator prior to its use to ensure that it is in good operating condition.

(7) Monitoring respirator use. The use of respirators on a routine or nonroutine basis shall be monitored to ensure that the correct respirators are being used, that the respirators are being worn properly and that the respirators being used are in good working condition.

(8) Evaluation of respiratory hazard during use. The level of the respiratory hazard in the workplace to which a

person wearing a respirator is exposed shall be evaluated periodically.

(9) Leaving a hazardous area. A respirator wearer shall be permitted to leave the hazardous area for any respirator-related cause. Reasons which may cause a respirator wearer to leave a hazardous area include, but are not limited to, the following:

(a) Failure of the respirator to provide adequate protection.

(b) Malfunction of the respirator.

(c) Detection of leakage of air contaminant into the respirator.

(d) Increase in resistance of respirator to breathing.

(e) Severe discomfort in wearing the respirator.

(f) Illness of respirator wearer, including: Sensation of dizziness, nausea, weakness, breathing difficulty, coughing, sneezing, vomiting, fever, and chills.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-62-07115, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-07115, filed 11/30/83; 82-08-026 (Order 82-10), § 296-62-07115, filed 3/30/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07115, filed 7/27/81.]

WAC 296-62-07117 Maintenance of respirators. (1)

General. A program for the maintenance of respirators shall be adjusted to the type of plant, working conditions, hazards involved, and shall include the following:

(a) Cleaning and sanitizing.

(b) Inspection for defects.

(c) Repair.

(d) Storage.

Each respirator shall be properly maintained to retain its original shape and effectiveness.

(2) Cleaning and sanitizing. Each respirator shall be cleaned and sanitized to ensure that the respirator wearer is provided with a clean and sanitized respirator at all times. A respirator issued for other than continuous personal use by a particular worker, such as with routine, nonroutine, emergency, or rescue use, shall be cleaned and sanitized after each use.

(3) Inspection. Each respirator shall be inspected routinely before and after use. A respirator shall be inspected by the user immediately prior to each use to ensure that it is in proper working condition.

(a) After cleaning and sanitizing, each respirator shall be inspected to determine if it is in proper working condition, if it needs replacement of parts or repairs, or if it should be discarded. Each respirator stored for emergency or rescue use shall be inspected at least monthly. Respirator inspection shall include a check for tightness of connections; for the condition of the respiratory-inlet covering, head harness, valves, connecting tubes, harness assemblies, filters, cartridges, canisters, end-of-service-life indicator, and shelf life date(s); and for the proper function of regulators, alarms, and other warning systems.

(b) Each rubber or other elastomeric part shall be inspected for pliability and signs of deterioration. Each air and oxygen cylinder shall be inspected to ensure that it is fully charged according to the manufacturer's instructions.

(c) A record of inspection dates, findings, and remedial actions shall be kept for each respirator maintained for emergency or rescue use.

(4) Part replacement and repair. Replacement of parts or repairs shall be done only by persons trained in proper respirator assembly and correction of possible respirator malfunctions and defects. Replacement parts shall be only those designed for the specific respirator being repaired. Reducing or admission valves, regulators, and alarms shall be returned to the manufacturer or to a trained technician for repair or adjustment. Instrumentation for valve, regulator, and alarm adjustments and tests must be approved by the valve, regulator, or alarm manufacturer.

(5) Storage. Respirators shall be stored in a manner that will protect them against dust, sunlight, heat, extreme cold, excessive moisture, or damaging chemicals. Respirators shall be stored to prevent distortion of rubber or other elastomeric parts. Respirators shall not be stored in such places as lockers and tool boxes unless they are protected from contamination, distortion, and damage. Emergency and rescue-use respirators that are placed in work areas shall be quickly accessible at all times, and the storage cabinet or container in which they are stored shall be clearly marked.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07117, filed 7/27/81.]

WAC 296-62-07119 Identification of air-purifying respirator canisters. (1) The primary means of identifying a gas mask canister shall be by means of properly worded labels. The secondary means of identifying a gas mask canister shall be by a color code.

(2) Employers or their representative who issue or use gas masks falling within the scope of this section shall see that all gas mask canisters purchased or used by them are properly labeled and colored in accordance with these requirements before they are placed in service and that the labels and colors are properly maintained at all times thereafter until the canisters have completely served their purpose.

(3) On each canister shall appear in bold letters the following:

(a) Canister for

 (Name for atmospheric contaminant)
 or
 Type N Gas Mask Canister

(b) In addition, essentially the following wording shall appear beneath the appropriate phrase on the canister label:
 "For respiratory protection in atmospheres containing not more than percent by volume of"

(Name of atmospheric contaminant)

(c) All of the markings specified above should be placed on the most conspicuous surface or surfaces of the canister.

(4) Canisters having a special high-efficiency filter for protection against radionuclides and other highly toxic particulates shall be labeled with a statement of the type and degree of protection afforded by the filter. The label shall be affixed

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to the neck end of, or to the gray stripe which is around and near the top of, the canister. The degree of protection shall be marked as the percent of penetration of the canister by a 0.3 - micron-diameter dioctyl phthalate (DOP) smoke at a flow rate of 85 liters per minute.

(5) Each canister shall have a label warning that gas masks should be used only in atmospheres containing sufficient oxygen to support life (at least 16 percent by volume), since gas mask canisters are only designed to neutralize or remove contaminants from the air.

(6) Each gas mask canister shall be painted a distinctive color or combination of colors indicated in Table I. All colors used shall be such that they are clearly identifiable by the user and clearly distinguishable from one another. The color coating used shall offer a high degree of resistance to chipping, scaling, peeling, blistering, fading, and the effects of the ordinary atmospheres to which they may be exposed under normal conditions of storage and use. Appropriately colored pressure sensitive tape may be used for the stripes.

TABLE I
 Atmospheric Contaminants to be Protected Against Colors Assigned*

Acid gases	White.
Hydrocyanic acid gas	White with 1/2 - inch green stripe completely around the canister near the bottom.
Chlorine gas	White with 1/2 - inch yellow stripe completely around the canister near the bottom.
Organic vapors	Black.
Ammonia gas	Green.
Acid gases and ammonia gas	Green with 1/2 - inch white stripe completely around the canister near the bottom.
Carbon monoxide	Blue.
Acid gases and organic vapors. ...	Yellow.
Hydrocyanic acid gas and chloropicrin vapor	Yellow with 1/2 - inch blue stripe completely around the canister near the bottom.
Acid gases, organic vapors, and ammonia gases	Brown.

[Title 296 WAC—p. 1331]

Radioactive materials, excepting tritium and noble gases	Purple (Magenta).
Particulates (dusts, fumes, mists, fogs, or smokes) in combination with any of the above cases or vapors	Canister color for contaminant, as designated above, with 1/2 - inch gray stripe completely around the canister near the top.
All of the above atmospheric contaminants	Red with 1/2 - inch gray stripe completely around the canister near the top.

* Gray shall not be assigned as the main color for a canister designed to remove acids or vapors.

Note: Orange shall be used as a complete body, or stripe color to represent gases not included in this table. The user will need to refer to the canister label to determine the degree of protection the canister will afford.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07119, filed 7/27/81.]

WAC 296-62-07121 Effective date. This standard shall become effective thirty days after filing with the code reviser.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07121, filed 7/27/81.]

PART F—CARCINOGENS

WAC 296-62-073 Carcinogens—Scope and application. (1) All sections of this chapter which include WAC 296-62-073 in the section number apply to the manufacturing, processing, repackaging, releasing, handling or storing of carcinogens.

(2) This section shall not apply to solid or liquid mixtures containing less than 0.1 percent by weight or volume of the carcinogens listed in WAC 296-62-07302.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-073, filed 11/30/87. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-073, filed 11/13/80; Order 76-6, § 296-62-073, filed 3/1/76; Order 74-35, § 296-62-073, filed 9/20/74.]

WAC 296-62-07302 List of carcinogens. (1) The following substances are deemed to be carcinogens for the purposes of WAC 296-62-073 through 296-62-07316.

(2) Any reference to carcinogens in WAC 296-62-07304 through 296-62-07316 shall mean only those carcinogens listed in WAC 296-62-07302.

(a) 4-Nitrobiphenyl - Chemical Abstracts Registry Number 92-93-3.

(b) Alpha-Naphthylamine - Chemical Abstracts Registry Number 134-32-7.

[Title 296 WAC—p. 1332]

(c) 4,4' Methylene bis (2 - chloroaniline) - Chemical Abstracts Service Registry Number 101-14-4.

(d) Methyl chloromethyl ether - Chemical Abstracts Service Registry Number 107-30-2.

(e) 3,3'-Dichlorobenzidine (and its salts) - Chemical Abstracts Service Registry Number 91-94-1.

(f) Bis-Chloromethyl ether - Chemical Abstracts Service Registry Number 542-88-1.

(g) Beta-Naphthylamine - Chemical Abstracts Service Registry Number 91-59-8.

(h) Benzidine - Chemical Abstracts Service Registry Number 92-87-5.

(i) 4-Aminodiphenyl - Chemical Abstracts Service Registry Number 92-67-1.

(j) Ethyleneimine - Chemical Abstracts Service Registry Number 151-56-4.

(k) Beta-Propiolactone - Chemical Abstracts Service Registry Number 57-57-8.

(l) 2-Acetylaminofluorene - Chemical Abstracts Service Registry Number 53-96-3.

(m) 4-Dimethylaminoazobenzene - Chemical Abstracts Service Registry Number 60-11-7.

(n) N-Nitrosodimethylamine - Chemical Abstracts Service Registry Number 62-75-9.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07302, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040 and 49.17.050. 85-10-004 (Order 85-09), § 296-62-07302, filed 4/19/85; 82-13-045 (Order 82-22), § 296-62-07302, filed 6/11/82; 81-07-048 (Order 81-4), § 296-62-07302, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07302, filed 11/13/80.]

WAC 296-62-07304 Definitions. The definitions set forth in this section apply throughout WAC 296-62-073 through 296-62-07316.

(1) Absolute filter - is one capable of retaining 99.97 percent of a mono disperse aerosol of 0.3 micron size particles.

(2) Authorized employee - an employee whose duties require him to be in the regulated area and who has been specifically assigned to those duties by the employer.

(3) Clean change room - a room where employees put on clean clothing and/or protective equipment in an environment free of carcinogens listed in WAC 296-62-07302. The clean change room shall be contiguous to and have an entry from a shower room, when the shower room facilities are otherwise required in this section.

(4) Closed system - an operation involving carcinogens listed in WAC 296-62-07302 where containment prevents the release of carcinogens into regulated areas, or the external environment.

(5) Decontamination - the inactivation of a carcinogen listed in WAC 296-62-07302 or its safe disposal.

(6) Disposal - the safe removal of a carcinogen listed in WAC 296-62-07302 from the work environment.

(7) Emergency - an unforeseen circumstance or set of circumstances resulting in the release of a carcinogen which may result in exposure to or contact with any carcinogen listed in WAC 296-62-07302.

(8) External environment - any environment external to regulated and nonregulated areas.

(9) Isolated system - a fully enclosed structure other than the vessel of containment of a listed carcinogen which is impervious to the passage of listed carcinogens and which would prevent the entry of carcinogens into regulated areas, nonregulated areas, or the external environment, should leakage or spillage from the vessel of containment occur.

(10) Laboratory-type hood - a device enclosed on three sides and the top and bottom, designed and maintained so as to draw air inward at an average linear face velocity of 150 feet per minute with a minimum of 125 feet per minute, designed, constructed and maintained such that an operation involving a listed carcinogen within the hood does not require the insertion of any portion of any employees' body other than his hands and arms.

(11) Nonregulated area - any area under the control of the employer where entry and exit is neither restricted nor controlled.

(12) Open-vessel system - an operation involving listed carcinogens in an open vessel, which is not in an isolated system, a laboratory-type hood, nor in any other system affording equivalent protection against the entry of carcinogens into regulated areas, nonregulated areas, or the external environment.

(13) Protective clothing - clothing designed to protect an employee against contact with or exposure to listed carcinogens.

(14) Regulated area - an area where entry and exit is restricted and controlled.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07304, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 81-07-048 (Order 81-4), § 296-62-07304, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07304, filed 11/13/80.]

WAC 296-62-07306 Requirements for areas containing carcinogens listed in WAC 296-62-07302. (1) A regulated area shall be established by an employer where listed carcinogens are manufactured, processed, used, repackaged, released, handled or stored.

(2) All such areas shall be controlled in accordance with the requirements for the following category or categories describing the operation involved:

(a) Isolated systems. Employees working with carcinogens within an isolated system such as a "glove box" shall wash their hands and arms upon completion of the assigned task and before engaging in other activities not associated with the isolated system.

(b) Closed system operation. Within regulated areas where carcinogens are stored in sealed containers, or contained in a closed system including piping systems with any sample ports or openings closed while carcinogens are contained within:

(i) Access shall be restricted to authorized employees only;

(ii) Employees shall be required to wash hands, forearms, face and neck upon each exit from the regulated areas, close to the point of exit and before engaging in other activities.

(c) Open vessel system operations. Open vessel system operations as defined in WAC 296-62-07304(12) are prohibited.

(d) Transfer from a closed system. Charging or discharging point operations, or otherwise opening a closed system. In operations involving "laboratory-type hoods," or in locations where a carcinogen is contained in an otherwise "closed system," but is transferred, charged, or discharged into other normally closed containers, the provisions of this section shall apply.

(i) Access shall be restricted to authorized employees only;

(ii) Each operation shall be provided with continuous local exhaust ventilation so that air movement is always from ordinary work areas to the operation. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated. Clean makeup air shall be introduced in sufficient volume to maintain the correct operation of the local exhaust system.

(iii) Employees shall be provided with, and required to wear, clean, full body protective clothing (smocks, coveralls, or long-sleeved shirt and pants), shoe covers and gloves prior to entering the regulated area.

(iv) Employees engaged in operations handling the following carcinogens shall be provided with and required to wear and use a full-face, supplied-air respirator, of the continuous flow or pressure-demand type in accordance with WAC 296-62-071:

Methyl Chloromethyl Ether;
bis-Chloromethyl Ether;
Ethylenimine;
beta-Propiolactone;
4-Amino Diphenyl.

(v) Employees engaged in operations handling the following carcinogens shall be provided with and required to wear and use (not less than) a half-face, filter-type respirator for dusts, mists, and fumes in accordance with WAC 296-62-071:

4-Nitrobiphenyl; Alpha-Naphthylamine; 4,4'Methylene bis (2-Chloroaniline); 3,3'Dichlorobenzidine (and its salts); Beta-Naphthylamine; Benzidine; 2-Acetylamino Fluorene; 4-Dimethylaminoazobenzene; N-Nitrosodimethylamine.

(vi) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under WAC 296-62-07310 (2), (3) and (4).

(vii) Employees shall be required to wash hands, forearms, face and neck on each exit from the regulated area, close to the point of exit, and before engaging in other activities.

(viii) Employees shall be required to shower after the last exit of the day.

(ix) Drinking fountains are prohibited in the regulated area.

(e) Maintenance and decontamination activities. In clean up of leaks or spills, maintenance or repair operations on contaminated systems or equipment, or any operations involving

work in an area where direct contact with carcinogens could result, each authorized employee entering the area shall:

(i) Be provided with and required to wear, clean, impervious garments, including gloves, boots and continuous-air supplied hood in accordance with chapter 296-24 WAC, the general safety and health standards, and respiratory protective equipment required by this chapter 296-62 WAC;

(ii) Be decontaminated before removing the protective garments and hood;

(iii) Be required to shower upon removing the protective garments and hood.

(f) Laboratory activities. The requirements of this subdivision shall apply to research and quality control activities involving the use of carcinogens listed in WAC 296-62-07302.

(i) Mechanical pipetting aids shall be used for all pipetting procedures.

(ii) Experiments, procedures and equipment which could produce aerosols shall be confined to laboratory-type hoods or glove boxes.

(iii) Surfaces on which carcinogens are handled shall be protected from contamination.

(iv) Contaminated wastes and animal carcasses shall be collected in impervious containers which are closed and decontaminated prior to removal from the work area. Such wastes and carcasses shall be incinerated in such a manner that no carcinogenic products are released.

(v) All other forms of listed carcinogens shall be inactivated prior to disposal.

(vi) Laboratory vacuum systems shall be protected with high efficiency scrubbers or with disposable absolute filters.

(vii) Employees engaged in animal support activities shall be:

(A) Provided with, and required to wear, a complete protective clothing change, clean each day, including coveralls or pants and shirt, foot covers, head covers, gloves, and appropriate respiratory protective equipment or devices; and

(B) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be identified as required under WAC 296-62-07310 (2), (3) and (4).

(C) Required to wash hands, forearms, face and neck upon each exit from the regulated area close to the point of exit, and before engaging in other activities; and

(D) Required to shower after the last exit of the day.

(viii) Employees, other than those engaged only in animal support activities, each day shall be:

(A) Provided with and required to wear a clean change of appropriate laboratory clothing, such as a solid front gown, surgical scrub suit, or fully buttoned laboratory coat.

(B) Prior to each exit from a regulated area, employees shall be required to remove and leave protective clothing and equipment at the point of exit and at the last exit of the day, to place used clothing and equipment in impervious containers at the point of exit for purposes of decontamination or disposal. The contents of such impervious containers shall be

identified as required under WAC 296-62-07310 (2), (3) and (4).

(C) Required to wash hands, forearms, face and neck upon each exit from the regulated area close to the point of exit, and before engaging in other activities.

(ix) Air pressure in laboratory areas and animal rooms where carcinogens are handled and bioassay studies are performed shall be negative in relation to the pressure in surrounding areas. Exhaust air shall not be discharged to regulated areas, nonregulated areas or the external environment unless decontaminated.

(x) There shall be no connection between regulated areas and any other areas through the ventilation system.

(xi) A current inventory of the carcinogens shall be maintained.

(xii) Ventilated apparatus such as laboratory-type hoods, shall be tested at least semi-annually or immediately after ventilation modification or maintenance operations, by personnel fully qualified to certify correct containment and operation.

[Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-62-07306, filed 4/10/96, effective 6/1/96. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-16-009 (Order 86-28), § 296-62-07306, filed 7/25/86; 85-10-004 (Order 85-09), § 296-62-07306, filed 4/19/85. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-015 (Order 81-20), § 296-62-07306, filed 7/27/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07306, filed 11/13/80.]

WAC 296-62-07308 General regulated area requirements. (1) Emergencies. In an emergency, immediate measures including, but not limited to, the requirements of (a), (b), (c), (d) and (e) of this subsection shall be implemented.

(a) The potentially affected area shall be evacuated as soon as the emergency has been determined.

(b) Hazardous conditions created by the emergency shall be eliminated and the potentially affected area shall be decontaminated prior to the resumption of normal operations.

(c) Special medical surveillance by a physician shall be instituted within twenty-four hours for employees present in the potentially affected area at the time of the emergency. A report of the medical surveillance and any treatment shall be included in the incident report, in accordance with WAC 296-62-07312(2).

(d) Where an employee has a known contact with a listed carcinogen, such employee shall be required to shower as soon as possible, unless contraindicated by physical injuries.

(e) An incident report on the emergency shall be reported as provided in WAC 296-62-07312(2).

(2) Hygiene facilities and practices.

(a) Storage or consumption of food, storage or use of containers of beverages, storage or application of cosmetics, smoking, storage of smoking materials, tobacco products or other products for chewing, or the chewing of such products, are prohibited in regulated areas.

(b) Where employees are required by this section to wash, washing facilities shall be provided in accordance with WAC 296-24-12009, of the general safety and health standards.

(c) Where employees are required by this section to shower, shower facilities shall be provided.

(i) One shower shall be provided for each ten employees of each sex, or numerical fraction thereof, who are required to shower during the same shift.

(ii) Body soap or other appropriate cleansing agents convenient to the showers shall be provided as specified in WAC 296-24-12009, of the general safety and health standards.

(iii) Showers shall be provided with hot and cold water feeding a common discharge line.

(iv) Employees who use showers shall be provided with individual clean towels.

(d) Where employees wear protective clothing and equipment, clean change rooms shall be provided and shall be equipped with storage facilities for street clothes and separate storage facilities for the protective clothing for the number of such employees required to change clothes.

(e) Where toilets are in regulated areas, such toilets shall be in a separate room.

(3) Contamination control.

(a) Regulated areas, except for outdoor systems, shall be maintained under pressure negative with respect to nonregulated areas. Local exhaust ventilation may be used to satisfy this requirement. Clean makeup air in equal volume shall replace air removed.

(b) Any equipment, material, or other item taken into or removed from a regulated area shall be done so in a manner that does not cause contamination in nonregulated areas or the external environment.

(c) Decontamination procedures shall be established and implemented to remove carcinogens from the surfaces of materials, equipment and the decontamination facility.

(d) Dry sweeping and dry mopping are prohibited.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-07308, filed 11/30/83. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07308, filed 11/13/80.]

WAC 296-62-07310 Signs, information and training.

(1) Signs.

(a) Entrances to regulated areas shall be posted with signs bearing the legend:

CANCER-SUSPECT AGENT

AUTHORIZED PERSONNEL ONLY

(b) Entrances to regulated areas containing operations covered in WAC 296-62-07306 (2)(e) shall be posted with signs bearing the legend:

CANCER-SUSPECT AGENT EXPOSED IN THIS AREA

IMPERVIOUS SUIT INCLUDING GLOVES,
BOOTS, AND AIR-SUPPLIED HOOD
REQUIRED AT ALL TIMES

AUTHORIZED PERSONNEL ONLY

(c) Appropriate signs and instructions shall be posted at the entrance to, and exit from, regulated areas, informing employees of the procedures that must be followed in entering and leaving a regulated area.

(2) Container contents, identification.

(a) Containers of carcinogens named in WAC 296-62-07302 and containers required in WAC 296-62-07306 (2)(d)(v) and 296-62-07306 (2)(f)(vii)(B) and 296-62-07306 (2)(f)(viii)(B) which are accessible only to, and handled only by authorized employees, or by other employees training in accordance with WAC 296-62-07310(5), may have contents identification limited to a generic or proprietary name, or other proprietary identification of the carcinogen and percent.

(b) Containers of carcinogens and containers required under WAC 296-62-07306 (2)(d)(v) and 296-62-07306 (2)(f)(vii)(B) and 296-62-07306 (2)(f)(viii)(B) which are accessible to, or handled by employees other than authorized employees or employees trained in accordance with WAC 296-62-07310(5) shall have contents identification which includes the full chemical name and Chemical Abstracts Service Registry number as listed in WAC 296-62-07302.

(c) Containers shall have the warning words "CANCER-SUSPECT AGENT" displayed immediately under or adjacent to the contents identification.

(d) Containers which have carcinogenic contents with corrosive or irritating properties shall have label statements warning of such hazards, noting, if appropriate, particularly sensitive or affected portions of the body.

(3) Lettering. Lettering on signs and instructions required by WAC 296-62-07310(1) shall be a minimum letter height of two inches. Labels on containers required under this section shall not be less than one-half the size of the largest lettering on the package, and not less than eight point type in any instance: Provided, that no such required lettering need be more than one inch in height.

(4) Prohibited statements. No statements shall appear on or near any required sign, label, or instruction which contradicts or detracts from the effect of any required warning, information or instruction.

(5) Training and indoctrination.

(a) Each employee prior to being authorized to enter a regulated area, shall receive a training and indoctrination program including, but not necessarily limited to:

(i) The nature of the carcinogenic hazards of listed carcinogens, including local and systemic toxicity;

(ii) The specific nature of the operation involving carcinogens which could result in exposure;

(iii) The purpose for and application of the medical surveillance program, including, as appropriate, methods of self-examination;

(iv) The purpose for and application of decontamination practices and purposes;

(v) The purpose for and significance of emergency practices and procedures;

(vi) The employee's specific role in emergency procedures;

(vii) Specific information to aid the employee in recognition and evaluation of conditions and situations which may result in the release of listed carcinogens;

(viii) The purpose for and application of specific first-aid procedures and practices;

(ix) A review of this section at the employee's first training and indoctrination program and annually thereafter.

(b) Specific emergency procedures shall be prescribed, and posted, and employees, shall be familiarized with their terms, and rehearsed in their application.

(c) All materials relating to the program shall be provided upon request to the director.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07310, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050, 81-07-048 (Order 81-4), § 296-62-07310, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07310, filed 11/13/80.]

WAC 296-62-07312 Reports. (1) Operations. Not later than October 30, 1974, the information required in WAC 296-62-07312 (1)(a), (b), (c) and (d) of this section shall be reported in writing to the industrial hygiene section, division of industrial safety and health. Any changes in such information shall be similarly reported in writing within 15 calendar days of such change.

(a) A brief description and in plant location of the area(s) regulated and the address of each regulated area;

(b) The name(s) and other identifying information as to the presence of listed carcinogens in each regulated area;

(c) The number of employees in each regulated area, during normal operations including maintenance activities; and

(d) The manner in which a carcinogen is present in each regulated area; e.g., whether it is manufactured, processed, used, repackaged, released, stored, or otherwise handled.

(2) Incidents. Incidents which result in the release of a listed carcinogen into any area where employees may be potentially exposed shall be reported in accordance with this subsection.

(a) A report of the occurrence of the incident and the facts obtainable at that time including a report on any medical treatment of affected employees shall be made within 24 hours to the industrial hygiene section, division of industrial safety and health.

(b) A written report shall be filed with the industrial hygiene section, division of industrial safety and health, within 15 calendar days thereafter and shall include:

(i) A specification of the amount of material released, the amount of time involved, and an explanation of the procedure used in determining this figure;

(ii) A description of the area involved, and the extent of known and possible employee exposure and area contamination;

(iii) A report of any medical treatment of affected employees, and any medical surveillance program implemented; and

(iv) An analysis of the circumstances of the incident, and measures taken or to be taken, with specific completion dates, to avoid further similar releases.

CARCINOGEN STANDARD REPORT

Company: Prepared By:
 Plant Address: Title:
 Date:

Compound and Other Identifying Information	Description of Inplant Location of Regulated Area*	Number of Employees in Each Regulated Area* Normally Maintenance	Manner** In Which Compound is Present in Each Regulated Area*
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* See WAC 296-62-07308 for definition of "regulated area."

** Indicated whether manufactured, processed, used, repackaged, released, stored, or if otherwise handled (describe).

[Statutory Authority: RCW 49.17.040 and 49.17.050, 81-07-048 (Order 81-4), § 296-62-07312, filed 3/17/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07312, filed 11/13/80.]

WAC 296-62-07314 Medical surveillance. (1) At no cost to the employee, a program of medical surveillance shall be established and implemented for employees considered for assignment to enter regulated areas, and for authorized employees.

(2) Examinations.

(a) Before an employee is assigned to enter a regulated area, a preassignment physical examination by a physician shall be provided and shall include a personal history of the employee and/or his/her family and occupation background, including genetic and environmental factors.

(i) Taking of employees medical history and background history shall be considered routine part of standard medical practice.

(ii) This provision does not require "genetic testing" of any employee.

(iii) This provision does not require the exclusion of otherwise qualified employees from jobs on the basis of genetic factors.

(b) Authorized employees shall be provided periodic physical examination, not less often than annually, following the preassignment examination.

(c) In all physical examinations, the examining physician shall be requested to consider whether there exist conditions of increased risk, including reduced immunological competence, those undergoing treatment with steroids or cytotoxic agents, pregnancy and cigarette smoking.

(3) Records.

(a) Employers of employees examined pursuant to this subdivision shall cause to be maintained complete and accurate records of all such medical examinations. Records shall be maintained for the duration of the employee's employment. Upon termination of the employee's employment, including retirement or death, or in the event that the employer ceases business without a successor, records, or notarized true copies thereof, shall be forwarded by registered mail to the director.

(b) Records required by this section shall be provided upon request to employees, designated representatives, and the director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217. These records shall also be provided upon request to the director.

(c) Any employer who requests a physical examination of one of his employees or prospective employees as required

by this section shall obtain from the physician a statement of the employee's suitability for employment in the specific exposure.

[Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07314, filed 1/10/91, effective 2/12/91; 90-03-029 (Order 89-20), § 296-62-07314, filed 1/11/90, effective 2/26/90. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-15-017 (Order 83-19), § 296-62-07314, filed 7/13/83, effective 9/12/83. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07314, filed 11/13/80.]

WAC 296-62-07316 Premixed solutions. (1) Where 4,4'-Methylene bis (2-chloroaniline) is present only in a single solution at a temperature not exceeding 220°F. the establishment of a regulated area is not required; however,

(a) Only authorized employees shall be permitted to handle such materials.

(b) Each day employees shall be provided with and required to wear a clean change of protective clothing (smocks, coveralls, or long-sleeved shirts and pants), gloves and other protective garments and equipment necessary to prevent contact with the solution in the process used.

(c) Employees shall be required to remove and leave protective clothing and equipment when leaving the work area at the end of the work day, or at any time solution is spilled on such clothing or equipment. Used clothing and equipment shall be placed in impervious containers for purposes of decontamination or disposal. The contents of such impervious containers shall be identified, as required under WAC 296-62-07310 (2), (3) and (4).

(d) Employees shall be required to wash hands and face after removing such clothing and equipment and before engaging in other activities.

(e) Employees assigned to work covered by this section shall be deemed to be working in regulated areas for the purposes of WAC 296-62-07308 (1), (2)(a) and (b), and (3)(c) and (d), WAC 296-62-07310, 296-62-07312 and 296-62-07314.

(f) Work areas where solution may be spilled shall be:

(i) Covered daily or after any spill with a clean covering;

or

(ii) Clean thoroughly, daily and after any spill.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-07316, filed 11/13/80.]

PART G—CARCINOGENS (SPECIFIC)

WAC 296-62-07329 Vinyl chloride. (1) Scope and application.

(a) This section includes requirements for the control of employee exposure to vinyl chloride (chloroethene), Chemical Abstracts Service Registry No. 75014.

(b) This section applies to the manufacture, reaction, packaging, repackaging, storage, handling or use of vinyl chloride or polyvinyl chloride, but does not apply to the handling or use of fabricated products made of polyvinyl chloride.

(c) This section applies to the transportation of vinyl chloride or polyvinyl chloride except to the extent that the department of transportation may regulate the hazards covered by this section.

(1999 Ed.)

(2) Definitions.

(a) "Action level" means a concentration of vinyl chloride of 0.5 ppm averaged over an 8-hour work day.

(b) "Authorized person" means any person specifically authorized by the employer whose duties require him/her to enter a regulated area or any person entering such an area as a designated representative of employees for the purpose of exercising an opportunity to observe monitoring and measuring procedures.

(c) "Director" means the director of department of labor and industries or his/her designated representative.

(d) "Emergency" means any occurrence such as, but not limited to, equipment failure, or operation of a relief device which is likely to, or does, result in massive release of vinyl chloride.

(e) "Fabricated product" means a product made wholly or partly from polyvinyl chloride, and which does not require further processing at temperatures, and for times, sufficient to cause mass melting of the polyvinyl chloride resulting in the release of vinyl chloride.

(f) "Hazardous operation" means any operation, procedure, or activity where a release of either vinyl chloride liquid or gas might be expected as a consequence of the operation or because of an accident in the operation, which would result in an employee exposure in excess of the permissible exposure limit.

(g) "Polyvinyl chloride" means polyvinyl chloride homopolymer or copolymer before such is converted to a fabricated product.

(h) "Vinyl chloride" means vinyl chloride monomer.

(3) Permissible exposure limit.

(a) No employee may be exposed to vinyl chloride at concentrations greater than 1 ppm averaged over any 8-hour period, and

(b) No employee may be exposed to vinyl chloride at concentrations greater than 5 ppm averaged over any period not exceeding 15 minutes.

(c) No employee may be exposed to vinyl chloride by direct contact with liquid vinyl chloride.

(4) Monitoring.

(a) A program of initial monitoring and measurement shall be undertaken in each establishment to determine if there is any employee exposed, without regard to the use of respirators, in excess of the action level.

(b) Where a determination conducted under subdivision (a) of this subsection shows any employee exposures without regard to the use of respirators, in excess of the action level, a program for determining exposures for each such employee shall be established. Such a program:

(i) Shall be repeated at least monthly where any employee is exposed, without regard to the use of respirators, in excess of the permissible exposure limit.

(ii) Shall be repeated not less than quarterly where any employee is exposed, without regard to the use of respirators, in excess of the action level.

(iii) May be discontinued for any employee only when at least two consecutive monitoring determinations, made not less than 5 working days apart, show exposures for that employee at or below the action level.

(c) Whenever there has been a production, process or control change which may result in an increase in the release of vinyl chloride, or the employer has any other reason to suspect that any employee may be exposed in excess of the action level, a determination of employee exposure under subdivision (a) of this subsection shall be performed.

(d) The method of monitoring and measurement shall have an accuracy (with a confidence level of 95 percent) of not less than plus or minus 50 percent from 0.25 through 0.5 ppm, plus or minus 35 percent from over 0.5 ppm through 1.0 ppm, plus or minus 25 percent over 1.0 ppm, (methods meeting these accuracy requirements are available from the director).

(e) Employees or their designated representatives shall be afforded reasonable opportunity to observe the monitoring and measuring required by this subsection.

(5) Regulated area.

(a) A regulated area shall be established where:

(i) Vinyl chloride or polyvinyl chloride is manufactured, reacted, repackaged, stored, handled or used; and

(ii) Vinyl chloride concentrations are in excess of the permissible exposure limit.

(b) Access to regulated areas shall be limited to authorized persons.

(6) Methods of compliance. Employee exposures to vinyl chloride shall be controlled to at or below the permissible exposure limit provided in subsection (3) of this section by engineering, work practice, and personal protective controls as follows:

(a) Feasible engineering and work practice controls shall immediately be used to reduce exposures to at or below the permissible exposure limit.

(b) Wherever feasible engineering and work practice controls which can be instituted immediately are not sufficient to reduce exposures to at or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest practicable level, and shall be supplemented by respiratory protection in accordance with subsection (7) of this section. A program shall be established and implemented to reduce exposures to at or below the permissible exposure limit, or to the greatest extent feasible, solely by means of engineering and work practice controls, as soon as feasible.

(c) Written plans for such a program shall be developed and furnished upon request for examination and copying to the director. Such plans shall be updated at least every six months.

(7) Respiratory protection. Where respiratory protection is required under this section:

(a) The employer shall provide a respirator which meets the requirements of this subdivision and shall assure that the employee uses such respirator.

(b) Respirators shall be selected from among those jointly approved by the Mine Safety and Health Administration, and the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

Note: The Department of Interior published an article in Federal Register in April 1976 which extended time requirement for respirators used for protection against vinyl chloride to have a cartridge or canister with an end-of-service-life indicator. The indicator is an additional safety feature but does not adversely affect the effectiveness of currently approved

respirator cartridges or canisters. Until approved end-of-service-life indicators are available, the respirators, cartridges, or canisters presently approved are considered to meet requirements for vinyl chloride when used per manufacturer's instructions.

(c) A respiratory protection program meeting the requirements of chapter 296-62 WAC shall be established and maintained.

(d) Selection of respirators for vinyl chloride shall be as follows:

Atmospheric concentration of Vinyl Chloride	Required Apparatus
(i) Unknown, or above 3,600 ppm —————	Open-circuit, self-contained breathing apparatus, pressure demand type, with full facepiece.
(ii) Not over 3,600 ppm ———	Combination Type C supplied air respirator, pressure demand type, with full or half facepiece, and auxiliary self-contained air supply.
(iii) Not over 250 ppm ———	Type C, supplied air respirator, continuous flow type, with full or half facepiece, helmet or hood.
(iv) Not over 100 ppm ———	Supplied air respirator demand type, with full facepiece.
(v) Not over 25 ppm —————	(A) A powered air-purifying respirator with hood, helmet, full or half facepiece, and a canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm, or (B) Gas mask, front or back-mounted canister which provides a service life of at least 4 hours for concentrations of vinyl chloride up to 25 ppm.
(vi) Not over 10 ppm —————	Any chemical cartridge respirator with a vinyl chloride cartridge which provides a service life of at least 1 hour for concentrations of vinyl chloride up to 10 ppm.

(e)(i) Entry into unknown concentrations or concentrations greater than 36,000 ppm (lower explosive limit) may be made only for purposes of life rescue; and

(ii) Entry into concentrations of less than 36,000 ppm, but greater than 3,600 ppm may be made only for purposes of life rescue, fire fighting, or securing equipment so as to prevent a greater hazard from release of vinyl chloride.

(f) Where air-purifying respirators are used:

(i) Air-purifying canisters or cartridges shall be replaced prior to the expiration of their service life or the end of the shift in which they are first used, whichever occurs first, and

(ii) A continuous monitoring and alarm system shall be provided where concentrations of vinyl chloride could reasonably exceed the allowable concentrations for the devices in use. Such system shall be used to alert employees when

vinyl chloride concentrations exceed the allowable concentrations for the devices in use.

(g) Apparatus prescribed for higher concentrations may be used for any lower concentration.

(8) Hazardous operations:

(a) Employees engaged in hazardous operations, including entry of vessels to clean polyvinyl chloride residue from vessel walls, shall be provided and required to wear and use:

(i) Respiratory protection in accordance with subsections (3) and (7) of this section; and

(ii) Protective garments to prevent skin contact with liquid vinyl chloride or with polyvinyl chloride residue from vessel walls. The protective garments shall be selected for the operation and its possible exposure conditions.

(b) Protective garments shall be provided clean and dry for each use.

(c) Emergency situations. A written operational plan for emergency situations shall be developed for each facility storing, handling, or otherwise using vinyl chloride as a liquid or compressed gas. Appropriate portions of the plan shall be implemented in the event of an emergency. The plan shall specifically provide that:

(i) Employees engaged in hazardous operations or correcting situations of existing hazardous releases shall be equipped as required in subdivisions (a) and (b) of this subsection;

(ii) Other employees not so equipped shall evacuate the area and not return until conditions are controlled by the methods required in subsection (6) of this section and the emergency is abated.

(9) Training. Each employee engaged in vinyl chloride or polyvinyl chloride operations shall be provided training in a program relating to the hazards of vinyl chloride and precautions for its safe use.

(a) The program shall include:

(i) The nature of the health hazard from chronic exposure to vinyl chloride including specifically the carcinogenic hazard;

(ii) The specific nature of operations which could result in exposure to vinyl chloride in excess of the permissible limit and necessary protective steps;

(iii) The purpose for, proper use, and limitations of respiratory protective devices;

(iv) The fire hazard and acute toxicity of vinyl chloride, and the necessary protective steps;

(v) The purpose for and a description of the monitoring program;

(vi) The purpose for and a description of, the medical surveillance program;

(vii) Emergency procedures:

(A) Specific information to aid the employee in recognition of conditions which may result in the release of vinyl chloride; and

(B) A review of this standard at the employee's first training and indoctrination program, and annually thereafter.

(b) All materials relating to the program shall be provided upon request to the director.

(10) Medical surveillance. A program of medical surveillance shall be instituted for each employee exposed, without regard to the use of respirators, to vinyl chloride in excess

of the action level. The program shall provide each such employee with an opportunity for examinations and tests in accordance with this subsection. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician and shall be provided without cost to the employee.

(a) At the time of initial assignment, or upon institution of medical surveillance;

(i) A general physical examination shall be performed with specific attention to detecting enlargement of liver, spleen or kidneys, or dysfunction in these organs, and for abnormalities in skin, connective tissues and the pulmonary system (see Appendix A).

(ii) A medical history shall be taken, including the following topics:

(A) Alcohol intake,

(B) Past history of hepatitis,

(C) Work history and past exposure to potential hepatotoxic agents, including drugs and chemicals,

(D) Past history of blood transfusions, and

(E) Past history of hospitalizations.

(iii) A serum specimen shall be obtained and determinations made of:

(A) Total bilirubin,

(B) Alkaline phosphatase,

(C) Serum glutamic oxalacetic transaminase (SGOT),

(D) Serum glutamic pyruvic transaminase (SGPT), and

(E) Gamma glutamyl transpeptidase.

(b) Examinations provided in accordance with this subdivision shall be performed at least:

(i) Every 6 months for each employee who has been employed in vinyl chloride or polyvinyl chloride manufacturing for 10 years or longer; and

(ii) Annually for all other employees.

(c) Each employee exposed to an emergency shall be afforded appropriate medical surveillance.

(d) A statement of each employee's suitability for continued exposure to vinyl chloride including use of protective equipment and respirators, shall be obtained from the examining physician promptly after any examination. A copy of the physician's statement shall be provided each employee.

(e) If any employee's health would be materially impaired by continued exposure, such employee shall be withdrawn from possible contact with vinyl chloride.

(f) Laboratory analyses for all biological specimens included in medical examinations shall be performed in laboratories licensed under 42 CFR Part 74.

(g) If the examining physician determines that alternative medical examinations to those required by subdivision (a) of this subsection will provide at least equal assurance of detecting medical conditions pertinent to the exposure to vinyl chloride, the employer may accept such alternative examinations as meeting the requirements of subdivision (a) of this subsection, if the employer obtains a statement from the examining physician setting forth the alternative examinations and the rationale for substitution. This statement shall be available upon request for examination and copying to authorized representatives of the director.

(11) Signs and labels.

(a) Entrances to regulated areas shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT AREA AUTHORIZED PERSONNEL
ONLY

(b) Areas containing hazardous operations or where an emergency currently exists shall be posted with legible signs bearing the legend:

CANCER-SUSPECT AGENT IN THIS AREA PROTECTIVE EQUIP-
MENT REQUIRED AUTHORIZED PERSONNEL ONLY

(c) Containers of polyvinyl chloride resin waste from reactors or other waste contaminated with vinyl chloride shall be legibly labeled:

CONTAMINATED WITH VINYL CHLORIDE CANCER-SUSPECT
AGENT

(d) Containers of polyvinyl chloride shall be legibly labeled:

POLYVINYL CHLORIDE (OR TRADE NAME) CONTAINS VINYL
CHLORIDE VINYL CHLORIDE IS A CANCER-SUSPECT AGENT

(e) Containers of vinyl chloride shall be legibly labeled either:

VINYL CHLORIDE EXTREMELY FLAMMABLE GAS UNDER PRES-
SURE CANCER-SUSPECT AGENT

(or)

(f) In accordance with 49 CFR Part 173, Subpart H, with the additional legends:

CANCER-SUSPECT AGENT

Applied near the label or placard.

(g) No statement shall appear on or near any required sign, label or instruction which contradicts or detracts from the effect of any required warning, information or instruction.

(12) Records.

(a) All records maintained in accordance with this section shall include the name and social security number of each employee where relevant.

(b) Records of required monitoring and measuring and medical records shall be provided upon request to employees, designated representatives, and the director in accordance with WAC 296-62-05201 through 296-62-05209; and 296-62-05213 through 296-62-05217. These records shall be provided upon request to the director. Authorized personnel rosters shall also be provided upon request to the director.

(i) Monitoring and measuring records shall:

(A) State the date of such monitoring and measuring and the concentrations determined and identify the instruments and methods used;

(B) Include any additional information necessary to determine individual employee exposures where such exposures are determined by means other than individual monitoring of employees; and

(C) Be maintained for not less than 30 years.

(ii) Medical records shall be maintained for the duration of the employment of each employee plus 20 years, or 30 years, whichever is longer.

(c) In the event that the employer ceases to do business and there is no successor to receive and retain his/her records for the prescribed period, these records shall be transmitted by registered mail to the director, and each employee individually notified in writing of this transfer. The employer shall also comply with any additional requirements set forth in WAC 296-62-05215.

(d) Employees or their designated representatives shall be provided access to examine and copy records of required monitoring and measuring.

(e) Former employees shall be provided access to examine and copy required monitoring and measuring records reflecting their own exposures.

(f) Upon written request of any employee, a copy of the medical record of that employee shall be furnished to any physician designated by the employee.

(13) Reports.

(a) Not later than 1 month after the establishment of a regulated area, the following information shall be reported to the director. Any changes to such information shall be reported within 15 days.

(i) The address and location of each establishment which has one or more regulated areas; and

(ii) The number of employees in each regulated area during normal operations, including maintenance.

(b) Emergencies and the facts obtainable at that time, shall be reported within 24 hours to the director. Upon request of the director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of similar nature.

(c) Within 10 working days following any monitoring and measuring which discloses that any employee has been exposed, without regard to the use of respirators, in excess of the permissible exposure limit, each such employee shall be notified in writing of the results of the exposure measurement and the steps being taken to reduce the exposure to within the permissible exposure limit.

(14) Effective January 1, 1975, the provisions set forth in WAC 296-62-07329 shall apply.

APPENDIX A SUPPLEMENTARY MEDICAL INFORMATION

When required tests under subsection (10)(a) of this section show abnormalities, the tests should be repeated as soon as practicable, preferably within 3 to 4 weeks. If tests remain abnormal, consideration should be given to withdrawal of the employee from contact with vinyl chloride, while a more comprehensive examination is made.

Additional tests which may be useful:

(A) For kidney dysfunction: Urine examination for albumin, red blood cells, and exfoliative abnormal cells.

(B) Pulmonary system: Forced vital capacity, forced expiratory volume at 1 second, and chest roentgenogram (posterior-anterior, 14 x 17 inches).

(C) Additional serum tests: Lactic acid dehydrogenase, lactic acid dehydrogenase isoenzyme, protein determination, and protein electrophoresis.

(D) For a more comprehensive examination on repeated abnormal serum tests: Hepatitis B antigen, and liver scanning.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07329, filed 7/20/94, effective 9/20/94; 91-03-044 (Order 90-18), § 296-62-07329, filed 1/10/91, effective 2/12/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-16-009 (Order 86-28), § 296-62-07329, filed 7/25/86; 82-13-045 (Order 82-22), § 296-62-07329, filed 6/11/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-07329, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07329, filed 7/27/81; Order 75-41, § 296-62-07329, filed 12/19/75.]

WAC 296-62-07336 Acrylonitrile. (1) Scope and application.

(a) This section applies to all occupational exposure to acrylonitrile (AN), Chemical Abstracts Service Registry No. 000107131, except as provided in (b) and (c) of this subsection.

(b) This section does not apply to exposures which result solely from the processing, use, and handling of the following materials:

(i) ABS resins, SAN resins, nitrile barrier resins, solid nitrile elastomers, and acrylic and modacrylic fibers, when these listed materials are in the form of finished polymers, and products fabricated from such finished polymers;

(ii) Materials made from and/or containing AN for which objective data is reasonably relied upon to demonstrate that the material is not capable of releasing AN in airborne concentrations in excess of 1 ppm as an eight-hour time-weighted average, under the expected conditions of processing, use, and handling which will cause the greatest possible release; and

(iii) Solid materials made from and/or containing AN which will not be heated above 170°F during handling, use, or processing.

(c) An employer relying upon exemption under (1)(b)(ii) shall maintain records of the objective data supporting that exemption, and of the basis of the employer's reliance on the data as provided in subsection (17) of this section.

(2) Definitions, as applicable to this section:

(a) "Acrylonitrile" or "AN" - acrylonitrile monomer, chemical formula $CH_2 = CHCN$.

(b) "Action level" - a concentration of AN of 1 ppm as an eight-hour time-weighted average.

(c) "Authorized person" - any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the opportunity to observe monitoring procedures under subsection (18) of this section.

(d) "Decontamination" means treatment of materials and surfaces by water washdown, ventilation, or other means, to assure that the materials will not expose employees to airborne concentrations of AN above 1 ppm as an eight-hour time-weighted average.

(e) "Director" - the director of labor and industries, or his authorized representative.

(f) "Emergency" - any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which is likely to, or does, result in unexpected exposure to AN in excess of the ceiling limit.

(g) "Liquid AN" means AN monomer in liquid form, and liquid or semiliquid polymer intermediates, including slurries, suspensions, emulsions, and solutions, produced during the polymerization of AN.

(h) "Polyacrylonitrile" or "PAN" - polyacrylonitrile homopolymers or copolymers, except for materials as exempted under subsection (1)(b) of this section.

(3) Permissible exposure limits.

(a) Inhalation.

(i) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of two parts acrylonitrile per million parts of air (2 ppm), as an eight-hour time-weighted average.

(ii) Ceiling limit. The employer shall assure that no employee is exposed to an airborne concentration of acrylonitrile in excess of 10 ppm as averaged over any fifteen-minute period during the working day.

(b) Dermal and eye exposure. The employer shall assure that no employee is exposed to skin contact or eye contact with liquid AN or PAN.

(4) Notification of use and emergencies.

(a) Use. Within ten days of the effective date of this standard, or within fifteen days following the introduction of AN into the workplace, every employer shall report, unless he has done so pursuant to the emergency temporary standard, the following information to the director for each such workplace:

(i) The address and location of each workplace in which AN is present;

(ii) A brief description of each process of operation which may result in employee exposure to AN;

(iii) The number of employees engaged in each process or operation who may be exposed to AN and an estimate of the frequency and degree of exposure that occurs; and

(iv) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to AN. Whenever there has been a significant change in the information required by this subsection, the employer shall promptly amend such information previously provided to the director.

(b) Emergencies and remedial action. Emergencies, and the facts obtainable at that time, shall be reported within 24 hours of the initial occurrence to the director. Upon request of the director, the employer shall submit additional information in writing relevant to the nature and extent of employee exposures and measures taken to prevent future emergencies of a similar nature.

(5) Exposure monitoring.

(a) General.

(i) Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to AN over an eight-hour period.

(ii) For the purposes of this section, employee exposure is that which would occur if the employee were not using a respirator.

(b) Initial monitoring. Each employer who has a place of employment in which AN is present shall monitor each such workplace and work operation to accurately determine the airborne concentrations of AN to which employees may be

exposed. Such monitoring may be done on a representative basis, provided that the employer can demonstrate that the determinations are representative of employee exposures.

(c) Frequency.

(i) If the monitoring required by this section reveals employee exposure to be below the action level, the employer may discontinue monitoring for that employee. The employer shall continue these quarterly measurements until at least two consecutive measurements taken at least seven days apart, are below the action level, and thereafter the employer may discontinue monitoring for that employee.

(ii) If the monitoring required by this section reveals employee exposure to be at or above the action level but below the permissible exposure limits, the employer shall repeat such monitoring for each such employee at least quarterly.

(iii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly measurements until at least two consecutive measurements, taken at least seven days apart, are below the permissible exposure limits, and thereafter the employer shall monitor at least quarterly.

(d) Additional monitoring. Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to AN, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to AN, additional monitoring which complies with this subsection shall be conducted.

(e) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

(ii) Whenever the results indicate that the representative employee exposure exceeds the permissible exposure limits, the employer shall include in the written notice a statement that the permissible exposure limits were exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.

(f) Accuracy of measurement. The method of measurement of employee exposures shall be accurate, to a confidence level of 95 percent, to within plus or minus 25 percent for concentrations of AN at or above the permissible exposure limits, and plus or minus 35 percent for concentrations of AN between the action level and the permissible exposure limits.

(g) Weekly survey of operations involving liquid AN. In addition to monitoring of employee exposures to AN as otherwise required by this subsection, the employer shall survey areas of operations involving liquid AN at least weekly to detect points where AN liquid or vapor are being released into the workplace. The survey shall employ an infra-red gas analyzer calibrated for AN, a multipoint gas chromatographic monitor, or comparable system for detection of AN. A listing of levels detected and areas of AN release, as determined from the survey, shall be posted prominently in the workplace, and shall remain posted until the next survey is completed.

(6) Regulated areas.

(a) The employer shall establish regulated areas where AN concentrations are in excess of the permissible exposure limits.

(b) Regulated areas shall be demarcated and segregated from the rest of the workplace, in any manner that minimizes the number of persons who will be exposed to AN.

(c) Access to regulated areas shall be limited to authorized persons or to persons otherwise authorized by the act or regulations issued pursuant thereto.

(d) The employer shall assure that in the regulated area, food or beverages are not present or consumed, smoking products are not present or used, and cosmetics are not applied, (except that these activities may be conducted in the lunchrooms, change rooms and showers required under subsections (13)(a)-(13)(c) of this section.

(7) Methods of compliance.

(a) Engineering and work practice controls.

(i) The employer shall institute engineering or work practice controls to reduce and maintain employee exposures to AN, to or below the permissible exposure limits, except to the extent that the employer establishes that such controls are not feasible.

(ii) Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposures to or below the permissible exposure limits, the employer shall nonetheless use them to reduce exposures to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection which complies with the requirements of subsection (8) of this section.

(b) Compliance program.

(i) The employer shall establish and implement a written program to reduce employee exposures to or below the permissible exposure limits solely by means of engineering and work practice controls, as required by subsection (7)(a) of this section.

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation or process resulting in employee exposure to AN above the permissible exposure limits;

(B) Engineering plans and other studies used to determine the controls for each process;

(C) A report of the technology considered in meeting the permissible exposure limits;

(D) A detailed schedule for the implementation of engineering or work practice controls; and

(E) Other relevant information.

(iii) The employer shall complete the steps set forth in the compliance program by the dates in the schedule.

(iv) Written plans for such a program shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, or any affected employee or representative.

(v) The plans required by this subsection shall be revised and updated at least every six months to reflect the current status of the program.

(8) Respiratory protection.

(a) General. The employer shall assure that respirators are used where required pursuant to this section to reduce

employee exposure to within the permissible exposure limits and in emergencies. Compliance with the permissible exposure limits may not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement feasible engineering and work practice controls; or

(ii) In work operations such as maintenance and repair activities in which the employer establishes that engineering and work practice controls are not feasible; or

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limits; or

(iv) In emergencies.

(b) Respirator selection.

(i) Where respiratory protection is required under this section, the employer shall select and provide at no cost to the employee, the appropriate type of respirator from Table I and shall assure that the employee wears the respirator provided.

TABLE I
RESPIRATORY PROTECTION FOR ACRYLONITRILE (AN)

Concentration of AN or Condition of Use	Respirator Type
(a) Less than or equal to 25 x permissible exposure limits.	(i) Any Type C supplied air respirator.
(b) Less than or equal to 100 x permissible exposure limits.	(i) Any supplied air respirator with full facepiece; or
	(ii) Any self-contained breathing apparatus with full facepiece.
(c) Less than or equal to 250 x permissible exposure limits	(i) Supplied air respirator in positive pressure mode with full facepiece, helmet, hood, or suit.
	(ii) Open circuit self-contained breathing apparatus with full facepiece in positive pressure mode.
(d) Greater than 250 x permissible exposure limits.	(i) Supplied air respirator with full facepiece and an auxiliary self-contained air supply, operated in pressure demand mode; or
	(ii) Open circuit self-contained breathing apparatus with full facepiece in positive pressure mode.
(e) Emergency entry into unknown concentration or firefighting	(i) Any self-contained breathing apparatus with full facepiece in positive pressure mode.
(f) Escape.	(i) Any organic vapor gas mask; or
	(ii) Any self-contained breathing.

(ii) The employer shall select respirators from those approved for use with AN by the National Institute for Occupational Safety and Health under the provisions of WAC 296-62-071.

(c) Respirator program.

(i) The employer shall institute a respiratory protection program in accordance with WAC 296-62-071.

(ii) Testing. Fit testing of respirators shall be performed to assure that the respirator selected provides the protection required by Table I.

(A) Qualitative fit. The employer shall perform qualitative fit tests at the time of initial fitting and at least semiannually thereafter for each employee wearing respirators.

(B) Quantitative fit. Each employer with more than ten employees wearing negative pressure respirators shall perform quantitative fit testing at the time of initial fitting and at least semiannually thereafter for each such employee.

(iii) Employees who wear respirators shall be allowed to wash their faces and respirator facepieces to prevent potential skin irritation associated with respirator use.

(9) Emergency situations.

(a) Written plans.

(i) A written plan for emergency situations shall be developed for each workplace where AN is present. Appropriate portions of the plan shall be implemented in the event of an emergency.

(ii) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped as required in subsection (8) of this section until the emergency is abated.

(b) Alerting employees.

(i) Where there is the possibility of employee exposure to AN in excess of the ceiling limit due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.

(ii) Employees not engaged in correcting the emergency shall be evacuated from the area and shall not be permitted to return until the emergency is abated.

(10) Protective clothing and equipment.

(a) Provision and use. Where eye or skin contact with liquid AN or PAN may occur, the employer shall provide at no cost to the employee, and assure that employees wear, appropriate protective clothing or other equipment in accordance with WAC 296-24-07501 and 296-24-07801 to protect any area of the body which may come in contact with liquid AN or PAN.

(b) Cleaning and replacement.

(i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this subsection, as needed to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

(ii) The employer shall assure that impermeable protective clothing which contacts or is likely to have contacted liquid AN shall be decontaminated before being removed by the employee.

(iii) The employer shall assure that AN- or PAN-contaminated protective clothing and equipment is placed and stored in closable containers which prevent dispersion of the AN or PAN outside the container.

(iv) The employer shall assure that an employee whose nonimpermeable clothing becomes wetted with liquid AN shall immediately remove that clothing and proceed to shower. The clothing shall be decontaminated before it is removed from the regulated area.

(v) The employer shall assure that no employee removes AN-or PAN-contaminated protective equipment or clothing from the change room, except for those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(vi) The employer shall inform any person who launders or cleans AN-or PAN-contaminated protective clothing or equipment of the potentially harmful effects of exposure to AN.

(vii) The employer shall assure that containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with subsection (16)(c)(ii) of this section, and that such labels remain affixed when such containers leave the employer's workplace.

(11) Housekeeping.

(a) All surfaces shall be maintained free of accumulations of liquid AN and of PAN.

(b) For operations involving liquid AN, the employer shall institute a program for detecting leaks and spills of liquid AN, including regular visual inspections.

(c) Where spills of liquid AN are detected, the employer shall assure that surfaces contacted by the liquid AN are decontaminated. Employees not engaged in decontamination activities shall leave the area of the spill, and shall not be permitted in the area until decontamination is completed.

(d) Liquids. Where AN is present in a liquid form, or as a resultant vapor, all containers or vessels containing AN shall be enclosed to the maximum extent feasible and tightly covered when not in use, with adequate provision made to avoid any resulting potential explosion hazard.

(e) Surfaces.

(i) Dry sweeping and the use of compressed air for the cleaning of floors and other surfaces where AN and PAN are found is prohibited.

(ii) Where vacuuming methods are selected, either portable units or a permanent system may be used.

(A) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that AN is not reintroduced into the workplace air; and

(B) Portable vacuum units used to collect AN may not be used for other cleaning purposes and shall be labeled as prescribed by subsection (16)(c)(ii) of this section.

(iii) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.

(12) Waste disposal. AN and PAN waste, scrap, debris, bags, containers or equipment, shall be disposed of in sealed bags or other closed containers which prevent dispersion of AN outside the container, and labeled as prescribed in subsection (16)(c)(ii) of this section.

(13) Hygiene facilities and practices. Where employees are exposed to airborne concentrations of AN above the permissible exposure limits, or where employees are required to wear protective clothing or equipment pursuant to subsection (11) of this section, or where otherwise found to be appropriate, the facilities required by WAC 296-24-12009 shall be

provided by the employer for the use of those employees, and the employer shall assure that the employees use the facilities provided. In addition, the following facilities or requirements are mandated.

(a) Change rooms. The employer shall provide clean change rooms in accordance with WAC 296-24-12011.

(b) Showers.

(i) The employer shall provide shower facilities in accordance with WAC 296-24-12009(3).

(ii) In addition, the employer shall also assure that employees exposed to liquid AN and PAN shower at the end of the work shift.

(iii) The employer shall assure that, in the event of skin or eye exposure to liquid AN, the affected employee shall shower immediately to minimize the danger of skin absorption.

(c) Lunchrooms.

(i) Whenever food or beverages are consumed in the workplace, the employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees exposed to AN above the permissible exposure limits.

(ii) In addition, the employer shall also assure that employees exposed to AN above the permissible exposure limits wash their hands and face prior to eating.

(14) Medical surveillance.

(a) General.

(i) The employer shall institute a program of medical surveillance for each employee who is or will be exposed to AN above the action level. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subsection.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

(b) Initial examinations. At the time of initial assignment, or upon institution of the medical surveillance program, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:

(i) A work history and medical history with special attention to skin, respiratory, and gastrointestinal systems, and those non-specific symptoms, such as headache, nausea, vomiting, dizziness, weakness, or other central nervous system dysfunctions that may be associated with acute or chronic exposure to AN.

(ii) A physical examination giving particular attention to central nervous system, gastrointestinal system, respiratory system, skin and thyroid.

(iii) A 14" x 17" posteroanterior chest x-ray.

(iv) Further tests of the intestinal tract, including fecal occult blood screening, and proctosigmoidoscopy, for all workers 40 years of age or older, and for any other affected employees for whom, in the opinion of the physician, such testing is appropriate.

(c) Periodic examinations.

(i) The employer shall provide examinations specified in this subsection at least annually for all employees specified in subsection (14)(a) of this section.

(ii) If an employee has not had the examinations prescribed in subsection (14)(b) of this section within six months of termination of employment, the employer shall make such examination available to the employee upon such termination.

(d) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to AN, the employer shall provide appropriate examination and emergency medical treatment.

(e) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this standard and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level;

(iv) The employee's anticipated or estimated exposure level (for preplacement examinations or in cases of exposure due to an emergency);

(v) A description of any personal protective equipment used or to be used; and

(vi) Information from previous medical examinations of the affected employee, which is not otherwise available to the examining physician.

(f) Physician's written opinion.

(i) The employer shall obtain a written opinion from the examining physician which shall include:

(A) The results of the medical examination and test performed;

(B) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of the employee's health from exposure to AN;

(C) Any recommended limitations upon the employee's exposure to AN or upon the use of protective clothing and equipment such as respirators; and

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to AN.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(15) Employee information and training.

(a) Training program.

(i) The employer shall institute a training program for all employees where there is occupational exposure to AN and shall assure their participation in the training program.

(ii) The training program shall be provided at the time of initial assignment, or upon institution of the training program, and at least annually thereafter, and the employer shall assure that each employee is informed of the following:

(A) The information contained in Appendices A, B and C;

(B) The quantity, location, manner of use, release or storage of AN and the specific nature of operations which could result in exposure to AN, as well as any necessary protective steps;

(C) The purpose, proper use, and limitations of respirators and protective clothing;

(D) The purpose and a description of the medical surveillance program required by subsection (14) of this section;

(E) The emergency procedures developed, as required by subsection (9) of this section; and

(F) The engineering and work practice controls, their function and the employee's relationship thereto; and

(G) A review of this standard.

(b) Access to training materials.

(i) The employer shall make a copy of this standard and its appendices readily available to all affected employees.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(16) Signs and labels.

(a) General.

(i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to, or in combination with, signs and labels required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign or label, required by this subsection, which contradicts or detracts from such effects of the required sign or label.

(b) Signs.

(i) The employer shall post signs to clearly indicate all workplaces where AN concentrations exceed the permissible exposure limits. The signs shall bear the following legend:

DANGER
ACRYLONITRILE (AN)
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED

(ii) The employer shall assure that signs required by this subsection are illuminated and cleaned as necessary so that the legend is readily visible.

(c) Labels.

(i) The employer shall assure that precautionary labels are affixed to all containers of AN, and to containers of PAN and products fabricated from PAN, except for those materials for which objective data is provided as to the conditions specified in subsection (1)(b) of this section. The employer shall assure that the labels remain affixed when the AN or PAN are sold, distributed or otherwise leave the employer's workplace.

(ii) The employer shall assure that the precautionary labels required by this subsection are readily visible and legible. The labels shall bear the following legend:

DANGER
CONTAINS ACRYLONITRILE (AN)
CANCER HAZARD

(17) Recordkeeping.

(a) Objective data for exempted operations.

(i) Where the processing, use, and handling of products fabricated from PAN are exempted pursuant to subsection (1)(b) of this section, the employer shall establish and main-

tain an accurate record of objective data reasonably relied upon in support of the exemption.

(ii) This record shall include the following information:

(A) The relevant condition in subsection (1)(b) upon which exemption is based;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of AN;

(D) A description of the operation exempted and how the data supports the exemption; and

(E) Other data relevant to the operations, materials, and processing covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(b) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (5) of this section.

(ii) This record shall include:

(A) The dates, number, duration, and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

(B) A description of the sampling and analytical methods used and the data relied upon to establish that the methods used meet the accuracy and precision requirements of subsection (5)(f) of this section;

(C) Type of respiratory protective devices worn, if any; and

(D) Name, social security number and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least 40 years or the duration of employment plus 20 years, whichever is longer.

(c) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subsection (14) of this section.

(ii) This record shall include:

(A) A copy of the physicians' written opinions;

(B) Any employee medical complaints related to exposure to AN;

(C) A copy of the information provided to the physician as required by subsection (14)(f) of this section; and

(D) A copy of the employee's medical and work history.

(iii) The employer shall assure that this record be maintained for at least forty years or for the duration of employment plus twenty years, whichever is longer.

(d) Availability.

(i) The employer shall assure that all records required to be maintained by this section be made available upon request to the director for examination and copying.

(ii) Records required by subdivisions (a) through (c) of this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217. Records required by subdivision (a) of this section shall be provided in the same manner as exposure monitoring records.

(iii) The employer shall assure that employee medical records required to be maintained by this section, be made available, upon request, for examination and copying, to the affected employee or former employee, or to a physician designated by the affected employee, former employee, or designated representative.

(e) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, these records shall be transmitted to the director.

(iii) At the expiration of the retention period for the records required to be maintained pursuant to this section, the employer shall transmit these records to the director.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in WAC 296-62-05215.

(18) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to AN conducted pursuant to subsection (5) of this section.

(b) Observation procedures.

(i) Whenever observation of the monitoring of employee exposure to AN requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled:

(A) To receive an explanation of the measurement procedures;

(B) To observe all steps related to the measurement of airborne concentrations of AN performed at the place of exposure; and

(C) To record the results obtained.

(19) Effective date. This standard will become effective July 28, 1978.

(20) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligation not otherwise imposed, or to detract from any obligation.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07336, filed 5/11/88.]

WAC 296-62-07337 Appendix A—Substance safety data sheet for acrylonitrile. (1) Substance identification.

(a) Substance: Acrylonitrile (CH₂ CHCN).

(b) Synonyms: Propenenitrile; vinyl cyanide; cyanoethylene; AN; VCN; acylon; carbacryl; fumigriant; ventox.

(c) Acrylonitrile can be found as a liquid or vapor, and can also be found in polymer resins, rubbers, plastics, polyols, and other polymers having acrylonitrile as a raw or intermediate material.

(d) AN is used in the manufacture of acrylic and modiacrylic fibers, acrylic plastics and resins, speciality polymers, nitrile rubbers, and other organic chemicals. It has also been used as a fumigant.

(e) Appearance and odor: Colorless to pale yellow liquid with a pungent odor which can only be detected at concentrations above the permissible exposure level, in a range of 13-19 parts AN per million parts of air (13-19 ppm).

(f) Permissible exposure: Exposure may not exceed either:

(i) Two parts AN per million parts of air (2 ppm) averaged over the eight-hour workday; or

(ii) Ten parts AN per million parts of air (10 ppm) averaged over any fifteen-minute period in the workday.

(iii) In addition, skin and eye contact with liquid AN is prohibited.

(2) Health hazard data.

(a) Acrylonitrile can affect your body if you inhale the vapor (breathing), if it comes in contact with your eyes or skin, or if you swallow it. It may enter your body through your skin.

(b) Effects of overexposure:

(i) Short-term exposure: Acrylonitrile can cause eye irritation, nausea, vomiting, headache, sneezing, weakness, and light-headedness. At high concentrations, the effects of exposure may go on to loss of consciousness and death. When acrylonitrile is held in contact with the skin after being absorbed into shoe leather or clothing, it may produce blisters following several hours of no apparent effect. Unless the shoes or clothing are removed immediately and the area washed, blistering will occur. Usually there is no pain or inflammation associated with blister formation.

(ii) Long-term exposure: Acrylonitrile has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Repeated or prolonged exposure of the skin to acrylonitrile may produce irritation and dermatitis.

(iii) Reporting signs and symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to acrylonitrile.

(3) Emergency first aid procedures.

(a) Eye exposure: If acrylonitrile gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

(b) Skin exposure: If acrylonitrile gets on your skin, immediately wash the contaminated skin with water. If acrylonitrile soaks through your clothing, especially your shoes, remove the clothing immediately and wash the skin with water. If symptoms occur after washing, get medical attention immediately. Thoroughly wash the clothing before reusing. Contaminated leather shoes or other leather articles should be discarded.

(c) Inhalation: If you or any other person breathes in large amounts of acrylonitrile, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

(d) Swallowing: When acrylonitrile has been swallowed, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

(e) Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

(f) Special first aid procedures: First aid kits containing an adequate supply (at least two dozen) of amyl nitrite pearls, each containing 0.3 ml, should be maintained at each site where acrylonitrile is used. When a person is suspected of receiving an overexposure to acrylonitrile, immediately remove that person from the contaminated area using established rescue procedures. Contaminated clothing must be removed and the acrylonitrile washed from the skin immediately. Artificial respiration should be started at once if breathing has stopped. If the person is unconscious, amyl nitrite may be used as an antidote by a properly trained individual in accordance with established emergency procedures. Medical aid should be obtained immediately.

(4) Respirators and protective clothing.

(a) Respirators:

(i) You may be required to wear a respirator for non-routine activities, in emergencies, while your employer is in the process of reducing acrylonitrile exposures through engineering controls, and in areas where engineering controls are not feasible. If respirators are worn, they must have a Mine Safety and Health Administration (MSHA or MESA) or National Institute for Occupational Safety and Health (NIOSH) label of approval for use with organic vapors. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required.

(ii) Acrylonitrile does not have a detectable odor except at levels above the permissible exposure limits. Do not depend on odor to warn you when a respirator cartridge or canister is exhausted. Cartridges or canisters must be changed daily or before the end-of-service-life, whichever comes first. Reuse of these may allow acrylonitrile to gradually filter through the cartridge and cause exposures which you cannot detect by odor. If you can smell acrylonitrile while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

(b) Supplied-air suits: In some work situations, the wearing of supplied-air suits may be necessary. Your employer must instruct you in their proper use and operation.

(c) Protective clothing:

(i) You must wear impervious clothing, gloves, face shield, or other appropriate protective clothing to prevent skin contact with liquid acrylonitrile. Where protective clothing is required, your employer is required to provide clean garments to you as necessary to assume that the clothing protects you adequately.

(ii) Replace or repair impervious clothing that has developed leaks.

(iii) Acrylonitrile should never be allowed to remain on the skin. Clothing and shoes which are not impervious to acrylonitrile should not be allowed to become contaminated with acrylonitrile, and if they do the clothing and shoes should be promptly removed and decontaminated. The clothing should be laundered or discarded after the AN is removed. Once acrylonitrile penetrates shoes or other leather articles, they should not be worn again.

(d) Eye protection: You must wear splashproof safety goggles in areas where liquid acrylonitrile may contact your eyes. In addition, contact lenses should not be worn in areas where eye contact with acrylonitrile can occur.

(5) Precautions for safe use, handling, and storage.

(a) Acrylonitrile is a flammable liquid, and its vapors can easily form explosive mixtures in air.

(b) Acrylonitrile must be stored in tightly closed containers in a cool, well-ventilated area, away from heat, sparks, flames, strong oxidizers (especially bromine), strong bases, copper, copper alloys, ammonia, and amines.

(c) Sources of ignition such as smoking and open flames are prohibited wherever acrylonitrile is handled, used, or stored in a manner that could create a potential fire or explosion hazard.

(d) You should use nonsparking tools when opening or closing metal containers of acrylonitrile, and containers must be bonded and grounded when pouring or transferring liquid acrylonitrile.

(e) You must immediately remove any nonimpervious clothing that becomes wetted with acrylonitrile, and this clothing must not be reworn until the acrylonitrile is removed from the clothing.

(f) Impervious clothing wet with liquid acrylonitrile can be easily ignited. This clothing must be washed down with water before you remove it.

(g) If your skin becomes wet with liquid acrylonitrile, you must promptly and thoroughly wash or shower with soap or mild detergent to remove any acrylonitrile from your skin.

(h) You must not keep food, beverages, or smoking materials, nor are you permitted to eat or smoke in regulated areas where acrylonitrile concentrations are above the permissible exposure limits.

(i) If you contact liquid acrylonitrile, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

(j) Fire extinguishers and quick drenching facilities must be readily available, and you should know where they are and how to operate them.

(k) Ask your supervisor where acrylonitrile is used in your work area and for any additional plant safety and health rules.

(6) Access to information.

(a) Each year, your employer is required to inform you of the information contained in this Substance Safety Data Sheet for acrylonitrile. In addition, your employer must instruct you in the proper work practices for using acrylonitrile, emergency procedures, and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to acrylonitrile. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.

(c) Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least forty years or for the period of your employment plus twenty years, whichever is longer.

(d) Your employer is required to release your exposure and medical records to you or your representative upon your request.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07337, filed 7/20/94, effective 9/20/94; 88-11-021 (Order 88-04), § 296-62-07337, filed 5/11/88.]

WAC 296-62-07338 Appendix B—Substance technical guidelines for acrylonitrile. (1) Physical and chemical data.

(a) Substance identification:

(i) Synonyms: AN; VCN; vinyl cyanide; propenenitrile; cyanoethylene; Acrylon; Carbacryl; Fumigrain; Ventox.

(ii) Formula: $\text{CH}_2 = \text{CHCN}$.

(iii) Molecular weight: 53.1.

(b) Physical data:

(i) Boiling point (760 mm Hg): 77.3°C (171°F);

(ii) Specific gravity (water = 1): 0.81 (at 20°C or 68°F);

(iii) Vapor density (air = 1 at boiling point of acrylonitrile): 1.83;

(iv) Melting point: -83°C (-117°F);

(v) Vapor pressure (@20°F): 83 mm Hg;

(vi) Solubility in water, percent by weight @20°C (68°F): 7.35;

(vii) Evaporation rate (Butyl Acetate = 1): 4.54; and

(viii) Appearance and odor: Colorless to pale yellow liquid with a pungent odor at concentrations above the permissible exposure level. Any detectable odor of acrylonitrile may indicate overexposure.

(2) Fire, explosion, and reactivity hazard data.

(a) Fire:

(i) Flash point: -1°C (30°F) (closed cup).

(ii) Autoignition temperature: 481°C (898°F).

(iii) Flammable limits air, percent by volume: Lower: 3, Upper: 17.

(iv) Extinguishing media: Alcohol foam, carbon dioxide, and dry chemical.

(v) Special fire-fighting procedures: Do not use a solid stream of water, since the stream will scatter and spread the fire. Use water to cool containers exposed to a fire.

(vi) Unusual fire and explosion hazards: Acrylonitrile is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where acrylonitrile is handled, used, or stored in a manner that could create a potential fire or explosion hazard. Acrylonitrile vapors are heavier than air and may travel along the ground

and be ignited by open flames or sparks at locations remote from the site at which acrylonitrile is being handled.

(vii) For purposes of compliance with the requirements of WAC 296-24-330, acrylonitrile is classified as a class IB flammable liquid. For example, 7,500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

(viii) For purposes of compliance with WAC 296-24-59207, acrylonitrile is classified as a Class B fire hazard.

(ix) For purpose of compliance with WAC 296-24-95613, locations classified as hazardous due to the presence of acrylonitrile shall be Class I, Group D.

(b) Reactivity:

(i) Conditions contributing to instability: Acrylonitrile will polymerize when hot, and the additional heat liberated by the polymerization may cause containers to explode. Pure AN may self-polymerize, with a rapid build-up of pressure, resulting in an explosion hazard. Inhibitors are added to the commercial product to prevent self-polymerization.

(ii) Incompatibilities: Contact with strong oxidizers (especially bromine) and strong bases may cause fires and explosions. Contact with copper, copper alloys, ammonia, and amines may start serious decomposition.

(iii) Hazardous decomposition products: Toxic gases and vapors (such as hydrogen cyanide, oxides of nitrogen, and carbon monoxide) may be released in a fire involving acrylonitrile and certain polymers made from acrylonitrile.

(iv) Special precautions: Liquid acrylonitrile will attack some forms of plastics, rubbers, and coatings.

(3) Spill, leak, and disposal procedures.

(a) If acrylonitrile is spilled or leaked, the following steps should be taken:

(i) Remove all ignition sources.

(ii) The area should be evacuated at once and re-entered only after the area has been thoroughly ventilated and washed down with water.

(iii) If liquid acrylonitrile or polymer intermediate, collect for reclamation or absorb in paper, vermiculite, dry sand, earth, or similar material, or wash down with water into process sewer system.

(b) Persons not wearing protective equipment should be restricted from areas of spills or leaks until clean-up has been completed.

(c) Waste disposal methods: Waste materials shall be disposed of in a manner that is not hazardous to employees or to the general population. Spills of acrylonitrile and flushing of such spills shall be channeled for appropriate treatment or collection for disposal. They shall not be channeled directly into the sanitary sewer system. In selecting the method of waste disposal, applicable local, state, and federal regulations should be consulted.

(4) Monitoring and measurement procedures.

(a) Exposure above the permissible exposure limit:

(i) Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken so that the average eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

(ii) Ceiling evaluation: Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentrations of acrylonitrile in the employee's breathing zone. A minimum of three measurements should be taken on one work shift. The average of all measurements taken is an estimate of the employee's ceiling exposure.

(iii) Monitoring techniques: The sampling and analysis under this section may be performed by collecting the acrylonitrile vapor on charcoal adsorption tubes or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by instruments such as real-time continuous monitoring systems, portable direct-reading instruments, or passive dosimeters. Analysis of resultant samples should be by gas chromatograph.

(iv) Appendix D lists methods of sampling and analysis which have been tested by NIOSH and OSHA for use with acrylonitrile. NIOSH and OSHA have validated modifications of NIOSH Method S-156 (see Appendix D) under laboratory conditions for concentrations below 1 ppm. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his/her unique field conditions. The standard requires that methods of monitoring must be accurate, to a 95-percent confidence level, to ± 35 -percent for concentrations of AN at or above 2 ppm, and to ± 50 -percent for concentrations below 2 ppm. In addition to the methods described in Appendix D, there are numerous other methods available for monitoring for AN in the workplace. Details on these other methods have been submitted by various companies to the rulemaking record, and are available at the OSHA Docket Office.

(b) Since many of the duties relating to employee exposure are dependent on the results of monitoring and measuring procedures, employers shall assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

(5) Protective clothing.

(a) Employees shall be provided with and required to wear appropriate protective clothing to prevent any possibility of skin contact with liquid AN. Because acrylonitrile is absorbed through the skin, it is important to prevent skin contact with liquid AN. Protective clothing shall include impermeable coveralls or similar full-body work clothing, gloves, head-coverings, as appropriate to protect areas of the body which may come in contact with liquid AN.

(b) Employers should ascertain that the protective garments are impermeable to acrylonitrile. Nonimpermeable clothing and shoes should not be allowed to become contaminated with liquid AN. If permeable clothing does become contaminated, it should be promptly removed, placed in a regulated area for removal of the AN, and not worn again until the AN is removed. If leather footwear or other leather garments become wet from acrylonitrile, they should be replaced and not worn again, due to the ability of leather to absorb acrylonitrile and hold it against the skin. Since there is no pain associated with the blistering which may result from skin contact with liquid AN, it is essential that the employee be informed of this hazard so that he or she can be protected.

(c) Any protective clothing which has developed leaks or is otherwise found to be defective shall be repaired or replaced. Clean protective clothing shall be provided to the employee as necessary to assure its protectiveness. Whenever impervious clothing becomes wet with liquid AN, it shall be washed down with water before being removed by the employee. Employees are also required to wear splash-proof safety goggles where there is any possibility of acrylonitrile contacting the eyes.

(6) Housekeeping and hygiene facilities. For purposes of complying with WAC 296-24-120, the following items should be emphasized:

(a) The workplace should be kept clean, orderly, and in a sanitary condition. The employer is required to institute a leak and spill detection program for operations involving liquid AN in order to detect sources of fugitive AN emissions.

(b) Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where liquid AN may be found.

(c) Adequate washing facilities with hot and cold water are to be provided, and maintained in a sanitary condition. Suitable cleansing agents are also to be provided to assure the effective removal of acrylonitrile from the skin.

(d) Change or dressing rooms with individual clothes storage facilities must be provided to prevent the contamination of street clothes with acrylonitrile. Because of the hazardous nature of acrylonitrile, contaminated protective clothing should be placed in a regulated area designated by the employer for removal of the AN before the clothing is laundered or disposed of.

(7) Miscellaneous precautions.

(a) Store acrylonitrile in tightly-closed containers in a cool, well-ventilated area and take necessary precautions to avoid any explosion hazard.

(b) High exposures to acrylonitrile can occur when transferring the liquid from one container to another.

(c) Nonsparking tools must be used to open and close metal acrylonitrile containers. These containers must be effectively grounded and bonded prior to pouring.

(d) Never store uninhibited acrylonitrile.

(e) Acrylonitrile vapors are not inhibited.

They may form polymers and clog vents of storage tanks.

(f) Use of supplied-air suits or other impervious coverings may be necessary to prevent skin contact with and provide respiratory protection from acrylonitrile where the concentration of acrylonitrile is unknown or is above the ceiling limit. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits.

(g) Employers shall advise employees of all areas and operations where exposure to acrylonitrile could occur.

(8) Common operations. Common operations in which exposure to acrylonitrile is likely to occur include the following: Manufacture of the acrylonitrile monomer; synthesis of acrylic fibers, ABS, SAN, and nitrile barrier plastics and resins, nitrile rubber, surface coatings, specialty chemicals; use as a chemical intermediate; use as a fumigant; and in the cyanoethylation of cotton.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07338, filed 5/11/88.]

WAC 296-62-07339 Appendix C—Medical surveillance guidelines for acrylonitrile. (1) Route of entry.

- (a) Inhalation;
- (b) Skin absorption;
- (c) Ingestion.

(2) Toxicology.

(a) Acrylonitrile vapor is an asphyxiant due to inhibitory action on metabolic enzyme systems. Animals exposed to 75 or 100 ppm for seven hours have shown signs of anoxia; in some animals which died at the higher level, cyanomethemoglobin was found in the blood. Two human fatalities from accidental poisoning have been reported; one was caused by inhalation of an unknown concentration of the vapor, and the other was thought to be caused by skin absorption or inhalation. Most cases of intoxication from industrial exposure have been mild, with rapid onset of eye irritation, headache, sneezing, and nausea. Weakness, lightheadedness, and vomiting may also occur. Exposure to high concentrations may produce profound weakness, asphyxia, and death. The vapor is a severe eye irritant. Prolonged skin contact [contact] with the liquid may result in absorption with systemic effects, and in the formation of large blisters after a latent period of several hours. Although there is usually little or no pain or inflammation, the affected skin resembles a second-degree thermal burn. Solutions spilled on exposed skin, or on areas covered only by a light layer of clothing, evaporate rapidly, leaving no irritation, or, at the most, mild transient redness. Repeated spills on exposed skin may result in dermatitis due to solvent effects.

(b) Results after one year of a planned two-year animal study on the effects of exposure to acrylonitrile have indicated that rats ingesting as little as 35 ppm in their drinking water develop tumors of the central nervous system. The interim results of this study have been supported by a similar study being conducted by the same laboratory, involving exposure of rats by inhalation of acrylonitrile vapor, which has shown similar types of tumors in animals exposed to 80 ppm.

(c) In addition, the preliminary results of an epidemiological study being performed by duPont on a cohort of workers in their Camden, S.C. acrylic fiber plant indicate a statistically significant increase in the incidence of colon and lung cancers among employees exposed to acrylonitrile.

(3) Signs and symptoms of acute overexposure. Asphyxia and death can occur from exposure to high concentrations of acrylonitrile. Symptoms of overexposure include eye irritation, headache, sneezing, nausea and vomiting, weakness, and light-headedness. Prolonged skin contact can cause blisters on the skin with appearance of a second-degree burn, but with little or no pain. Repeated skin contact may produce scaling dermatitis.

(4) Treatment of acute overexposure. Remove employee from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If AN has been swallowed, and person is conscious, induce vomiting. Give artificial respiration if indicated. More severe cases, such as those associated with loss of consciousness, may be treated by the intravenous administration of sodium nitrite, followed

by sodium thiosulfate, although this is not as effective for acrylonitrile poisoning as for inorganic cyanide poisoning.

(5) Surveillance and preventive considerations.

(a) As noted above, exposure to acrylonitrile has been linked to increased incidence of cancers of the colon and lung in employees of the duPont acrylic fiber plant in Camden, S.C. In addition, the animal testing of acrylonitrile has resulted in the development of cancers of the central nervous system in rats exposed by either inhalation or ingestion. The physician should be aware of the findings of these studies in evaluating the health of employees exposed to acrylonitrile.

(b) Most reported acute effects of occupational exposure to acrylonitrile are due to its ability to cause tissue anoxia and asphyxia. The effects are similar to those caused by hydrogen cyanide. Liquid acrylonitrile can be absorbed through the skin upon prolonged contact. The liquid readily penetrates leather, and will produce burns of the feet if footwear contaminated with acrylonitrile is not removed.

(c) It is important for the physician to become familiar with the operating conditions in which exposure to acrylonitrile may occur. Those employees with skin diseases may not tolerate the wearing of whatever protective clothing may be necessary to protect them from exposure. In addition, those with chronic respiratory disease may not tolerate the wearing of negative-pressure respirators.

(d) Surveillance and screening. Medical histories and laboratory examinations are required for each employee subject to exposure to acrylonitrile above the action level. The employer must screen employees for history of certain medical conditions which might place the employee at increased risk from exposure.

(i) Central nervous system dysfunction. Acute effects of exposure to acrylonitrile generally involve the central nervous system. Symptoms of acrylonitrile exposure include headache, nausea, dizziness, and general weakness. The animal studies cited above suggest possible carcinogenic effects of acrylonitrile on the central nervous system, since rats exposed by either inhalation or ingestion have developed similar CNS tumors.

(ii) Respiratory disease. The duPont data indicate an increased risk of lung cancer among employees exposed to acrylonitrile.

(iii) Gastrointestinal disease. The duPont data indicate an increased risk of cancer of the colon among employees exposed to acrylonitrile. In addition, the animal studies show possible tumor production in the stomachs of the rats in the ingestion study.

(iv) Skin disease. Acrylonitrile can cause skin burns when prolonged skin contact with the liquid occurs. In addition, repeated skin contact with the liquid can cause dermatitis.

(e) General. The purpose of the medical procedures outlined in the standard is to establish a baseline for future health monitoring. Persons unusually susceptible to the effects of anoxia or those with anemia would be expected to be at increased risk. In addition to emphasis on the CNS, respiratory and gastro-intestinal systems, the cardiovascular system, liver, and kidney function should also be stressed.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07339, filed 5/11/88.]

(1999 Ed.)

WAC 296-62-07340 Appendix D—Sampling and analytical methods for acrylonitrile. (1) There are many methods available for monitoring employee exposures to acrylonitrile. Most of these involve the use of charcoal tubes and sampling pumps, with analysis by gas chromatograph. The essential differences between the charcoal tube methods include, among others, the use of different desorbing solvents, the use of different lots of charcoal, and the use of different equipment for analysis of the samples.

(2) Besides charcoal, considerable work has been performed on methods using porous polymer sampling tubes and passive dosimeters. In addition, there are several portable gas analyzers and monitoring units available on the open market.

(3) This appendix contains details for the methods which have been tested at OSHA Analytical Laboratory in Salt Lake City, and NIOSH in Cincinnati. Each is a variation on NIOSH Method S-156, which is also included for reference. This does not indicate that these methods are the only ones which will be satisfactory. There also may be workplace situations in which these methods are not adequate, due to such factors as high humidity. Copies of the other methods available to OSHA are available in the rulemaking record, and may be obtained from the OSHA docket office. These include, the Union Carbide, Monsanto, Dow Chemical and Dow Badische methods, as well as NIOSH Method P & CAM 127.

(4) Employers who note problems with sample breakthrough should try larger charcoal tubes. Tubes of larger capacity are available, and are often used for sampling vinyl chloride. In addition, lower flow rates and shorter sampling times should be beneficial in minimizing breakthrough problems.

(5) Whatever method the employer chooses, he must assure himself of the method's accuracy and precision under the unique conditions present in his workplace.

(6) NIOSH Method S-156 (unmodified)

Analyte: Acrylonitrile.

Matrix: Air.

Procedure: Absorption on charcoal, desorption with methanol, GC.

(a) Principle of the method. Reference (k)(i) of this subsection.

(i) A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

(ii) The charcoal in the tube is transferred to a small, stoppered sample container, and the analyte is desorbed with methanol.

(iii) An aliquot of the desorbed sample is injected into a gas chromatograph.

(iv) The area of the resulting peak is determined and compared with areas obtained for standards.

(b) Range and sensitivity.

(i) This method was validated over the range of 17.5-70.0 mg/cu m at an atmospheric temperature and pressure of 22°C and 760 mm Hg, using a twenty-liter sample. Under the conditions of sample size (20 liters) the probable useful range of this method is 4.5-135 mg/cu m. The method is capable of measuring much smaller amounts if the desorption efficiency is adequate. Desorption efficiency must be determined over the range used.

(ii) The upper limit of the range of the method is dependent on the adsorptive capacity of the charcoal tube. This capacity varies with the concentrations of acrylonitrile and other substances in the air. The first section of the charcoal tube was found to hold at least 3.97 mg of acrylonitrile when a test atmosphere containing 92.0 mg/cu m of acrylonitrile in air was sampled 0.18 liter per minute for 240 minutes; at that time the concentration of acrylonitrile in the effluent was less than 5 percent of that in the influent. (The charcoal tube consists of two sections of activated charcoal separated by a section of urethane foam. See (f)(ii) of this subsection. If a particular atmosphere is suspected of containing a large amount of contaminant, a smaller sampling volume should be taken.

(c) Interference.

(i) When the amount of water in the air is so great that condensation actually occurs in the tube, organic vapors will not be trapped efficiently. Preliminary experiments using toluene indicate that high humidity severely decreases the breakthrough volume.

(ii) When interfering compounds are known or suspected to be present in the air, such information, including their suspected identities, should be transmitted with the sample.

(iii) It must be emphasized that any compound which has the same retention time as the analyte at the operating conditions described in this method is an interference. Retention time data on a single column cannot be considered proof of chemical identity.

(iv) If the possibility of interference exists, separation conditions (column packing, temperature, etc.) must be changed to circumvent the problem.

(d) Precision and accuracy.

(i) The coefficient of variation (CV) for the total analytical and sampling method in the range of 17.5-70.0 mg/cu m was 0.073. This value corresponds to a 3.3 mg/cu m standard deviation at the (previous) OSHA standard level (20 ppm). Statistical information and details of the validation and experimental test procedures can be found in (k)(ii) of this subsection.

(ii) On the average the concentrations obtained at the 20 ppm level using the overall sampling and analytical method were 6.0 percent lower than the "true" concentrations for a limited number of laboratory experiments. Any difference between the "found" and "true" concentrations may not represent a bias in the sampling and analytical method, but rather a random variation from the experimentally determined "true" concentration. Therefore, no recovery correction should be applied to the final result in (j)(v) of this subsection.

(e) Advantages and disadvantages of the method.

(i) The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method.

(ii) The method can also be used for the simultaneous analysis of two or more substances suspected to be present in the same sample by simply changing gas chromatographic conditions.

(iii) One disadvantage of the method is that the amount of sample which can be taken is limited by the number of mil-

ligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal tube exceeds 25 percent of that found on the front section, the possibility of sample loss exists.

(iv) Furthermore, the precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

(f) Apparatus.

(i) A calibrated personal sampling pump whose flow can be determined within ± 5 percent at the recommended flow rate. Reference (k)(iii) of this subsection.

(ii) Charcoal tubes: Glass tubes with both ends flame sealed, 7 cm long with a 6 mm O.D. and a 4 mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2 mm portion of urethane foam. The activated charcoal is prepared from coconut shells and is fired at 600°C prior to packing. The adsorbing section contains 100 mg of charcoal, the backup section 50 mg. A 3 mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of silicated glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than 1 inch of mercury at a flow rate of 1 liter per minute.

(iii) Gas chromatograph equipped with a flame ionization detector.

(iv) Column (4 ft \times 1/4 in stainless steel) packed with 50/80 mesh Poropak, type Q.

(v) An electronic integrator or some other suitable method for measuring peak areas.

(vi) Two-milliliter sample containers with glass stoppers or Teflon-lined caps. If an automatic sample injector is used, the associated vials may be used.

(vii) Microliter syringes: Ten-microliter and other convenient sizes for making standards.

(viii) Pipets: 1.0 ml delivery pipets.

(ix) Volumetric flask: 10 ml or convenient sizes for making standard solutions.

(g) Reagents.

(i) Chromatographic quality methanol.

(ii) Acrylonitrile, reagent grade.

(iii) Hexane, reagent grade.

(iv) Purified nitrogen.

(v) Prepurified hydrogen.

(vi) Filtered compressed air.

(h) Procedure.

(i) Cleaning of equipment. All glassware used for the laboratory analysis should be detergent washed and thoroughly rinsed with tap water and distilled water.

(ii) Calibration of personal pumps. Each personal pump must be calibrated with a representative charcoal tube in the line. This will minimize errors associated with uncertainties in the sample volume collected.

(iii) Collection and shipping of samples.

(A) Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2mm).

(B) The smaller section of charcoal is used as a backup and should be positioned nearest the sampling pump.

(C) The charcoal tube should be placed in a vertical direction during sampling to minimize channeling through the charcoal.

(D) Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

(E) A maximum sample size of 20 liters is recommended. Sample at a flow of 0.20 liter per minute or less. The flow rate should be known with an accuracy of at least ± 5 percent.

(F) The temperature and pressure of the atmosphere being sampled should be recorded. If pressure reading is not available, record the elevation.

(G) The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Under no circumstances should rubber caps be used.

(H) With each batch of ten samples submit one tube from the same lot of tubes which was used for sample collection and which is subjected to exactly the same handling as the samples except that no air is drawn through it. Label this as a blank.

(I) Capped tubes should be packed tightly and padded before they are shipped to minimize tube breakage during shipping.

(J) A sample of the bulk material should be submitted to the laboratory in a glass container with a Teflon-lined cap. This sample should not be transported in the same container as the charcoal tubes.

(iv) Analysis of samples.

(A) Preparation of samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a 2 ml stoppered sample container. The separating section of foam is removed and discarded; the second section is transferred to another stoppered container. These two sections are analyzed separately.

(B) Desorption of samples. Prior to analysis, 1.0 ml of methanol is pipetted into each sample container. Desorption should be done for 30 minutes. Tests indicate that this is adequate if the sample is agitated occasionally during this period. If an automatic sample injector is used, the sample vials should be capped as soon as the solvent is added to minimize volatilization.

(C) GC conditions. The typical operating conditions for the gas chromatograph are:

(I) 50 ml/min (60 psig) nitrogen carrier gas flow.

(II) 65 ml/min (24 psig) hydrogen gas flow to detector.

(III) 500 ml/min (50 psig) air flow to detector.

(IV) 235°C injector temperature.

(V) 255°C manifold temperature (detector).

(VI) 155°C column temperature.

(D) Injection. The first step in the analysis is the injection of the sample into the gas chromatograph. To eliminate difficulties arising from blowback or distillation within the syringe needle, one should employ the solvent flush injection technique. The 10-microliter syringe is first flushed with solvent several times to wet the barrel and plunger. Three microliters of solvent are drawn into the syringe to increase the accuracy and reproducibility of the injected sample volume. The needle is removed from the solvent, and the plunger is

pulled back about 0.2 microliter to separate the solvent flush from the sample with a pocket of air to be used as a marker. The needle is then immersed in the sample, and a five microliter aliquot is withdrawn, taking into consideration the volume of the needle, since the sample in the needle will be completely injected. After the needle is removed from the sample and prior to injection, the plunger is pulled back 1.2 microliters to minimize evaporation of the sample from the tip of the needle. Observe that the sample occupies 4.9-5.0 microliters in the barrel of the syringe. Duplicate injections of each sample and standard should be made. No more than a 3 percent difference in area is to be expected. An automatic sample injector can be used if it is shown to give reproducibility at least as good as the solvent flush method.

(E) Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

(v) Determination of desorption efficiency.

(A) Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine at least once the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

(B) Procedure for determining desorption efficiency.

(I) Activated charcoal equivalent to the amount in the first section of the sampling tube (100 mg) is measured into a 2.5 in., 4 mm I.D. glass tube, flame sealed at one end. This charcoal must be from the same batch as that used in obtaining the samples and can be obtained from unused charcoal tubes. The open end is capped with Parafilm. A known amount of hexane solution of acrylonitrile containing 0.239 g/ml is injected directly into the activated charcoal with a microliter syringe, and tube is capped with more Parafilm. When using an automatic sample injector, the sample injector vials, capped with Teflon-faced septa, may be used in place of the glass tube.

(II) The amount injected is equivalent to that present in a twenty-liter air sample at the selected level.

(III) Six tubes at each of three levels (0.5X, 1X, and 2X of the standard) are prepared in this manner and allowed to stand for at least overnight to assure complete adsorption of the analyte onto the charcoal. These tubes are referred to as the sample. A parallel blank tube should be treated in the same manner except that no sample is added to it. The sample and blank tubes are desorbed and analyzed in exactly the same manner as the sampling tube described in (h)(iv) of this subsection

(IV) Two or three standards are prepared by injecting the same volume of compound into 1.0 ml of methanol with the same syringe used in the preparation of the samples. These are analyzed with the samples.

(V) The desorption efficiency (D.E.) equals the average weight in mg recovered from the tube divided by the weight in mg added to the tube, or

$$D.E. = \frac{\text{Average weight recovered (mg)}}{\text{weight added (mg)}}$$

(VI) The desorption efficiency is dependent on the amount of analyte collected on the charcoal. Plot the desorption efficiency versus weight of analyte found. This curve is used in (j)(iv) of this subsection to correct for adsorption losses.

(i) Calibration and standards. It is convenient to express concentration of standards in terms of mg/1.0 ml methanol, because samples are desorbed in this amount of methanol. The density of the analyte is used to convert mg into microliters for easy measurement with a microliter syringe. A series of standards, varying in concentration over the range of interest, is prepared and analyzed under the same GC conditions and during the same time period as the unknown samples. Curves are established by plotting concentration in mg/1.0 ml versus peak area.

Note: Since no internal standard is used in the method, standard solutions must be analyzed at the same time that the sample analysis is done. This will minimize the effect of known day-to-day variations and variations during the same day of the FID response.

(j) Calculations.

(i) Read the weight, in mg, corresponding to each peak area from the standard curve. No volume corrections are needed, because the standard curve is based on mg/1.0 ml methanol and the volume of sample injected is identical to the volume of the standards injected.

(ii) Corrections for the blank must be made for each sample.

$$\text{mg} = \text{mg sample} - \text{mg blank}$$

Where:

mg sample = mg found in front section of sample tube.

mg sample = mg found in front section of blank tube.

Note: A similar procedure is followed for the backup sections.

(iii) Add the weights found in the front and backup sections to get the total weight in the sample.

(iv) Read the desorption efficiency from the curve (reference (h)(v)(B) of this subsection) for the amount found in the front section. Divide the total weight by this desorption efficiency to obtain the corrected mg/sample.

$$\text{Corrected mg/sample} = \frac{\text{Total weight}}{\text{D.E.}}$$

(v) The concentration of the analyte in the air sampled can be expressed in mg/cu m.

$$\text{mg/cu m} = \text{Corrected mg (see (j)(iv))} \times \frac{1,000 \text{ (liter/cu m)}}{\text{air volume sampled (liter)}}$$

(vi) Another method of expressing concentration is ppm.

$$\text{ppm} = \text{mg/cu m} \times 24.45/\text{M.W.} \times 760/P \times T + 273/298$$

Where:

P = Pressure (mm Hg) of air sampled.

T = Temperature (°C) of air sampled.

24.45 = Molar volume (liter/mole) at 25°C and 760 mm Hg.

M.W. = Molecular weight (g/mole) of analyte.

760 = Standard pressure (mm Hg).

298 = Standard temperature (°K).

(k) References.

(i) White, L. D. et al., "A Convenient Optimized Method for the Analysis of Selected Solvent Vapors in the Industrial Atmosphere," Amer. Ind. Hyg. Assoc. J., 31:225 (1970).

(ii) Documentation of NIOSH Validation Tests, NIOSH Contract No. CDC-99-74-45.

(iii) Final Report, NIOSH Contract HSM-99-71-31, "Personal Sampler Pump for Charcoal Tubes," September 15, 1972.

(7) NIOSH Modification of NIOSH Method S-156. The NIOSH recommended method for low levels for acrylonitrile is a modification of method S-156. It differs in the following respects:

(a) Samples are desorbed using 1 ml of 1 percent acetone in CS₂ rather than methanol.

(b) The analytical column and conditions are:

(i) Column: 20 percent SP-1000 on 80/100 Supelcoport 10 feet × 1/8 inch S.S.

(ii) Conditions:

Injector temperature: 200°C.

Detector temperature: 100°C.

Column temperature: 85°C.

Helium flow: 25 ml/min.

Air flow: 450 ml/min.

Hydrogen flow: 55 ml/min.

(c) A 2 µl injection of the desorbed analyte is used.

(d) A sampling rate of 100 ml/min is recommended.

(8) OSHA Laboratory Modification of NIOSH Method S-156.

(a) Analyte: Acrylonitrile.

(b) Matrix: Air.

(c) Procedure: Adsorption on charcoal, desorption with methanol, GC.

(d) Principle of the method (subsection (1)(a) of this section).

(i) A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

(ii) The charcoal in the tube is transferred to a small, stoppered sample vial, and the analyte is desorbed with methanol.

(iii) An aliquot of the desorbed sample is injected into a gas chromatograph.

(iv) The area of the resulting peak is determined and compared with areas obtained for standards.

(e) Advantages and disadvantages of the method.

(i) The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The tubes are analyzed by means of a quick, instrumental method.

(ii) This method may not be adequate for the simultaneous analysis of two or more substances.

(iii) The amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup

section of the charcoal tube exceeds 25 percent of that found on the front section, the possibility of sample loss exists.

(iv) The precision of the method is limited by the reproducibility of the pressure drop across the tubes. This drop will affect the flow rate and cause the volume to be imprecise, because the pump is usually calibrated for one tube only.

(f) Apparatus.

(i) A calibrated personal sampling pump whose flow can be determined within ± 5 percent at the recommended flow rate.

(ii) Charcoal tubes: Glass tube with both ends flame sealed, 7 cm long with a 6 mm O.D. and a 4 mm I.D., containing 2 sections of 20/40 mesh activated charcoal separated by a 2 mm portion of urethane foam. The activated charcoal is prepared from coconut shells and is fired at 600°C prior to packing. The absorbing section contains 100 mg of charcoal, the back-up section 50 mg. A 3 mm portion of urethane foam is placed between the outlet end of the tube and the back-up section. A plug of silicated glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than one inch of mercury at a flow rate of 1 liter per minute.

(iii) Gas chromatograph equipped with a nitrogen phosphorus detector.

(iv) Column (10 ft \times 1/8 in stainless steel) packed with 100/120 Supelcoport coated with 10 percent SP 1000.

(v) An electronic integrator or some other suitable method for measuring peak area.

(vi) Two-milliliter sample vials with Teflon-lined caps.

(vii) Microliter syringes: 10 microliter, and other convenient sizes for making standards.

(viii) Pipets: 1.0 ml delivery pipets.

(ix) Volumetric flasks: Convenient sizes for making standard solutions.

(g) Reagents.

(i) Chromatographic quality methanol.

(ii) Acrylonitrile, reagent grade.

(iii) Filtered compressed air.

(iv) Purified hydrogen.

(v) Purified helium.

(h) Procedure.

(i) Cleaning of equipment. All glassware used for the laboratory analysis should be properly cleaned and free of organics which could interfere in the analysis.

(ii) Calibration of personal pumps. Each pump must be calibrated with a representative charcoal tube in the line.

(iii) Collection and shipping of samples.

(A) Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2 mm).

(B) The smaller section of the charcoal is used as the backup and should be placed nearest the sampling pump.

(C) The charcoal should be placed in a vertical position during sampling to minimize channeling through the charcoal.

(D) Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

(E) A sample size of 20 liters is recommended. Sample at a flow rate of approximately 0.2 liters per minute. The flow rate should be known with an accuracy of at least ± 5 percent.

(F) The temperature and pressure of the atmosphere being sampled should be recorded.

(G) The charcoal tubes should be capped with the supplied plastic caps immediately after sampling. Rubber caps should not be used.

(H) Submit at least one blank tube (a charcoal tube subjected to the same handling procedures, without having any air drawn through it) with each set of samples.

(I) Take necessary shipping and packing precautions to minimize breakage of samples.

(iv) Analysis of samples.

(A) Preparation of samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a 2 ml vial. The separating section of foam is removed and discarded; the section is transferred to another capped vial. These two sections are analyzed separately.

(B) Desorption of samples. Prior to analysis, 1.0 ml of methanol is pipetted into each sample container. Desorption should be done for 30 minutes in an ultrasonic bath. The sample vials are recapped as soon as the solvent is added.

(C) GC conditions. The typical operating conditions for the gas chromatograph are:

(I) 30 ml/min (60 psig) helium carrier gas flow.

(II) 3.0 ml/min (30 psig) hydrogen gas flow to detector.

(III) 50 ml/min (60 psig) air flow to detector.

(IV) 200°C injector temperature.

(V) 200°C detector temperature.

(VI) 100°C column temperature.

(D) Injection. Solvent flush technique or equivalent.

(E) Measurement of area. The area of the sample peak is measured by an electronic integrator or some other suitable form of area measurement, and preliminary results are read from a standard curve prepared as discussed below.

(v) Determination of desorption efficiency.

(A) Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and also from one batch of charcoal to another. Thus, it is necessary to determine, at least once, the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

(B) Procedure for determining desorption efficiency. The reference portion of the charcoal tube is removed. To the remaining portion, amounts representing 0.5X, 1X, and 2X (X represents TLV) based on a 20 l air sample are injected onto several tubes at each level. Dilutions of acrylonitrile with methanol are made to allow injection of measurable quantities. These tubes are then allowed to equilibrate at least overnight. Following equilibration they are analyzed following the same procedure as the samples. A curve of the desorption efficiency (amt recovered/amt added) is plotted versus amount of analyte found. This curve is used to correct for adsorption losses.

(i) Calibration and standards. A series of standards, varying in concentration over the range of interest, is prepared and analyzed under the same GC conditions and during the

same time period as the unknown samples. Curves are prepared by plotting concentration versus peak area.

Note: Since no internal standard is used in the method, standard solutions must be analyzed at the same time that the sample analysis is done. This will minimize the effect of known day-to-day variations and variations during the same day of the NPD response. Multiple injections are necessary.

(j) Calculations. Read the weight, corresponding to each peak area from the standard curve, correct for the blank, correct for the desorption efficiency, and make necessary air volume corrections.

(k) Reference. NIOSH Method S-156.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07340, filed 5/11/88.]

WAC 296-62-07342 1,2-Dibromo-3-chloropropane.

(1) Scope and application.

(a) This section applies to occupational exposure to 1,2-dibromo-3-chloropropane (DBCP).

(b) This section does not apply to:

(i) Exposure to DBCP which results solely from the application and use of DBCP as a pesticide; or

(ii) The storage, transportation, distribution or sale of DBCP in intact containers sealed in such a manner as to prevent exposure to DBCP vapors or liquids, except for the requirements of subsections (11), (16) and (17) of this section.

(2) Definitions applicable to this section:

(a) "Authorized person" - any person specifically authorized by the employer and whose duties require the person to be present in areas where DBCP is present; and any person entering this area as a designated representative of employees exercising an opportunity to observe employee exposure monitoring.

(b) "DBCP" - 1,2-dibromo-3-chloropropane, Chemical Abstracts Service Registry Number 96-12-8, and includes all forms of DBCP.

(c) "Director" - the director of labor and industries, or his authorized representative.

(d) "Emergency" - any occurrence such as, but not limited to equipment failure, rupture of containers, or failure of control equipment which may, or does, result in unexpected release of DBCP.

(3) Permissible exposure limits.

(a) Inhalation.

(i) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration in excess of 1 part DBCP per billion part of air (ppb) as an eight-hour time-weighted average.

(ii) Ceiling limit. The employer shall assure that no employee is exposed to an airborne concentration in excess of 5 parts DBCP per billion parts of air (ppb) as averaged over any 15 minutes during the working day.

(b) Dermal and eye exposure. The employer shall assure that no employee is exposed to eye or skin contact with DBCP.

(4) Notification of use. Within ten days of the effective date of this section or within ten days following the introduction of DBCP into the workplace, every employer who has a

workplace where DBCP is present shall report the following information to the director for each such workplace:

(a) The address and location of each workplace in which DBCP is present;

(b) A brief description of each process or operation which may result in employee exposure to DBCP;

(c) The number of employees engaged in each process or operation who may be exposed to DBCP and an estimate of the frequency and degree of exposure that occurs;

(d) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to DBCP.

(5) Regulated areas. The employer shall establish, within each place of employment, regulated areas wherever DBCP concentrations are in excess of the permissible exposure limit.

(a) The employer shall limit access to regulated areas to authorized persons.

(b) All employees entering or working in a regulated area shall wear respiratory protection in accordance with Table I.

(6) Exposure monitoring.

(a) General. Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to DBCP over an eight-hour period. (For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.)

(b) Initial. Each employer who has a place of employment in which DBCP is present shall monitor each workplace and work operation to accurately determine the airborne concentrations of DBCP to which employees may be exposed.

(c) Frequency.

(i) If the monitoring required by this section reveals employee exposures to be below the permissible exposure limits, the employer shall repeat these determinations at least quarterly.

(ii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly determinations until at least two consecutive measurements, taken at least seven days apart, are below the permissible exposure limit, thereafter the employer shall monitor at least quarterly.

(d) Additional. Whenever there has been a production process, control or personnel change which may result in any new or additional exposure to DBCP, or whenever the employer has any other reason to suspect a change which may result in new or additional exposure to DBCP, additional monitoring which complies with subsection (6) shall be conducted.

(e) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of results which represent the employee's exposure.

(ii) Whenever the results indicate that employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the

corrective action being taken to reduce exposure to or below the permissible exposure limits.

(f) Accuracy of measurement. The method of measurement shall be accurate, to a confidence level of 95 percent, to within plus or minus 25 percent for concentrations of DBCP at or above the permissible exposure limits.

(7) Methods of compliance.

(a) Priority of compliance methods. The employer shall institute engineering and work practice controls to reduce and maintain employee exposures to DBCP at or below the permissible exposure limit, except to the extent that the employer establishes that such controls are not feasible. Where feasible engineering and work practice controls are not sufficient to reduce employee exposures to within the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest level achievable by these controls, and shall supplement them by use of respiratory protection.

(b) Compliance program.

(i) The employer shall establish and implement a written program to reduce employee exposure to DBCP to or below the permissible exposure limit solely by means of engineering and work practice controls as required by this section.

(ii) The written program shall include a detailed schedule for development and implementation of the engineering and work practice controls. These plans shall be revised at least every six months to reflect the current status of the program.

(iii) Written plans for these compliance programs shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, and any affected employee or designated representative of employees.

(iv) The employer shall institute and maintain at least the controls described in his most recent written compliance program.

(8) Respirators.

(a) General. Where respiratory protection is required under this section, the employer shall select, provide and assure the proper use of respirators.

(b) Respirators shall be used in the following circumstances:

(i) During the period necessary to install or implement feasible engineering and work practice controls; or

(ii) During maintenance and repair activities in which engineering and work practice controls are not feasible; or

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limit; or

(iv) In emergencies.

(9) Respirator selection.

(a) Where respirators are required under this section, the employer shall select and provide, at no cost to the employee, the appropriate respirator from Table I of this section and shall assure that the employee uses the respirator provided.

(b) The employer shall select respirators from among those approved by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(1999 Ed.)

TABLE I

RESPIRATORY PROTECTION FOR DBCP

Concentration Not Greater Than	Respirator Type
(a) 10 ppb:	(i) Any supplied-air respirator. (ii) Any self-contained breathing apparatus.
(b) 50 ppb:	(i) Any supplied-air respirator with full facepiece, helmet or hood. (ii) Any self-contained breathing apparatus with full facepiece.
(c) 250 ppb:	(i) A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous flow mode.
(d) 500 ppb:	(i) A Type C supplied-air respirator with full facepiece operated in pressure-demand mode with full facepiece.
(e) Greater than 500 ppb or entry into unknown concentrations:	(i) A combination respirator which includes a Type C supplied-air respirator with full facepiece operated in pressure-demand mode and an auxiliary self-contained breathing apparatus. (ii) A self-contained breathing apparatus with full facepiece operated in pressure-demand mode.
(f) Firefighting:	(i) A self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

(c) Respirator program.

(i) The employer shall institute a respiratory protection program in accordance with WAC 296-62-071.

(ii) Employees who wear respirators shall be allowed to wash their face and respirator facepiece to prevent potential skin irritation associated with respirator use.

(10) Emergency situations.

(a) Written plans.

(i) A written plan for emergency situations shall be developed for each workplace in which DBCP is present.

(ii) Appropriate portions of the plan shall be implemented in the event of an emergency.

(b) Employees engaged in correcting conditions shall be equipped as required in subsection (11) of this section until the emergency is abated.

(c) Evacuation. Employees not engaged in correcting the emergency shall be removed and restricted from the area and normal operations in the affected area shall not be resumed until the emergency is abated.

(d) Alerting employees. Where there is a possibility of employee exposure to DBCP due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.

(e) Medical surveillance. For any employee exposed to DBCP in an emergency situation, the employer shall provide medical surveillance in accordance with subsection (14) of this section.

(f) Exposure monitoring.

(i) Following an emergency, the employer shall conduct monitoring which complies with subsection (6) of this section.

(ii) In workplaces not normally subject to periodic monitoring, the employer may terminate monitoring when two consecutive measurements indicate exposures below the permissible exposure limit.

(11) Protective clothing and equipment.

(a) Provision and use. Where eye or skin contact with liquid or solid DBCP may occur, employers shall provide at no cost to the employee, and assure that employees wear impermeable protective clothing and equipment in accordance with WAC 296-24-07501 and 296-24-07801 to protect the area of the body which may come in contact with DBCP.

(b) Cleaning and replacement.

(i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this subsection to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least daily to each affected employee.

(ii) Removal and storage.

(A) The employer shall assure that employees remove DBCP contaminated work clothing only in change rooms provided in accordance with subsection (13) of this section.

(B) The employer shall assure that employees promptly remove any protective clothing and equipment which becomes contaminated with DBCP-containing liquids and solids. This clothing shall not be reworn until the DBCP has been removed from the clothing or equipment.

(C) The employer shall assure that no employee takes DBCP contaminated protective devices and work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(iii) The employer shall assure that DBCP-contaminated protective work clothing and equipment is placed and stored in closed containers which prevent dispersion of DBCP outside the container.

(iv) The employer shall inform any person who launders or cleans DBCP-contaminated protective clothing or equipment of the potentially harmful effects of exposure to DBCP.

(v) The employer shall assure that the containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with subsection (16)(c) of this section.

(vi) The employer shall prohibit the removal of DBCP from protective clothing and equipment by blowing or shaking.

(12) Housekeeping.

(a) Surfaces.

(i) All surfaces shall be maintained free of accumulations of DBCP.

(ii) Dry sweeping and the use of air for the cleaning of floors and other surfaces where DBCP dust or liquids are found is prohibited.

(iii) Where vacuuming methods are selected, either portable units or a permanent system may be used.

(A) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that DBCP is not reintroduced into the workplace air; and

(B) Portable vacuum units used to collect DBCP may not be used for other cleaning purposes and shall be labeled as prescribed by subsection (16)(c) of this section.

(iv) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.

(b) Liquids. Where DBCP is present in a liquid form, or as a resultant vapor, all containers or vessels containing DBCP shall be enclosed to the maximum extent feasible and tightly covered when not in use.

(c) Waste disposal. DBCP waste, scrap, debris, bags, containers or equipment, shall be disposed in sealed bags or other closed containers which prevent dispersion of DBCP outside the container.

(13) Hygiene facilities and practices.

(a) Change rooms. The employer shall provide clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment whenever employees are required to wear protective clothing and equipment in accordance with subsections (8), (9) and (11) of this section.

(b) Showers.

(i) The employer shall assure that employees working in the regulated area shower at the end of the work shift.

(ii) The employer shall assure that employees whose skin becomes contaminated with DBCP-containing liquids or solids immediately wash or shower to remove any DBCP from the skin.

(iii) The employer shall provide shower facilities in accordance with WAC 296-24-12009 (3)(c).

(c) Lunchrooms. The employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

(d) Lavatories.

(i) The employer shall assure that employees working in the regulated area remove protective clothing and wash their hands and face prior to eating.

(ii) The employer shall provide a sufficient number of lavatory facilities which comply with WAC 296-24-12009 (1) and (2).

(e) Prohibition of activities in regulated areas. The employer shall assure that, in regulated areas, food or beverages are not present or consumed, smoking products and implements are not present or used, and cosmetics are not present or applied.

(14) Medical surveillance.

(a) General. The employer shall institute a program of medical surveillance for each employee who is or will be

exposed, without regard to the use of respirators, to DBCP. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subsection. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.

(b) Frequency and content. At the time of initial assignment, annually thereafter, and whenever exposure to DBCP occurs, the employer shall provide a medical examination for employees who work in regulated areas, which includes at least the following:

(i) A complete medical and occupational history with emphasis on reproductive history.

(ii) A complete physical examination with emphasis on the genito-urinary tract, testicle size, and body habitus including the following tests:

- (A) Sperm count;
- (B) Complete urinalysis (U/A);
- (C) Complete blood count; and
- (D) Thyroid profile.

(iii) A serum specimen shall be obtained and the following determinations made by radioimmunoassay techniques utilizing National Institutes of Health (NIH) specific antigen or one of equivalent sensitivity:

- (A) Serum multiphasic analysis (SMA 12);
- (B) Serum follicle stimulating hormone (FSH);
- (C) Serum luteinizing hormone (LH); and
- (D) Serum estrogen (females).

(iv) Any other tests deemed appropriate by the examining physician.

(c) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to DBCP, the employer shall provide the employee with a medical examination which shall include those elements considered appropriate by the examining physician.

(d) Information provided to the physician. The employer shall provide the following information to the examining physician:

- (i) A copy of this standard and its appendices;
- (ii) A description of the affected employee's duties as they relate to the employee's exposure;
- (iii) The level of DBCP to which the employee is exposed; and
- (iv) A description of any personal protective equipment used or to be used.

(e) Physician's written opinion.

(i) For each examination under this section, the employer shall obtain and provide the employee with a written opinion from the examining physician which shall include:

- (A) The results of the medical tests performed;
- (B) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of health from exposure to DBCP;

(C) Any recommended limitations upon the employee's exposure to DBCP or upon the use of protective clothing and equipment such as respirators; and

(D) A statement that the employee was informed by the physician of the results of the medical examination, and any

medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to DBCP.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(f) Emergency situations. If the employee is exposed to DBCP in an emergency situation, the employer shall provide the employee with a sperm count test as soon as practicable, or, if the employee is unable to produce a semen specimen, the hormone tests contained in subsection (14)(b) of this section. The employer shall provide these same tests three months later.

(15) Employee information and training.

(a) Training program.

(i) Within thirty days of the effective date of this standard, the employer shall institute a training program for all employees who may be exposed to DBCP and shall assure their participation in such training program.

(ii) The employer shall assure that each employee is informed of the following:

(A) The information contained in Appendices A, B and C;

(B) The quantity, location, manner of use, release or storage of DBCP and the specific nature of operations which could result in exposure to DBCP as well as any necessary protective steps;

(C) The purpose, proper use, and limitations of respirators;

(D) The purpose and description of the medical surveillance program required by subsection (14) of this section; and

(E) A review of this standard.

(b) Access to training materials.

(i) The employer shall make a copy of this standard and its appendices readily available to all affected employees.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(16) Signs and labels.

(a) General.

(i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to or in combination with, signs and labels required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign or label required by this subsection which contradicts or detracts from the required sign or label.

(b) Signs.

(i) The employer shall post signs to clearly indicate all work areas where DBCP may be present. These signs shall bear the legend:

DANGER
1,2-Dibromo-3-chloropropane

(Insert appropriate trade or common names)

CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

(ii) Where airborne concentrations of DBCP exceed the permissible exposure limits, the signs shall bear the additional legend:

RESPIRATOR REQUIRED

(c) Labels.

(i) The employer shall assure that precautionary labels are affixed to all containers of DBCP and of products containing DBCP, and that the labels remain affixed when the DBCP or products containing DBCP are sold, distributed, or otherwise leave the employer's workplace. Where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this subsection need not be affixed.

(ii) The employer shall assure that the precautionary labels required by this subsection are readily visible and legible. The labels shall bear the following legend:

DANGER
1,2-Dibromo-3-chloropropane
CANCER HAZARD

(17) Recordkeeping.

(a) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (6) of this section.

(ii) This record shall include:

(A) The dates, number, duration and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;

(B) A description of the sampling and analytical methods used;

(C) Type of respiratory worn, if any; and

(D) Name, Social Security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by subsection (14) of this section.

(ii) This record shall include:

(A) The name and Social Security number of the employee;

(B) A copy of the physician's written opinion;

(C) Any employee medical complaints related to exposure to DBCP;

(D) A copy of the information provided the physician as required by subsection (14)(c) of this section; and

(E) A copy of the employee's medical and work history.

(iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.

(c) Availability.

(i) The employer shall assure that all records required to be maintained by this section be made available upon request to the director for examination and copying.

(ii) Employee exposure monitoring records and employee medical records required by this subsection shall be provided upon request to employees' designated representatives and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209; and 296-62-05213 through 296-62-05217.

(d) Transfer of records.

(i) If the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section for the prescribed period.

(ii) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall transmit these records by mail to the director.

(iii) At the expiration of the retention period for the records required to be maintained under this section, the employer shall transmit these records by mail to the director.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in WAC 296-62-05215.

(18) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to DBCP conducted under subsection (6) of this section.

(b) Observation procedures.

(i) Whenever observation of the measuring or monitoring of employee exposure to DBCP requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring or measurement, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the measurement of airborne concentrations of DBCP performed at the place of exposure; and

(C) Record the results obtained.

(19) Effective date. This standard will become effective July 28, 1978.

(20) Appendices. The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-62-07342, filed 4/10/96, effective 6/1/96; 88-11-021 (Order 88-04), § 296-62-07342, filed 5/11/88.]

WAC 296-62-07343 Appendix A—Substance safety data sheet for DBCP. (1) Substance identification.

(a) Synonyms and trade names: DBCP; Dibromochloropropane; Fumazone (Dow Chemical Company TM); Nemaflume; Nemagon (Shell Chemical Co. TM); Nemasol; BBC 12; and OS 1879.

(b) Permissible exposure:

(i) Airborne. 1 part DBCP vapor per billion parts of air (1 ppb); time-weighted average (TWA) for an eight-hour workday.

(ii) Dermal. Eye contact and skin contact with DBCP are prohibited.

(c) Appearance and odor: Technical grade DBCP is a dense yellow or amber liquid with a pungent odor. It may also appear in granular form, or blended in varying concentrations with other liquids.

(d) Uses: DBCP is used to control nematodes, very small worm-like plant parasites, on crops including cotton, soybeans, fruits, nuts, vegetables and ornamentals.

(2) Health hazard data.

(a) Routes of entry: Employees may be exposed:

(i) Through inhalation (breathing);

(ii) Through ingestion (swallowing);

(iii) Skin contact; and

(iv) Eye contact.

(b) Effects of exposure:

(i) Acute exposure. DBCP may cause drowsiness, irritation of the eyes, nose, throat and skin, nausea and vomiting. In addition, overexposure may cause damage to the lungs, liver or kidneys.

(ii) Chronic exposure. Prolonged or repeated exposure to DBCP has been shown to cause sterility in humans. It also has been shown to produce cancer and sterility in laboratory animals and has been determined to constitute an increased risk of cancer in people.

(iii) Reporting signs and symptoms. If you develop any of the above signs or symptoms that you think are caused by exposure to DBCP, you should inform your employer.

(3) Emergency first-aid procedures.

(a) Eye exposure. If DBCP liquid or dust containing DBCP gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with DBCP.

(b) Skin exposure. If DBCP liquids or dusts containing DBCP get on your skin, immediately wash using soap or mild detergent and water. If DBCP liquids or dusts containing DBCP penetrate through your clothing, remove the clothing immediately and wash. If irritation is present after washing get medical attention.

(c) Breathing. If you or any person breathe in large amounts of DBCP, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Do not use mouth-to-mouth. Keep the affected person warm and at rest. Get medical attention as soon as possible.

(d) Swallowing. When DBCP has been swallowed and the person is conscious, give the person large amounts of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

(e) Rescue. Notify someone. Put into effect the established emergency rescue procedures. Know the locations of the emergency rescue equipment before the need arises.

(4) Respirators and protective clothing.

(a) Respirators. You may be required to wear a respirator in emergencies and while your employer is in the process of reducing DBCP exposures through engineering controls. If respirators are worn, they must have a National Institute for Occupational Safety and Health (NIOSH) approval label (older respirators may have a Bureau of Mines Approval label). For effective protection, a respirator must fit your face and head snugly. The respirator should not be loosened or removed in work situations where its use is required. DBCP does not have a detectable odor except at 1,000 times or more above the permissible exposure limit. If you can smell DBCP while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

(b) Protective clothing. When working with DBCP you must wear for your protection impermeable work clothing provided by your employer. (Standard rubber and neoprene protective clothing do not offer adequate protection). DBCP must never be allowed to remain on the skin. Clothing and shoes must not be allowed to become contaminated with DBCP, and if they do, they must be promptly removed and not worn again until completely free of DBCP. Turn in impermeable clothing that has developed leaks for repair or replacement.

(c) Eye protection. You must wear splashproof safety goggles where there is any possibility of DBCP liquid or dust contacting your eyes.

(5) Precautions for safe use, handling, and storage.

(a) DBCP must be stored in tightly closed containers in a cool, well-ventilated area.

(b) If your work clothing may have become contaminated with DBCP, or liquids or dusts containing DBCP, you must change into uncontaminated clothing before leaving the work premises.

(c) You must promptly remove any protective clothing that becomes contaminated with DBCP. This clothing must not be reworn until the DBCP is removed from the clothing.

(d) If your skin becomes contaminated with DBCP, you must immediately and thoroughly wash or shower with soap or mild detergent and water to remove any DBCP from your skin.

(e) You must not keep food, beverages, cosmetics, or smoking materials, nor eat or smoke, in regulated areas.

(f) If you work in a regulated area, you must wash your hands thoroughly with soap or mild detergent and water, before eating, smoking or using toilet facilities.

(g) If you work in a regulated area, you must remove any protective equipment or clothing before leaving the regulated area.

(h) Ask your supervisor where DBCP is used in your work area and for any additional safety and health rules.

(6) Access to information.

(a) Each year, your employer is required to inform you of the information contained in this substance safety data sheet for DBCP. In addition, your employer must instruct you in

the safe use of DBCP, emergency procedures, and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to DBCP. You or your representative have the right to observe employee exposure measurements and to record the result obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, they are required to inform you of the actions which are being taken to reduce your exposure.

(c) Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure and medical data for at least forty years or the duration of your employment plus twenty years, whichever is longer.

(d) Your employer is required to release exposure and medical records to you, your physician, or other individual designated by you upon your written request.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-62-07343, filed 7/20/94, effective 9/20/94; 88-11-021 (Order 88-04), § 296-62-07343, filed 5/11/88.]

WAC 296-62-07344 Appendix B—Substance technical guidelines for DBCP. (1) Physical and chemical data.

(a) Substance identification.

(i) Synonyms: 1,2-dibromo-3-chloropropane; DBCP, Fumazone; Nema-fume; Nemagon; Nemaset; BBC 12; OS 1879. DBCP is also included in agricultural pesticides and fumigants which include the phrase "Nema____, in their name.

(ii) Formula: C₃H₅Br₂Cl.

(iii) Molecular weight: 236.

(b) Physical data:

(i) Boiling point (760 mm HG): 195C (383F)

(ii) Specific gravity (water = 1): 2.093.

(iii) Vapor density (air = 1 at boiling point of DBCP):

Data not available.

(iv) Melting point: 6C (43F).

(v) Vapor pressure at 20C (68F): 0.8 mm HG

(vi) Solubility in water: 1000 ppm.

(vii) Evaporation rate (Butyl Acetate = 1): Very much less than 1.

(c) Appearance and odor: Dense yellow or amber liquid with a pungent odor at high concentrations. Any detectable odor of DBCP indicates overexposure.

(2) Fire explosion and reactivity hazard data.

(a) Fire.

(i) Flash point: 170F (77C)

(ii) Autoignition temperature: Data not available.

(iii) Flammable limits in air, percent by volume: Data not available.

(iv) Extinguishing media: Carbon dioxide, dry chemical.

(v) Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.

(vi) Unusual fire and explosion hazards: None known.

(vii) For purposes of complying with the requirements of WAC 296-24-330, liquid DBCP is classified as a Class III A combustible liquid.

(viii) For the purpose of complying with chapter 296-24 WAC Part L, the classification of hazardous locations as

described in article 500 of the National Electrical Code for DBCP shall be Class I, Group D.

(ix) For the purpose of compliance with WAC 296-24-592, DBCP is classified as a Class B fire hazard.

(x) For the purpose of compliance with WAC 296-24-230, locations classified as hazardous locations due to the presence of DBCP shall be Class I, Group D.

(xi) Sources of ignition are prohibited where DBCP presents a fire or explosion hazard.

(b) Reactivity.

(i) Conditions contributing to instability: None known.

(ii) Incompatibilities: Reacts with chemically active metals, such as aluminum, magnesium and tin alloys.

(iii) Hazardous decomposition products: Toxic gases and vapors (such as HBr, HCl and carbon monoxide) may be released in a fire involving DBCP.

(iv) Special precautions: DBCP will attack some rubber materials and coatings.

(3) Spill, leak and disposal procedures.

(a) If DBCP is spilled or leaked, the following steps should be taken:

(i) The area should be evacuated at once and re-entered only after thorough ventilation.

(ii) Ventilate area of spill or leak.

(iii) If in liquid form, collect for reclamation or absorb in paper, vermiculite, dry sand, earth or similar material.

(iv) If in solid form, collect spilled material in the most convenient and safe manner for reclamation or for disposal.

(b) Persons not wearing protective equipment must be restricted from areas of spills or leaks until cleanup has been completed.

(c) Waste disposal methods:

(i) For small quantities of liquid DBCP, absorb on paper towels, remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. If liquid DBCP is absorbed in vermiculite, dry sand, earth or similar material and placed in sealed containers it may be disposed of in a state-approved sanitary landfill.

(ii) If in solid form, for small quantities, place on paper towels, remove to a safe place (such as a fume hood) and burn. Large quantities may be reclaimed. However, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. DBCP in solid form may also be disposed in a state-approved sanitary landfill.

(4) Monitoring and measurement procedures.

(a) Exposure above the permissible exposure limit.

(i) Eight hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken so that the average eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

(ii) Monitoring techniques: The sampling and analysis under this section may be performed by collecting the DBCP vapor on petroleum based charcoal absorption tubes with

subsequent chemical analyses. The method of measurement chosen should determine the concentration of airborne DBCP at the permissible exposure limit to an accuracy of plus or minus twenty-five percent. If charcoal tubes are used, a total volume of ten liters should be collected at a flow rate of 50 cc per minute for each tube. Analyze the resultant samples as you would samples of halogenated solvent.

(b) Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

(5) Protective clothing. Employees should be required to wear appropriate protective clothing to prevent any possibility of skin contact with DBCP. Because DBCP is absorbed through the skin, it is important to prevent skin contact with both liquid and solid forms of DBCP. Protective clothing should include impermeable coveralls or similar fullbody work clothing, gloves, headcoverings, and workshoes or shoe coverings. Standard rubber and neoprene gloves do not offer adequate protection and should not be relied upon to keep DBCP off the skin. DBCP should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with the material; and if they do, they should be promptly removed and not worn again until completely free of the material. Any protective clothing which has developed leaks or is otherwise found to be defective should be repaired or replaced. Employees should also be required to wear splashproof safety goggles where there is any possibility of DBCP contacting the eyes.

(6) Housekeeping and hygiene facilities.

(a) The workplace must be kept clean, orderly and in a sanitary condition.

(b) Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where DBCP dust or liquids are found. To minimize the contamination of air with dust, vacuuming with either portable or permanent systems must be used. If a portable unit is selected, the exhaust must be attached to the general workplace exhaust ventilation system, or collected within the vacuum unit equipped with high efficiency filters or other appropriate means of contamination removal and not used for other purposes. Units used to collect DBCP must be labeled.

(c) Adequate washing facilities with hot and cold water must be provided, and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of DBCP from the skin.

(d) Change or dressing rooms with individual clothes storage facilities must be provided to prevent the contamination of street clothes with DBCP. Because of the hazardous nature of DBCP, contaminated protective clothing must be stored in closed containers for cleaning or disposal.

(7) Miscellaneous precautions.

(a) Store DBCP in tightly closed containers in a cool, well ventilated area.

(b) Use of supplied-air suits or other impervious clothing (such as acid suits) may be necessary to prevent skin contact with DBCP. Supplied-air suits should be selected, used, and maintained under the supervision of persons knowledgeable

in the limitations and potential life-endangering characteristics of supplied-air suits.

(c) The use of air-conditioned suits may be necessary in warmer climates.

(d) Advise employees of all areas and operations where exposure to DBCP could occur.

(8) Common operations. Common operations in which exposure to DBCP is likely to occur are: During its production; and during its formulation into pesticides and fumigants.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-07344, filed 11/22/91, effective 12/24/91; 88-11-021 (Order 88-04), § 296-62-07344, filed 5/11/88.]

WAC 296-62-07346 Appendix C—Medical surveillance guidelines for DBCP. (1) Route of entry.

(a) Inhalation;

(b) Skin absorption.

(2) Toxicology. Recent data collected on workers involved in the manufacture and formulation of DBCP has shown that DBCP can cause sterility at very low levels of exposure. This finding is supported by studies showing that DBCP causes sterility in animals. Chronic exposure to DBCP resulted in pronounced necrotic action on the parenchymatous organs (i.e., liver, kidney, spleen) and on the testicles of rats at concentrations as low as 5 ppm. Rats that were chronically exposed to DBCP also showed changes in the composition of the blood, showing low RBC, hemoglobin, and WBC, and high reticulocyte levels as well as functional hepatic disturbance, manifesting itself in a long prothrombin time. Reznik et al., noted a single dose of 100 mg produced profound depression of the nervous system of rats. Their condition gradually improved. Acute exposure also resulted in the destruction of the sex gland activity of male rats as well as causing changes in the estrous cycle in female rats. Animal studies have also associated DBCP with an increased incidence of carcinoma. Olson, et al., orally administered DBCP to rats and mice five times per week at experimentally predetermined maximally tolerated doses and at half those doses. As early as ten weeks after initiation of treatment, DBCP induced a high incidence of squamous cell carcinomas of the stomach with metastases in both species. DBCP also induced mammary adenocarcinomas in the female rats at both dose levels.

(3) Signs and symptoms.

(a) Inhalation: Nausea, eye irritation, conjunctivitis, respiratory irritation, pulmonary congestion or edema, CNS depression with apathy, sluggishness, and ataxia.

(b) Dermal: Erythema or inflammation and dermatitis on repeated exposure.

(4) Special tests.

(a) Semen analysis: The following information excerpted from the document "Evaluation of Testicular Function," submitted by the Corporate Medical Department of the Shell Oil Company (exhibit 39-3), may be useful to physicians conducting the medical surveillance program. In performing semen analyses certain minimal but specific criteria should be met:

(i) It is recommended that a minimum of three valid semen analyses be obtained in order to make a determination of an individual's average sperm count.

(ii) A period of sexual abstinence is necessary prior to the collection of each masturbatory sample. It is recommended that intercourse or masturbation be performed 48 hours before the actual specimen collection. A period of 48 hours of abstinence would follow; then the masturbatory sample would be collected.

(iii) Each semen specimen should be collected in a clean, widemouthed, glass jar (not necessarily pre-sterilized) in a manner designated by the examining physician. Any part of the seminal fluid exam should be initialed *only after liquifaction* is complete, i.e., 30 to 45 minutes after collection.

(iv) Semen volume should be measured to the nearest 1/10 of a cubic centimeter.

(v) Sperm density should be determined using routine techniques involving the use of a white cell pipette and a hemocytometer chamber. The immobilizing fluid most effective and most easily obtained for this process is distilled water.

(vi) Thin, dry smears of the semen should be made for a morphologic classification of the sperm forms and should be stained with either hematoxylin or the more difficult, yet more precise, Papanicolaou technique. Also of importance to record is obvious sperm agglutination, pyospermia, delayed liquifaction (greater than 30 minutes), and hyperviscosity. In addition, pH, using nitrazine paper, should be determined.

(vii) A total morphology evaluation should include percentages of the following:

- (A) Normal (oval) forms,
- (B) Tapered forms,
- (C) Amorphous forms (include large and small sperm shapes),
- (D) Duplicated (either heads or tails) forms, and
- (E) Immature forms.

(viii) Each sample should be evaluated for sperm *viability* (percent viable sperm moving at the time of examination) as well as sperm *motility* (subjective characterization of "purposeful forward sperm progression" of the majority of those viable sperm analyzed) within two hours after collection, ideally by the same or equally qualified examiner.

(b) Serum determinations: The following serum determinations should be performed by radiomuno-assay techniques using National Institutes of Health (NIH) specific antigen or antigen preparations of equivalent sensitivity:

- (i) Serum follicle stimulating hormone (FSH),
- (ii) Serum luteinizing hormone (LH), and
- (iii) Serum total estrogen (females only).

(5) Treatment. Remove from exposure immediately, give oxygen or artificial resuscitation if indicated. Contaminated clothing and shoes should be removed immediately. Flush eyes and wash contaminated skin. If swallowed and the person is conscious, induce vomiting. Recovery from mild exposures is usually rapid and complete.

(6) Surveillance and preventive considerations.

(a) Other considerations. DBCP can cause both acute and chronic effects. It is important that the physician become familiar with the operating conditions in which exposure to DBCP occurs. Those with respiratory disorders may not tolerate the wearing of negative pressure respirators.

(b) Surveillance and screening. Medical histories and laboratory examinations are required for each employee sub-

ject to exposure to DBCP. The employer should screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from exposure:

(i) Liver disease. The primary site of biotransformation and detoxification of DBCP is the liver. Liver dysfunctions likely to inhibit the conjugation reactions will tend to promote the toxic actions of DBCP. These precautions should be considered before exposing persons with impaired liver function to DBCP.

(ii) Renal disease. Because DBCP has been associated with injury to the kidney it is important that special consideration be given to those with possible impairment of renal function.

(iii) Skin disease. DBCP can penetrate the skin and can cause erythema on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of DBCP.

(iv) Blood dyscrasias. DBCP has been shown to decrease the content of erythrocytes, hemoglobin, and leukocytes in the blood, as well as increase the prothrombin time. Persons with existing blood disorders may be more susceptible to the effects of DBCP.

(v) Reproductive disorders. Animal studies have associated DBCP with various effects on the reproductive organs. Among these effects are atrophy of the testicles and changes in the estrous cycle. Persons with pre-existing reproductive disorders may be at increased risk to these effects of DBCP.

(7) References.

(a) Reznik, Ya. B. and Sprinchan, G. K.: Experimental Data on the Gonadotoxic effect of Nemagon, *Gig. Sanit.*, (6), 1975, pp. 101-102, (translated from Russian).

(b) Faydysh, E. V., Rakhmatullaev, N. N. and Varshavskii, V. A.: The Cytotoxic Action of Nemagon in a Subacute Experiment, *Med. Zh. Uzbekistana*, (No. 1), 1970, pp. 64-65, (translated from Russian).

(c) Rakhmatullaev, N. N.: Hygienic Characteristics of the Nematocide Nemagon in Relation to Water Pollution Control, *Hyg. Sanit.*, 36(3), 1971, pp. 344-348, (translated from Russian).

(d) Olson, W. A. *et al.*: Induction of Stomach Cancer in Rats and Mice by Halogenated Aliphatic Fumigants, *Journal of the National Cancer Institute*, (51), 1973, pp. 1993-1995.

(e) Torkelson, T. R. *et al.*: Toxicologic Investigations of 1,2-Dibromo-3-chloropropane, *Toxicology and Applied Pharmacology*, 3, 1961 pp. 545-559.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07346, filed 5/11/88.]

WAC 296-62-07347 Inorganic arsenic. (1) Scope and application. This section applies to all occupational exposures to inorganic arsenic except that this section does not apply to employee exposures in agriculture or resulting from pesticide application, the treatment of wood with preservatives or the utilization of arsenically preserved wood.

(2) Definitions.

(a) "Action level" - a concentration of inorganic arsenic of 5 micrograms per cubic meter of air (5 µg/m³) averaged over any eight-hour period.

(b) "Authorized person" - any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under subsection (5) of this section.

(c) "Director" - the director of the department of labor and industries, or his/her designated representative.

(d) "Inorganic arsenic" - copper aceto-arsenite and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).

(3) Permissible exposure limit. The employer shall assure that no employee is exposed to inorganic arsenic at concentrations greater than 10 micrograms per cubic meter of air ($10 \mu\text{g}/\text{m}^3$), averaged over any eight-hour period.

(4) Notification of use.

(a) By October 1, 1978, or within sixty days after the introduction of inorganic arsenic into the workplace, every employer who is required to establish a regulated area in his/her workplaces shall report in writing to the department of labor and industries for each such workplace:

(i) The address of each such workplace;

(ii) The approximate number of employees who will be working in regulated areas; and

(iii) A brief summary of the operations creating the exposure and the actions which the employer intends to take to reduce exposures.

(b) Whenever there has been a significant change in the information required by subsection (4)(a) of this section, the employer shall report the changes in writing within sixty days to the department of labor and industries.

(5) Exposure monitoring.

(a) General.

(i) Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to inorganic arsenic over an eight-hour period.

(ii) For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.

(iii) The employer shall collect full shift (for at least seven continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

(b) Initial monitoring. Each employer who has a workplace or work operation covered by this standard shall monitor each such workplace and work operation to accurately determine the airborne concentration of inorganic arsenic to which employees may be exposed.

(c) Frequency.

(i) If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in subsection (5)(d) of this section.

(ii) If the initial monitoring, required by this section, or subsequent monitoring reveals employee exposure to be above the permissible exposure limit, the employer shall repeat monitoring at least quarterly.

(iii) If the initial monitoring, required by this section, or subsequent monitoring reveals employee exposure to be

above the action level and below the permissible exposure limit the employee shall repeat monitoring at least every six months.

(iv) The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least seven days apart, are below the action level at which time the employer may discontinue monitoring for that employee until such time as any of the events in subsection (5)(d) of this section occur.

(d) Additional monitoring. Whenever there has been a production, process, control or personal change which may result in new or additional exposure to inorganic arsenic, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to inorganic arsenic, additional monitoring which complies with subsection (5) of this section shall be conducted.

(e) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposures.

(ii) Whenever the results indicate that the representative employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken to reduce exposure to or below the permissible exposure limit.

(f) Accuracy of measurement.

(i) The employer shall use a method of monitoring and measurement which has an accuracy (with a confidence level of 95 percent) of not less than plus or minus 25 percent for concentrations of inorganic arsenic greater than or equal to $10 \mu\text{g}/\text{m}^3$.

(ii) The employer shall use a method of monitoring and measurement which has an accuracy (with confidence level of 95 percent) of not less than plus or minus 35 percent for concentrations of inorganic arsenic greater than $5 \mu\text{g}/\text{m}^3$ but less than $10 \mu\text{g}/\text{m}^3$.

(6) Regulated area.

(a) Establishment. The employer shall establish regulated areas where worker exposures to inorganic arsenic, without regard to the use of respirators, are in excess of the permissible limit.

(b) Demarcation. Regulated areas shall be demarcated and segregated from the rest of the workplace in any manner that minimizes the number of persons who will be exposed to inorganic arsenic.

(c) Access. Access to regulated areas shall be limited to authorized persons or to persons otherwise authorized by the Act or regulations issued pursuant thereto to enter such areas.

(d) Provision of respirators. All persons entering a regulated area shall be supplied with a respirator, selected in accordance with subsection (8)(b) of this section.

(e) Prohibited activities. The employer shall assure that in regulated areas, food or beverages are not consumed, smoking products, chewing tobacco and gum are not used and cosmetics are not applied, except that these activities may be conducted in the lunchrooms, change rooms and showers required under subsection (12) of this section. Drinking water may be consumed in the regulated area.

(7) Methods of compliance.

(a) Controls.

(i) The employer shall institute at the earliest possible time but not later than December 31, 1979, engineering and work practice controls to reduce exposures to or below the permissible exposure limit, except to the extent that the employer can establish that such controls are not feasible.

(ii) Where engineering and work practice controls are not sufficient to reduce exposures to or below the permissible exposure limit, they shall nonetheless be used to reduce exposures to the lowest levels achievable by these controls and shall be supplemented by the use of respirators in accordance with subsection (8) of this section and other necessary personal protective equipment. Employee rotation is not required as a control strategy before respiratory protection is instituted.

(b) Compliance program.

(i) The employer shall establish and implement a written program to reduce exposures to or below the permissible exposure limit by means of engineering and work practice controls.

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation in which inorganic arsenic is emitted; e.g., machinery used, material processed, controls in place, crew size, operating procedures and maintenance practices;

(B) Engineering plans and studies used to determine methods selected for controlling exposure to inorganic arsenic;

(C) A report of the technology considered in meeting the permissible exposure limit;

(D) Monitoring data;

(E) A detailed schedule for implementation of the engineering controls and work practices that cannot be implemented immediately and for the adaption and implementation of any additional engineering and work practices necessary to meet the permissible exposure limit;

(F) Whenever the employer will not achieve the permissible exposure limit with engineering controls and work practices by December 31, 1979, the employer shall include in the compliance plan an analysis of the effectiveness of the various controls, shall install engineering controls and institute work practices on the quickest schedule feasible, and shall include in the compliance plan and implement a program to minimize the discomfort and maximize the effectiveness of respirator use; and

(G) Other relevant information.

(iii) Written plans for such a program shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, any affected employee or authorized employee representatives.

(iv) The plans required by this subsection shall be revised and updated at least every six months to reflect the current status of the program.

(8) Respiratory protection.

(a) General. The employer shall assure that respirators are used where required under this section to reduce employee exposures to below the permissible exposure limit and in emergencies. Respirators shall be used in the following circumstances:

(i) During the time period necessary to install or implement feasible engineering or work practice controls;

(ii) In work operations such as maintenance and repair activities in which the employer establishes that engineering and work practice controls are not feasible;

(iii) In work situations in which engineering controls and supplemental work practice controls are not yet sufficient to reduce exposures to or below the permissible exposure limit; or

(iv) In emergencies.

(b) Respirator selection.

(i) Where respirators are required under this section the employer shall select, provide at no cost to the employee and assure the use of the appropriate respirator or combination of respirators from Table I for inorganic arsenic compounds without significant vapor pressure, or Table II for inorganic arsenic compounds which have significant vapor pressure.

(ii) Where employee exposures exceed the permissible exposure limit for inorganic arsenic and also exceed the relevant limit for particular gasses such as sulfur dioxide, any air purifying respirator supplied to the employee as permitted by this standard must have a combination high efficiency filter with an appropriate gas sorbent. (See footnote in Table I)

TABLE I

RESPIRATORY PROTECTION FOR INORGANIC ARSENIC PARTICULATE EXCEPT FOR THOSE WITH SIGNIFICANT VAPOR PRESSURE

Concentration of Inorganic Arsenic (as As) or Condition of Use	Required Respirator
(i) Unknown or greater or lesser than 20,000 $\mu\text{g}/\text{m}^3$ (20 mg/m^3) firefighting.	(A) Any full facepiece self-contained or breathing apparatus operated in positive pressure mode.
(ii) Not greater than 20,000 $\mu\text{g}/\text{m}^3$ (20 mg/m^3)	(A) Supplied air respirator with full facepiece, hood, or helmet or suit and operated in positive pressure mode.
(iii) Not greater than 10,000 $\mu\text{g}/\text{m}^3$ (10 mg/m^3)	(A) Powered air-purifying respirators in all inlet face coverings with high-efficiency filters. ¹ (B) Half-mask supplied air respirators operated in positive pressure mode.
(iv) Not greater than 500 $\mu\text{g}/\text{m}^3$	(A) Full facepiece air-purifying respirator equipped with high-efficiency filter. ¹ (B) Any full facepiece supplied air respirator.

Concentration of Inorganic Arsenic (as As) or Condition of Use	Required Respirator
(v) Not greater than 100 $\mu\text{g}/\text{m}^3$	(C) Any full facepiece self-contained breathing apparatus. (A) Half-mask air-purifying respirator equipped with high-efficiency filter. ¹ (B) Any half-mask supplied air respirator.

¹High-efficiency filter-99.97 pct efficiency against 0.3 micrometer monodisperse diethyl-hexyl phthalate (DOP) particles.

TABLE II

RESPIRATORY PROTECTION FOR INORGANIC ARSENICALS
(SUCH AS ARSENIC TRICHLORIDE² AND ARSENIC PHOSPHIDE)
WITH SIGNIFICANT VAPOR PRESSURE

Concentration of Inorganic Arsenic (as As) or Condition of Use	Required Respirator
(i) Unknown or greater or lesser than 20,000 $\mu\text{g}/\text{m}^3$ (20 mg/m^3) or firefighting.	(A) Any full facepiece contained breathing apparatus operated in positive pressure mode.
(ii) Not greater than 20,000 $\mu\text{g}/\text{m}^3$ (20 mg/m^3)	(A) Supplied air respirator with full facepiece hood, or helmet or suit and operated in positive pressure mode.
(iii) Not greater than 10,000 $\mu\text{g}/\text{m}^3$ (10 mg/m^3)	(A) Half-mask ² supplied air respirator operated in positive pressure mode.
(iv) Not greater than 500 $\mu\text{g}/\text{m}^3$	(A) Front or back mounted gas mask equipped with high-efficiency filter ¹ and acid gas canister. (B) Any full facepiece supplied air respirator. (C) Any full facepiece self-contained breathing apparatus.
(v) Not greater than 100 $\mu\text{g}/\text{m}^3$	(A) Half-mask ² air-purifying respirator equipped with high-efficiency filter ¹ and acid gas cartridge.

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Concentration of Inorganic Arsenic (as As) or Condition of Use	Required Respirator
	(B) Any half-mask supplied air respirator.

¹High efficiency filter-99.97 pct efficiency against 0.3 micrometer monodisperse diethyl-hexyl phthalate (DOP) particles.

²Half-mask respirators shall not be used for protection against arsenic trichloride, as it is rapidly absorbed through the skin.

(iii) The employer shall select respirators from among those approved for protection against dust, fume, and mist by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(c) Respirator usage.

(i) The employer shall assure that the respirator issued to the employee exhibits minimum facepiece leakage and that the respirator is fitted properly.

(ii) The employer shall perform qualitative fit tests at the time of initial fitting and at least semi-annually thereafter for each employee wearing respirators, where quantitative fit tests are not required.

(iii) Employers with more than twenty employees wearing respirators shall perform a quantitative face fit test at the time of initial fitting and at least semi-annually thereafter for each employee wearing negative pressure respirators. The test shall be used to select facepieces that provide the required protection as prescribed in Table I or II.

(iv) If an employee has demonstrated difficulty in breathing during the fitting test or during use, he or she shall be examined by a physician trained in pulmonary medicine to determine whether the employee can wear a respirator while performing the required duty.

(d) Respirator program.

(i) The employer shall institute a respiratory protection program in accordance with WAC 296-62-071.

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their face and respirator facepiece to prevent skin irritation associated with respirator use.

(e) Commencement of respirator use.

(i) The employer's obligation to provide respirators commences on August 1, 1978, for employees exposed over 500 $\mu\text{g}/\text{m}^3$ of inorganic arsenic, as soon as possible but not later than October 1, 1978, for employees exposed to over 50 $\mu\text{g}/\text{m}^3$ of inorganic arsenic, and as soon as possible but not later than December 1, 1978, for employees exposed between 10 and 50 $\mu\text{g}/\text{m}^3$ of inorganic arsenic.

(ii) Employees with exposures below 50 $\mu\text{g}/\text{m}^3$ of inorganic arsenic may choose not to wear respirators until December 31, 1979.

(iii) After December 1, 1978, any employee required to wear air purifying respirators may choose, and if so chosen the employer must provide, if it will give proper protection, a

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powered air purifying respirator and in addition if necessary a combination dust and acid gas respirator for times where exposures to gases are over the relevant exposure limits.

(9) **Reserved.**

(10) Protective work clothing and equipment.

(a) Provision and use. Where the possibility of skin or eye irritation from inorganic arsenic exists, and for all workers working in regulated areas, the employer shall provide at no cost to the employee and assure that employees use appropriate and clean protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, and shoes or coverlets;

(iii) Face shields or vented goggles when necessary to prevent eye irritation, which comply with the requirements of WAC 296-24-07801 (1) - (6).

(iv) Impervious clothing for employees subject to exposure to arsenic trichloride.

(b) Cleaning and replacement.

(i) The employer shall provide the protective clothing required in subsection (10)(a) of this section in a freshly laundered and dry condition at least weekly, and daily if the employee works in areas where exposures are over 100 $\mu\text{g}/\text{m}^3$ of inorganic arsenic or in areas where more frequent washing is needed to prevent skin irritation.

(ii) The employer shall clean, launder, or dispose of protective clothing required by subsection (10)(a) of this section.

(iii) The employer shall repair or replace the protective clothing and equipment as needed to maintain their effectiveness.

(iv) The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms prescribed in subsection (13)(a) of this section.

(v) The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of inorganic arsenic outside the container.

(vi) The employer shall inform in writing any person who cleans or launders clothing required by this section, of the potentially harmful affects including the carcinogenic effects of exposure to inorganic arsenic.

(vii) The employer shall assure that the containers of contaminated protective clothing and equipment in the workplace or which are to be removed from the workplace are labeled as follows:

Caution: Clothing contaminated with inorganic arsenic; do not remove dust by blowing or shaking. Dispose of inorganic arsenic contaminated wash water in accordance with applicable local, state, or federal regulations.

(viii) The employer shall prohibit the removal of inorganic arsenic from protective clothing or equipment by blowing or shaking.

(11) Housekeeping.

(a) Surfaces. All surfaces shall be maintained as free as practicable of accumulations of inorganic arsenic.

(b) Cleaning floors. Floors and other accessible surfaces contaminated with inorganic arsenic may not be cleaned by the use of compressed air, and shoveling and brushing may

be used only where vacuuming or other relevant methods have been tried and found not to be effective.

(c) Vacuuming. Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner to minimize the reentry of inorganic arsenic into the workplace.

(d) Housekeeping plan. A written housekeeping and maintenance plan shall be kept which shall list appropriate frequencies for carrying out housekeeping operations, and for cleaning and maintaining dust collection equipment. The plan shall be available for inspection by the director.

(e) Maintenance of equipment. Periodic cleaning of dust collection and ventilation equipment and checks of their effectiveness shall be carried out to maintain the effectiveness of the system and a notation kept of the last check of effectiveness and cleaning or maintenance.

(12) **Reserved.**

(13) Hygiene facilities and practices.

(a) Change rooms. The employer shall provide for employees working in regulated areas or subject to the possibility of skin or eye irritation from inorganic arsenic, clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment in accordance with WAC 296-24-12011.

(b) Showers.

(i) The employer shall assure that employees working in regulated areas or subject to the possibility of skin or eye irritation from inorganic arsenic shower at the end of the work shift.

(ii) The employer shall provide shower facilities in accordance with WAC 296-24-12009(3).

(c) Lunchrooms.

(i) The employer shall provide for employees working in regulated areas, lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

(ii) The employer shall assure that employees working in the regulated area or subject to the possibility of skin or eye irritation from exposure to inorganic arsenic wash their hands and face prior to eating.

(d) Lavatories. The employer shall provide lavatory facilities which comply with WAC 296-24-12009 (1) and (2).

(e) Vacuuming clothes. The employer shall provide facilities for employees working in areas where exposure, without regard to the use of respirators, exceeds 100 $\mu\text{g}/\text{m}^3$ to vacuum their protective clothing and clean or change shoes worn in such areas before entering change rooms, lunchrooms or shower rooms required by subsection (10) of this section and shall assure that such employees use such facilities.

(f) Avoidance of skin irritation. The employer shall assure that no employee is exposed to skin or eye contact with arsenic trichloride, or to skin or eye contact with liquid or particulate inorganic arsenic which is likely to cause skin or eye irritation.

(14) Medical surveillance.

(a) General.

(i) Employees covered. The employer shall institute a medical surveillance program for the following employees:

(A) All employees who are or will be exposed above the action level, without regard to the use of respirators, at least thirty days per year; and

(B) All employees who have been exposed above the action level, without regard to respirator use, for thirty days or more per year for a total of ten years or more of combined employment with the employer or predecessor employers prior to or after the effective date of this standard. The determination of exposures prior to the effective date of this standard shall be based upon prior exposure records, comparison with the first measurements taken after the effective date of this standard, or comparison with records of exposures in areas with similar processes, extent of engineering controls utilized and materials used by that employer.

(ii) Examination by physician. The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee, without loss of pay and at a reasonable time and place.

(b) Initial examinations. By December 1, 1978, for employees initially covered by the medical provisions of this section, or thereafter at the time of initial assignment to an area where the employee is likely to be exposed over the action level at least thirty days per year, the employer shall provide each affected employee an opportunity for a medical examination, including at least the following elements:

(i) A work history and a medical history which shall include a smoking history and the presence and degree of respiratory symptoms such as breathlessness, cough, sputum production and wheezing.

(ii) A medical examination which shall include at least the following:

(A) A 14" by 17" posterior-anterior chest x-ray and International Labor Office UICC/Cincinnati (ILO U/C) rating;

(B) A nasal and skin examination; and

(C) Other examinations which the physician believes appropriate because of the employees exposure to inorganic arsenic or because of required respirator use.

(c) Periodic examinations.

(i) The employer shall provide the examinations specified in subsections (14)(b)(i) and (14)(b)(ii)(A), (B) and (C) of this section at least annually for covered employees who are under forty-five years of age with fewer than ten years of exposure over the action level without regard to respirator use.

(ii) The employer shall provide the examinations specified in subsections (14)(b)(i) and (ii)(B) and (C) of this section at least semi-annually for other covered employees.

(iii) Whenever a covered employee has not taken the examinations specified in subsection (14)(b)(i) and (ii)(B) and (C) of this section within six months preceding the termination of employment, the employer shall provide such examinations to the employee upon termination of employment.

(d) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to inorganic arsenic the employer shall provide an appropriate examination and emergency medical treatment.

(e) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this standard and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's representative exposure level or anticipated exposure level;

(iv) A description of any personal protective equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee which is not readily available to the examining physician.

(f) Physician's written opinion.

(i) The employer shall obtain a written opinion from the examining physician which shall include:

(A) The results of the medical examination and tests performed;

(B) The physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of the employee's health from exposure to inorganic arsenic;

(C) Any recommended limitations upon the employee's exposure to inorganic arsenic or upon the use of protective clothing or equipment such as respirators; and

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure.

(iii) The employer shall provide a copy of the written opinion to the affected employee.

(15) Employee information and training.

(a) Training program.

(i) The employer shall institute a training program for all employees who are subject to exposure to inorganic arsenic above the action level without regard to respirator use, or for whom there is the possibility of skin or eye irritation from inorganic arsenic. The employer shall assure that those employees participate in the training program.

(ii) The training program shall be provided by October 1, 1978 for employees covered by this provision, at the time of initial assignment for those subsequently covered by this provision, and shall be repeated at least quarterly for employees who have optional use of respirators and at least annually for other covered employees thereafter, and the employer shall assure that each employee is informed of the following:

(A) The information contained in Appendix A;

(B) The quantity, location, manner of use, storage, sources of exposure, and the specific nature of operations which could result in exposure to inorganic arsenic as well as any necessary protective steps;

(C) The purpose, proper use, and limitation of respirators;

(D) The purpose and a description of medical surveillance program as required by subsection (14) of this section;

(E) The engineering controls and work practices associated with the employee's job assignment; and

(F) A review of this standard.

(b) Access to training materials.

(i) The employer shall make readily available to all affected employees a copy of this standard and its appendices.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(16) Signs and labels.

(a) General.

(i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to, or in combination with, signs and labels required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign or label required by this subsection which contradicts or detracts from the meaning of the required sign or label.

(b) Signs.

(i) The employer shall post signs demarcating regulated areas bearing the legend:

DANGER
INORGANIC ARSENIC
CANCER HAZARD
AUTHORIZED PERSONNEL ONLY
NO SMOKING OR EATING
RESPIRATOR REQUIRED

(ii) The employer shall assure that signs required by this subsection are illuminated and cleaned as necessary so that the legend is readily visible.

(c) Labels. The employer shall apply precautionary labels to all shipping and storage containers of inorganic arsenic, and to all products containing inorganic arsenic except when the inorganic arsenic in the product is bound in such a manner so as to make unlikely the possibility of airborne exposure to inorganic arsenic. (Possible examples of products not requiring labels are semiconductors, light emitting diodes and glass.) The label shall bear the following legend:

DANGER
CONTAINS INORGANIC ARSENIC
CANCER HAZARD
HARMFUL IF INHALED OR
SWALLOWED
USE ONLY WITH ADEQUATE
VENTILATION
OR RESPIRATORY PROTECTION

(17) Recordkeeping.

(a) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (5) of this section.

(ii) This record shall include:

(A) The date(s), number, duration location, and results of each of the samples taken, including a description of the sam-

pling procedure used to determine representative employee exposure where applicable;

(B) A description of the sampling and analytical methods used and evidence of their accuracy;

(C) The type of respiratory protective devices worn, if any;

(D) Name, Social Security number, and job classification of the employees monitored and of all other employees whose exposure the measurement is intended to represent; and

(E) The environmental variables that could affect the measurement of the employee's exposure.

(iii) The employer shall maintain these monitoring records for at least forty years or for the duration of employment plus twenty years, whichever is longer.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subsection (14) of this section.

(ii) This record shall include:

(A) The name, Social Security number, and description of duties of the employee;

(B) A copy of the physician's written opinions;

(C) Results of any exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(D) Any employee medical complaints related to exposure to inorganic arsenic.

(iii) The employer shall in addition keep, or assure that the examining physician keeps, the following medical records:

(A) A copy of the medical examination results including medical and work history required under subsection (14) of this section;

(B) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information;

(C) The initial x-ray;

(D) The x-rays for the most recent five years;

(E) Any x-rays with a demonstrated abnormality and all subsequent x-rays; and

(F) Any cytologic examination slides with demonstrated atypia, if such atypia persists for three years, and all subsequent slides and written descriptions.

(iv) The employer shall maintain or assure that the physician maintains those medical records for at least forty years, or for the duration of employment, plus twenty years, whichever is longer.

(c) Availability.

(i) The employer shall make available upon request all records required to be maintained by subsection (17) of this section to the director for examination and copying.

(ii) Records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(iii) The employer shall make available upon request an employee's medical records and exposure records representative of that employee's exposure required to be maintained by

subsection (17) of this section to the affected employee or former employee or to a physician designated by the affected employee or former employee.

(d) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section.

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by this section for the prescribed period, these records shall be transmitted to the director.

(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the director at least three months prior to the disposal of such records and shall transmit those records to the director if he requests them within that period.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in WAC 296-62-05215.

(18) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to inorganic arsenic conducted pursuant to subsection (5) of this section.

(b) Observation procedures.

(i) Whenever observation of the monitoring of employee exposure to inorganic arsenic requires entry into an area where the use of respirators, protective clothing, or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing, and such equipment, and shall require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled to;

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the monitoring of inorganic arsenic performed at the place of exposure; and

(C) Record the results obtained or receive copies of the results when returned by the laboratory.

(19) Effective date. This standard shall become effective thirty days after filing with the code reviser.

(20) Appendices. The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

(21) Startup dates.

(a) General. The startup dates of requirements of this standard shall be the effective date of this standard unless another startup date is provided for, either in other subsections of this section or in this subsection.

(b) Monitoring. Initial monitoring shall be commenced by August 1, 1978, and shall be completed by September 15, 1978.

(c) Regulated areas. Regulated areas required to be established as a result of initial monitoring shall be set up as soon as possible after the results of that monitoring is known and no later than October 1, 1978.

(d) Compliance program. The written program required by subsection (7)(b) as a result of initial monitoring shall be made available for inspection and copying as soon as possible and no later than December 1, 1978.

(e) Hygiene and lunchroom facilities. Construction plans for change-rooms, showers, lavatories, and lunchroom facilities shall be completed no later than December 1, 1978, and these facilities shall be constructed and in use no later than July 1, 1979. However, if as part of the compliance plan it is predicted by an independent engineering firm that engineering controls and work practices will reduce exposures below the permissible exposure limit by December 31, 1979, for affected employees, then such facilities need not be completed until one year after the engineering controls are completed or December 31, 1980, whichever is earlier, if such controls have not in fact succeeded in reducing exposure to below the permissible exposure limit.

(f) Summary of startup dates set forth elsewhere in this standard.

STARTUP DATES

August 1, 1978 - Respirator use over 500 $\mu\text{g}/\text{m}^3$.

AS SOON AS POSSIBLE BUT NO LATER THAN

September 15, 1978 - Completion of initial monitoring.

October 1, 1978 - Complete establishment of regulated areas.
Respirator use for employees exposed above 50 $\mu\text{g}/\text{m}^3$.
Completion of initial training. Notification of use.

December 1, 1978 - Respirator use over 10 $\mu\text{g}/\text{m}^3$. Completion of initial medical. Completion of compliance plan.
Optional use of powered air-purifying respirators.

July 1, 1979 - Completion of lunch rooms and hygiene facilities.

December 31, 1979 - Completion of engineering controls.

All other requirements of the standard have as their startup date August 1, 1978.

[Statutory Authority: RCW 49.17.010, [49.17].040 and [49.17].050. 98-02-030, § 296-62-07347, filed 12/31/97, effective 1/31/98. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07347, filed 7/20/94, effective 9/20/94. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-07347, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07347, filed 7/27/81; 79-08-115 (Order 79-9), § 296-62-07347, filed 7/31/79; 79-02-037 (Order 79-1), § 296-62-07347, filed 1/23/79.]

WAC 296-62-07354 Appendices—Inorganic arsenic. The information in Appendices A, B, and C is not intended, by itself, to create any additional obligations not otherwise imposed by WAC 296-62-07347 nor detract from existing obligation.

(1) Appendix A—Inorganic arsenic substance information sheet.

(a) Substance identification.

(i) Substance. Inorganic arsenic.

(ii) Definition. Copper acetoarsenite, arsenic and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).

(iii) Permissible exposure limit. Ten micrograms per cubic meter of air as determined as an average over an 8 hour period. No employee may be exposed to any skin or eye con-

tact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.

(iv) Regulated areas. Only employees authorized by your employer should enter a regulated area.

(b) Health hazard data.

(i) Comments. The health hazard of inorganic arsenic is high.

(ii) Ways in which the chemical affects your body. Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.

(c) Personal protective equipment and clothing.

(i) Respirators. Respirators will be provided by the employer at no cost to employees for routine use if the employer is in the process of implementing engineering and work practice controls or where engineering and work practice controls are not feasible or insufficient. Respirators must be worn for nonroutine activities or in emergency situations where there is likely to be exposure to levels of inorganic arsenic in excess of the permissible exposure limit. Since how well the respirator fits is very important, the employer is required to conduct fit tests to make sure the respirator seals properly when worn. These tests are simple and rapid and will be explained during training sessions.

(ii) Protective clothing. If work is in a regulated area, the employer is required to provide at no cost to employees, and it must be worn, appropriate, clean, protective clothing and equipment. The purpose of this equipment is to prevent the employee from taking home arsenic-contaminated dust and to protect the body from repeated skin contact with inorganic arsenic likely to cause skin irritation. This clothing shall include such items as coveralls or similar full-body clothing, gloves, shoes or coverlets, and aprons. Protective equipment should include face shields or vented goggles, where eye irritation may occur.

(d) Hygiene facilities and practices.

(i) The employer shall ensure that employees do not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the regulated area, except that drinking water is permitted. If work is in a regulated area, the employer is required to provide lunchrooms or other areas for these purposes.

(ii) If work is in a regulated area, the employer is required to provide showers, washing facilities, and change rooms. The employer shall ensure that employees wash faces and hands before eating and shower at the end of the work shift. Do not take used protective clothing out of change rooms without the employer's permission. The employer is required to provide for laundering or cleaning of the protective clothing.

(e) Signs and labels. The employer is required to post warning signs and labels for employee protection. Signs must be posted in regulated areas. The signs must warn that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking or eating is allowed, and that respirators must be worn.

(f) Medical examinations. If exposure to arsenic is over the action level ($5 \mu\text{g}/\text{m}^3$) (including all persons working in regulated areas) at least 30 days per year, or employees have been exposed to arsenic for more than 10 years over the action level, the employer is required to provide employees with a medical examination. The examination shall be every 6 months for employees over 45 years old or with more than 10 years exposure over the action level and annually for other covered employees. The medical examination must include a medical history; a chest x-ray (annual requirement only); skin examination; and nasal examination. The examining physician will provide a written opinion to the employer containing the results of the medical exams. Employees should also receive a copy of this opinion. The physician must not tell the employer any conditions he detects unrelated to occupational exposure to arsenic but must tell employees those conditions.

(g) Observation of monitoring. The employer is required to monitor employee exposure to arsenic and employees or their representatives are entitled to observe the monitoring procedure. Employees are entitled to receive an explanation of the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, employees must also be provided with and must wear the protective clothing and equipment.

(h) Access to records. Employees or their representatives are entitled to records of employee exposure to inorganic arsenic upon request to the employer. Employee medical examination records can be furnished to employees' physician if employees request the employer to provide them.

(i) Training and notification. Additional information on all of these items plus training as to hazards of exposure to inorganic arsenic and the engineering and work practice controls associated with employees' jobs will also be provided by the employer. If employees are exposed over the permissible exposure limit, the employer must inform employees of that fact and the actions to be taken to reduce employee exposure.

(2) Appendix B—Substance technical guidelines.
Arsenic, arsenic trioxide, arsenic trichloride (3 examples)

(a) Physical and chemical properties

(i) Arsenic (metal)

(A) Formula: As

(B) Appearance: Gray metal

(C) Melting point: Sublimes without melting at 613C

(D) Specific gravity: ($\text{H}_2\text{O} = 1$):5.73.

(E) Solubility in water: Insoluble

(ii) Arsenic trioxide

(A) Formula: As_2O_3 , (As_4O_6).

(B) Appearance: White powder

(C) Melting point: 315C

(D) Specific gravity: ($\text{H}_2\text{O} = 1$):3.74

(E) Solubility in water: 3.7 grams in 100cc of water at 20C

(iii) Arsenic trichloride (liquid)(Trichloride)

(A) Formula: AsCl_3

(B) Appearance: Colorless or pale yellow liquid

(C) Melting point: -8.5C

(D) Boiling point: 130.2C

(E) Specific gravity ($1120 = 1$):2:16 at 20C

- (F) Vapor Pressure: 10mm Hg at 23.5C.
- (G) Solubility in water: Decomposes in water.
- (b) Fire, explosion, and reactivity data.
- (i) Fire: Arsenic trioxide and arsenic trichloride are non-flammable.
- (ii) Reactivity:
- (A) Conditions contributing to instability: Heat.
- (B) Incompatibility: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.
- (c) Monitoring and measurement procedures.
- (i) Samples collected should be full shift (at least 7 hours) samples. Sampling should be done using a personal sampling pump at a flow rate of 2 liters per minute. Samples should be collected on 0.8 micrometer pore size membrane filter (37mm diameter). Volatile arsenicals such as arsenic trichloride can be most easily collected in a midget bubbler filled with 15 ml. of 0.1 N NaOH.
- (ii) The method of sampling and analysis should have an accuracy of not less than ± 25 percent (with a confidence limit of 95 percent) for 10 micrograms per cubic meter of air ($10 \mu\text{g}/\text{m}^3$) and ± 35 percent (with a confidence limit of 95 percent) for concentrations of inorganic arsenic between 5 and $10 \mu\text{g}/\text{m}^3$.
- (3) Appendix C—Medical surveillance guidelines.
- (a) General.
- (i) Medical examinations are to be provided for all employees exposed to levels of inorganic arsenic above the action level ($5 \mu\text{g}/\text{m}^3$) for at least 30 days per year (which would include among others, all employees, who work in regulated areas). Examinations are also to be provided to all employees who have had 10 years or more exposure above the action level for more than 30 days per year while working for the present or predecessor employer though they may no longer be exposed above the level.
- (ii) An initial medical examination is to be provided to all such employees by December 1, 1978. In addition, an initial medical examination is to be provided to all employees who are first assigned to areas in which worker exposure will probably exceed $5 \mu\text{g}/\text{m}^3$ (after the effective date of this standard) at the time of initial assignment. In addition to its immediate diagnostic usefulness the initial examination will provide a baseline for comparing future test results. The initial examination must include as a minimum the following elements:
- (A) A work and medical history, including a smoking history, and presence and degree of respiratory symptoms such as breathlessness, cough, sputum production, and wheezing;
- (B) A 14-inch by 17-inch posterior-anterior chest x-ray and an International Labor Office UICC/Cincinnati (ILO U/C) rating;
- (C) A nasal and skin examination; and
- (D) Other examinations which the physician believes appropriate because of the employee's exposure to inorganic arsenic or because of required respirator use.
- (iii) Periodic examinations are also to be provided to the employees listed above. The periodic examinations shall be given annually for those covered employees 45 years of age or less with fewer than 10 years employment in areas where

employee exposure exceeds the action level ($5 \mu\text{g}/\text{m}^3$). Periodic examinations need to include an updated work history and medical history; chest x-ray; nasal and skin examinations; and other examinations which the physician believes appropriate.

(iv) Periodic examinations for other covered employees, shall be provided every 6 months. These examinations shall include an updated work history and medical history; nasal and skin examinations; and other examinations which the physician believes appropriate.

(v) The examination contents are minimum requirements. Additional tests such as lateral and oblique x-rays or pulmonary function tests may be useful. For workers exposed to 3 arsenicals, copper acetoarsenite, potassium arsenite, or sodium arsenite, which are associated with lymphatic cancer, the examination should also include palpation of superficial lymph nodes and complete blood count.

(b) Noncarcinogenic effects.

(i) The WISHA standard is based on minimizing risk of exposed workers dying of lung cancer from exposure to inorganic arsenic. It will also minimize skin cancer from such exposures.

(ii) The following three sections quoted from "Occupational Diseases: A Guide to Their Recognition," Revised Edition, June 1977, National Institute for Occupational Safety and Health is included to provide information on the nonneoplastic effects of exposure to inorganic arsenic. Such effects should not occur if the WISHA standards are followed.

(A) Local—Trivalent arsenic compounds are corrosive to the skin. Brief contact has no effect but prolonged contact results in a local hyperemia and later vesicular or pustular eruption. The moist mucous membranes are most sensitive to the irritant action. Conjunctiva, moist and macerated areas of skin, the eyelids, the angles of the ears, nose, mouth, and respiratory mucosa are also vulnerable to the irritant effects. The wrists are common sites of dermatitis, as are the genitalia if personal hygiene is poor. Perforations of the nasal septum may occur. Arsenic trioxide and pentoxide are capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially of the palms and soles.

(B) Systemic.

(I) The acute toxic effects of arsenic are generally seen following ingestion of inorganic arsenical compounds. This rarely occurs in an industrial setting. Symptoms develop within 1/2 to 4 hours following ingestion and are usually characterized by constriction of the throat followed by dysphagia, epigastric pain, vomiting, and watery diarrhea. Blood may appear in vomitus and stools. If the amount ingested is sufficiently high, shock may develop due to severe fluid loss, and death may ensue in 24 hours. If the acute effects are survived, exfoliative dermatitis and peripheral neuritis may develop.

(II) Cases of acute arsenical poisoning due to inhalation are exceedingly rare in industry. When it does occur, respiratory tract symptoms - cough, chest pain, dyspnea - giddiness, headache, and extreme general weakness precede gastrointestinal symptoms. The acute toxic symptoms of trivalent arsenical poisoning are due to severe inflammation of the

mucous membranes and greatly increased permeability of the blood capillaries.

(III) Chronic arsenical poisoning due to ingestion is rare and generally confined to patients taking prescribed medications. However, it can be a concomitant of inhaled inorganic arsenic from swallowed sputum and improper eating habits. Symptoms are weight loss, nausea and diarrhea alternating with constipation, pigmentation and eruption of the skin, loss of hair, and peripheral neuritis. Chronic hepatitis and cirrhosis have been described. Polyneuritis may be the salient feature, but more frequently there are numbness and paresthesias of "glove and stocking" distribution. The skin lesions are usually melanotic and keratotic and may occasionally take the form of an intradermal cancer of the squamous cell type, but without infiltrative properties. Horizontal white lines (striations) on the fingernails and toenails are commonly seen in chronic arsenical poisoning and are considered to be a diagnostic accompaniment of arsenical polyneuritis.

(IV) Inhalation of inorganic arsenic compounds is the most common cause of chronic poisoning in the industrial situation. This condition is divided into three phases based on signs and symptoms.

(V) First phase: The worker complains of weakness, loss of appetite, some nausea, occasional vomiting, a sense of heaviness in the stomach, and some diarrhea.

(VI) Second phase: The worker complains of conjunctivitis, a catarrhal state of the mucous membranes of the nose, larynx, and respiratory passage. Coryza, hoarseness, and mild tracheobronchitis may occur. Perforation of the nasal septum is common, and is probably the most typical lesion of the upper respiratory tract in occupational exposure to arsenical dust. Skin lesions, eczematoid and allergic in type, are common.

(VII) Third phase: The worker complains of symptoms of peripheral neuritis, initially of hands and feet, which is essentially sensory. In more severe cases, motor paralyses occur; the first muscles affected are usually the toe extensors and the peronei. In only the most severe cases will paralysis of flexor muscles of the feet or of the extensor muscles of hands occur.

(VIII) Liver damage from chronic arsenical poisoning is still debated, and as yet the question is unanswered. In cases of chronic and acute arsenical poisoning, toxic effects to the myocardium have been reported based on EKG changes. These findings, however, are now largely discounted and the EKG changes are ascribed to electrolyte disturbances concomitant with arsenicalism. Inhalation of arsenic trioxide and other inorganic arsenical dusts does not give rise to radiological evidence or pneumoconiosis. Arsenic does have a depressant effect upon the bone marrow, with disturbances of both erythropoiesis and myelopoiesis.

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[Statutory Authority: RCW 49.17.010, [49.17].040 and [49.17].050. 98-02-030, § 296-62-07354, filed 12/31/97, effective 1/31/98. Statutory Authority: Chapter 49.17 RCW. 90-20-091 (Order 90-14), § 296-62-07354, filed 10/1/90, effective 11/15/90.]

WAC 296-62-07355 Ethylene oxide. Scope and application.

(1) WAC 296-62-07355 through 296-62-07389 applies to all occupational exposures to ethylene oxide (EtO), Chemical Abstracts Service Registry No. 75-21-8, except as provided in subsection (2) of this section.

(2) WAC 296-62-07355 through 296-62-07389 does not apply to the processing, use, or handling of products containing EtO where objective data are reasonably relied upon that demonstrate that the product is not capable of releasing EtO in airborne concentrations at or above the action level, and may not reasonably be foreseen to release EtO in excess of the excursion limit, under the expected conditions of processing, use, or handling that will cause the greatest possible release.

(3) Where products containing EtO are exempted under subsection (2) of this section, the employer shall maintain records of the objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in WAC 296-62-07375(1).

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-07355, filed 11/22/91, effective 12/24/91; 88-23-054 (Order 88-25), § 296-62-07355, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07355, filed 11/30/87.]

WAC 296-62-07357 Definitions. For the purpose of WAC 296-62-07355 through 296-62-07389, the following definitions shall apply:

(1) "Action level" means a concentration of airborne EtO of 0.5 ppm calculated as an eight-hour time-weighted average.

(2) "Authorized person" means any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under WAC 296-62-07377, or any other person authorized by chapter 49.17 RCW or regulations issued under chapter 49.17 RCW.

(3) "Director" means the director of the department of labor and industries, or designee.

(4) "Emergency" means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that is likely to or does result in an unexpected significant release of EtO.

(5) "Employee exposure" means exposure to airborne EtO which would occur if the employee were not using respiratory protective equipment.

(6) "Ethylene oxide" or "EtO" means the three-membered ring organic compound with chemical formula C_2H_4O .

[Statutory Authority: Chapter 49.17 RCW, 87-24-051 (Order 87-24), § 296-62-07357, filed 11/30/87.]

WAC 296-62-07359 Permissible exposure limits (PEL). (1) Eight-hour time-weighted average (TWA). The employer shall ensure that no employee is exposed to an airborne concentration of EtO in excess of one part EtO per million parts of air (1 ppm) as an eight-hour time-weighted average. (Eight-hour TWA.)

(2) Excursion limit. The employer shall ensure that no employee is exposed to an airborne concentration of EtO in excess of five parts of EtO per million parts of air (5 ppm) as averaged over a sampling period of fifteen minutes.

[Statutory Authority: Chapter 49.17 RCW, 88-23-054 (Order 88-25), § 296-62-07359, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07359, filed 11/30/87.]

WAC 296-62-07361 Exposure monitoring. (1) General.

(a) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the eight-hour TWA and fifteen-minute short-term exposures of each employee.

(b) Representative eight-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for each shift for each job classification in each work area. Representative fifteen-minute short-term employee exposures shall be determined on the basis of one or more samples representing fifteen-minute exposures associated with operations that are most likely to produce exposures above the excursion limit for each shift for each job classification in each work area.

(c) Where the employer can document that exposure levels are equivalent for similar operations in different work shifts, the employer need only determine representative employee exposure for that operation during one shift.

(2) Initial monitoring.

(a) Each employer who has a workplace or work operation covered by WAC 296-62-07355 through 296-62-07389, except as provided in WAC 296-62-07355 (2) or (b) of this subsection, shall perform initial monitoring to determine accurately the airborne concentrations of EtO to which employees may be exposed.

(b) Where the employer has monitored after June 15, 1983, and the monitoring satisfies all other requirements of WAC 296-62-07355 through 296-62-07389, the employer may rely on such earlier monitoring results to satisfy the requirements of (a) of this subsection.

(c) Where the employer has previously monitored for the excursion limit and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of (a) of this subsection.

(3) Monitoring frequency (periodic monitoring).

(a) If the monitoring required by subsection (2) of this section reveals employee exposure at or above the action

level but at or below the eight-hour TWA, the employer shall repeat such monitoring for each such employee at least every six months.

(b) If the monitoring required by subsection (2)(a) of this section reveals employee exposure above the eight-hour TWA, the employer shall repeat such monitoring for each such employee at least every three months.

(c) The employer may alter the monitoring schedule from quarterly to semiannually for any employee for whom two consecutive measurements taken at least seven days apart indicate that the employee's exposure has decreased to or below the eight-hour TWA.

(d) If the monitoring required by subsection (2)(a) of this section reveals employee exposure above the fifteen-minute excursion limit, the employer shall repeat such monitoring for each such employee at least every three months, and more often as necessary to evaluate the employee's short-term exposures.

(4) Termination of monitoring.

(a) If the initial monitoring required by subsection (2)(a) of this section reveals employee exposure to be below the action level, the employer may discontinue TWA monitoring for those employees whose exposures are represented by the initial monitoring.

(b) If the periodic monitoring required by subsection (3) of this section reveals that employee exposures, as indicated by at least two consecutive measurements taken at least seven days apart, are below the action level, the employer may discontinue TWA monitoring for those employees whose exposures are represented by such monitoring.

(c) If the initial monitoring required by subsection (2)(a) of this section reveals the employee exposure to be at or below the excursion limit, the employer may discontinue excursion limit monitoring for those employees whose exposures are represented by the initial monitoring.

(d) If the periodic monitoring required by subsection (3) of this section reveals that employee exposures, as indicated by at least two consecutive measurements taken at least seven days apart, are at or below the excursion limit, the employer may discontinue excursion limit monitoring for those employees whose exposures are represented by such monitoring.

(5) Additional monitoring. Notwithstanding the provisions of subsection (4) of this section, the employer shall institute the exposure monitoring required under subsections (2)(a) and (3) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures to EtO or when the employer has any reason to suspect that a change may result in new or additional exposures.

(6) Accuracy of monitoring.

(a) Monitoring shall be accurate, to a confidence level of ninety-five percent, to within plus or minus twenty-five percent for airborne concentrations of EtO at the 1 ppm TWA and to within plus or minus thirty-five percent for airborne concentrations of EtO at the action level of 0.5 ppm.

(b) Monitoring shall be accurate, to a confidence level of ninety-five percent, to within plus or minus thirty-five percent for airborne concentrations of EtO at the excursion limit.

(7) Employee notification of monitoring results.

(a) The employer shall, within fifteen working days after the receipt of the results of any monitoring performed under WAC 296-62-07355 through 296-62-07389, notify the affected employee of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(b) The written notification required by (a) of this subsection shall contain the corrective action being taken by the employer to reduce employee exposure to or below the TWA and/or excursion limit, wherever monitoring results indicated that the TWA and/or excursion limit has been exceeded.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-62-07361, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07361, filed 11/30/87.]

WAC 296-62-07363 Regulated areas. (1) The employer shall establish a regulated area wherever occupational exposures to airborne concentrations of EtO may exceed the TWA or wherever the EtO concentration exceeds or can reasonably be expected to exceed the excursion limit.

(2) Access to regulated areas shall be limited to authorized persons.

(3) Regulated areas shall be demarcated in any manner that minimizes the number of employees within the regulated area.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-62-07363, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07363, filed 11/30/87.]

WAC 296-62-07365 Methods of compliance. (1) Engineering controls and work practices.

(a) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the TWA and to or below the excursion limit, except to the extent that such controls are not feasible.

(b) Wherever the feasible engineering controls and work practices that can be instituted are not sufficient to reduce employee exposure to or below the TWA and to or below the excursion limit, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of WAC 296-62-07367.

(c) Engineering controls are generally infeasible for the following operations: Collection of quality assurance sampling from sterilized materials removal of biological indicators from sterilized materials; Loading and unloading of tank cars; changing of ethylene oxide tanks on sterilizers; and vessel cleaning. For these operations, engineering controls are required only where the director demonstrates that such controls are feasible.

(2) Compliance program.

(a) Where the TWA or excursion limit is exceeded, the employer shall establish and implement a written program to reduce employee exposure to or below the TWA and to or below the excursion limit by means of engineering and work practice controls, as required by subsection (1) of this section, and by the use of respiratory protection where required or permitted under WAC 296-62-07355 through 296-62-07389.

(b) The compliance program shall include a schedule for periodic leak detection surveys and a written plan for emergency situations, as specified in WAC 296-62-07369 (1)(a).

(c) Written plans for a program required in this subsection shall be developed and furnished upon request for examination and copying to the director, affected employees and designated employee representatives. Such plans shall be reviewed at least every twelve months, and shall be updated as necessary to reflect significant changes in the status of the employer's compliance program.

(d) The employer shall not implement a schedule of employee rotation as a means of compliance with the TWA or excursion limit.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-62-07365, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07365, filed 11/30/87.]

WAC 296-62-07367 Respiratory protection and personal protective equipment. (1) General. The employer shall provide respirators, and ensure that they are used, where required by WAC 296-62-07355 through 296-62-07389. Respirators shall be used in the following circumstances.

(a) During the interval necessary to install or implement feasible engineering and work practice controls;

(b) In work operations, such as maintenance and repair activities, vessel cleaning, or other activities for which engineering and work practice controls are not feasible;

(c) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the TWA or excursion limit; and

(d) In emergencies.

(2) Respirator selection.

(a) Where respirators are required under WAC 296-62-07355 through 296-62-07389, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1, and shall ensure that the employee uses the respirator provided.

(b) The employer shall select respirators from among those jointly approved as being acceptable for protection against EtO by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(3) Respirator program. Where respiratory protection is required by WAC 296-62-07355 through 296-62-07389, the employer shall institute a respirator program in accordance with WAC 296-62-071.

(4) Protective clothing and equipment. Where eye or skin contact with liquid EtO or EtO solutions may occur, the employer shall select and provide, at no cost to the employee, appropriate protective clothing or other equipment in accordance with chapter 296-24 WAC, Part A-2, and to protect any area of the body that may come in contact with liquid EtO or EtO in solution, and shall ensure that the employee wears the protective clothing and equipment provided.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-62-07367, filed 9/30/94, effective 11/20/94; 88-23-054 (Order 88-25), § 296-62-07367, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07367, filed 11/30/87.]

WAC 296-62-07369 Emergency situations. (1) Written plan.

(a) A written plan for emergency situations shall be developed for each workplace where there is a possibility of an emergency. Appropriate portions of the plan shall be implemented in the event of an emergency.

(b) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped with respiratory protection as required by WAC 296-62-07367 until the emergency is abated.

(c) The plan shall include the elements prescribed in WAC 296-24-567, "Employee emergency plans and fire prevention plans."

(2) Alerting employees. Where there is the possibility of employee exposure to EtO due to an emergency, means shall be developed to alert potentially affected employees of such occurrences promptly. Affected employees shall be immediately evacuated from the area in the event that an emergency occurs.

Table 1.—Minimum Requirements for Respiratory Protection for Airborne EtO

Condition of use or concentration of airborne EtO (ppm)	Minimum required respirator
Equal to or less than 50.	(a) Full facepiece respirator with EtO approved canister, front-or back-mounted.
Equal to or less than 2,000.	(a) Positive-pressure supplied air respirator, equipped with full facepiece, hood, or helmet, or
	(b) Continuous-flow supplied air respirator (positive pressure) equipped with hood, helmet or suit.
Concentration above 2,000 or unknown concentration (such as in emergencies).	(a) Positive-pressure self-contained breathing apparatus (SCBA), equipped with full facepiece, or
	(b) Positive-pressure full facepiece supplied air respirator equipped with an auxiliary positive-pressure self-contained breathing apparatus.
Firefighting	(a) Positive pressure self-contained breathing apparatus equipped with full facepiece.
Escape	(a) Any respirator described above.

Note: Respirators approved for use in higher concentrations are permitted to be used in lower concentrations.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07369, filed 11/30/87.]

WAC 296-62-07371 Medical surveillance. (1) General.

(a) Employees covered.

(i) The employer shall institute a medical surveillance program for all employees who are or may be exposed to EtO at or above the action level, without regard to the use of respirators, for at least thirty days a year.

(ii) The employer shall make available medical examinations and consultations to all employees who have been exposed to EtO in an emergency situation.

(b) Examination by a physician. The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and are provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(2) Medical examinations and consultations.

(a) Frequency. The employer shall make available medical examinations and consultations to each employee covered under subsection (1)(a) of this section on the following schedules:

(i) Prior to assignment of the employee to an area where exposure may be at or above the action level for at least thirty days a year.

(ii) At least annually each employee exposed at or above the action level for at least thirty days in the past year.

(iii) At termination of employment or reassignment to an area where exposure to EtO is not at or above the action level for at least thirty days a year.

(iv) As medically appropriate for any employee exposed during an emergency.

(v) As soon as possible, upon notification by an employee either (A) that the employee has developed signs or symptoms indicating possible overexposure to EtO, or (B) that the employee desires medical advice concerning the effects of current or past exposure to EtO on the employee's ability to produce a healthy child.

(vi) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies recommended by the physician.

(b) Content.

(i) Medical examinations made available pursuant to (a)(i) through (iv) of this subsection shall include:

(A) A medical and work history with special emphasis directed to symptoms related to the pulmonary, hematologic, neurologic, and reproductive systems and to the eyes and skin.

(B) A physical examination with particular emphasis given to the pulmonary, hematologic, neurologic, and reproductive systems and to the eyes and skin.

(C) A complete blood count to include at least a white cell count (including differential cell count), red cell count, hematocrit, and hemoglobin.

(D) Any laboratory or other test which the examining physician deems necessary by sound medical practice.

(ii) The content of medical examinations or consultation made available pursuant to (a)(i)(v) of this subsection shall be determined by the examining physician, and shall include pregnancy testing or laboratory evaluation of fertility, if requested by the employee and deemed appropriate by the physician.

(3) Information provided to the physician. The employer shall provide the following information to the examining physician:

(a) A copy of WAC 296-62-07355 through 296-62-07389.

(b) A description of the affected employee's duties as they relate to the employee's exposure.

(c) The employee's representative exposure level or anticipated exposure level.

(d) A description of any personal protective and respiratory equipment used or to be used.

(e) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(4) Physician's written opinion.

(a) The employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(i) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to EtO;

(ii) Any recommended limitations on the employee or upon the use of personal protective equipment such as clothing or respirators; and

(iii) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions resulting from EtO exposure that require further explanation or treatment.

(b) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to EtO.

(c) The employer shall provide a copy of the physician's written opinion to the affected employee within fifteen days from its receipt.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07371, filed 11/30/87.]

WAC 296-62-07373 Communication of EtO hazards to employees. (1) Signs and labels.

(a) The employer shall post and maintain legible signs demarcating regulated areas and entrances or accessways to regulated areas that bear the following legend:

DANGER
ETHYLENE OXIDE
CANCER HAZARD AND REPRODUCTIVE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING MAY BE REQUIRED
TO BE WORN IN THIS AREA

(b) The employer shall ensure that precautionary labels are affixed to all containers of EtO whose contents are capable of causing employee exposure at or above the action level or whose contents may reasonably be foreseen to cause employee exposure above the excursion limit, and that the labels remain affixed when the containers of EtO leave the workplace. For the purpose of this subsection, reaction vessels, storage tanks, and pipes or piping systems are not considered to be containers. The labels shall comply with the requirements of WAC 296-62-05411 of WISHA's hazard communication standard, and shall include the following legend:

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(i)

DANGER
CONTAINS ETHYLENE OXIDE
CANCER HAZARD AND REPRODUCTIVE HAZARD; and

(ii) A warning statement against breathing airborne concentrations of EtO.

(c) The labeling requirements under WAC 296-62-07355 through 296-62-07389 do not apply where EtO is used as a pesticide, as such term is defined in the Federal Insecticide, Fungicide, and Rodenticide Act (7 U.S.C. 136 et seq.), when it is labeled pursuant to that act and regulations issued under that act by the Environmental Protection Agency.

(2) Material safety data sheets. Employers who are manufacturers or importers of EtO shall comply with the requirements regarding development of material safety data sheets as specified in WAC 296-62-05413 of the hazard communication standard.

(3) Information and training.

(a) The employer shall provide employees who are potentially exposed to EtO at or above the action level or above the excursion limit with information and training on EtO at the time of initial assignment and at least annually thereafter.

(b) Employees shall be informed of the following:

(i) The requirements of WAC 296-62-07353 through 296-62-07389 with an explanation of its contents, including Appendices A and B;

(ii) Any operations in their work area where EtO is present;

(iii) The location and availability of the written EtO final rule; and

(iv) The medical surveillance program required by WAC 296-62-07371 with an explanation of the information in Appendix C.

(c) Employee training shall include at least:

(i) Methods and observations that may be used to detect the presence or release of EtO in the work area (such as monitoring conducted by the employer, continuous monitoring devices, etc.);

(ii) The physical and health hazards of EtO;

(iii) The measures employees can take to protect themselves from hazards associated with EtO exposure, including specific procedures the employer has implemented to protect employees from exposure to EtO, such as work practices, emergency procedures, and personal protective equipment to be used; and

(iv) The details of the hazard communication program developed by the employer, including an explanation of the labeling system and how employees can obtain and use the appropriate hazard information.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-62-07373, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07373, filed 11/30/87.]

WAC 296-62-07375 Recordkeeping. (1) Objective data for exempted operations.

(a) Where the processing, use, or handling of products made from or containing EtO are exempted from other requirements of WAC 296-62-07355 through 296-62-07389

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under WAC 296-62-07355, or where objective data have been relied on in lieu of initial monitoring under WAC 296-62-07361 (2)(b), the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(b) This record shall include at least the following information:

- (i) The product qualifying for exemption;
- (ii) The source of the objective data;
- (iii) The testing protocol, results of testing, and/or analysis of the material for the release of EtO;
- (iv) A description of the operation exempted and how the data support the exemption; and
- (v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) Exposure measurements.

(a) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to EtO as prescribed in WAC 296-62-07361.

(b) This record shall include at least the following information:

- (i) The date of measurement;
- (ii) The operation involving exposure to EtO which is being monitored;
- (iii) Sampling and analytical methods used and evidence of their accuracy;
- (iv) Number, duration, and results of samples taken;
- (v) Type of protective devices worn, if any; and
- (vi) Name, Social Security number and exposure of the employees whose exposures are represented.

(c) The employer shall maintain this record for at least thirty years, in accordance with WAC 296-62-05207.

(3) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by WAC 296-62-07371 (1)(a), in accordance with WAC 296-62-05207.

(b) The record shall include at least the following information:

- (i) The name and Social Security number of the employee;
- (ii) Physicians' written opinions;
- (iii) Any employee medical complaints related to exposure to EtO; and
- (iv) A copy of the information provided to the physician as required by WAC 296-62-07371(3).

(c) The employer shall ensure that this record is maintained for the duration of employment plus thirty years, in accordance with WAC 296-62-05207.

(4) Availability.

(a) The employer, upon written request, shall make all records required to be maintained by WAC 296-62-07355 through 296-62-07389 available to the director for examination and copying.

(b) The employer, upon request, shall make any exemption and exposure records required by WAC 296-62-07377 (1) and (2) available for examination and copying to affected employees, former employees, designated representatives

and the director, in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(c) The employer, upon request, shall make employee medical records required by subsection (3) of this section available for examination and copying to the subject employee, anyone having the specific written consent of the subject employee, and the director, in accordance with WAC 296-62-052.

(5) Transfer of records.

(a) The employer shall comply with the requirements concerning transfer of records set forth in WAC 296-62-05215.

(b) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director at least ninety days prior to disposal and transmit them to the director.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07375, filed 11/30/87.]

WAC 296-62-07377 Observation of monitoring. (1) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to EtO conducted in accordance with WAC 296-62-07361.

(2) Observation procedures. When observation of the monitoring of employee exposure to EtO requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07377, filed 11/30/87.]

WAC 296-62-07379 Dates. (1) Effective date.

(a) WAC 296-62-07355 through 296-62-07389 shall become effective thirty days after filing with the code reviser.

(b) The requirements in the amended subsections in this section which pertain only to or are triggered by the excursion limit shall become effective December 30, 1988.

(2) Start-up dates.

(a) The requirements of WAC 296-62-07359 through 296-62-07377, including feasible work practice controls but not including engineering controls specified in WAC 296-62-07365(1), shall be complied with within one hundred eighty days after the effective date of WAC 296-62-07355 through 296-62-07389.

(b) Engineering controls specified by WAC 296-62-07365(1) shall be implemented within one year after the effective date of WAC 296-62-07355 through 296-62-07389.

(c) Compliance with the excursion limit requirements in this section shall be by March 30, 1989, except that implementation of engineering controls specified for compliance with excursion limit shall be by June 30, 1989.

[Statutory Authority: Chapter 49.17 RCW. 88-23-054 (Order 88-25), § 296-62-07379, filed 11/14/88; 87-24-051 (Order 87-24), § 296-62-07379, filed 11/30/87.]

WAC 296-62-07381 Appendices. The information contained in the appendices is not intended by itself to create any

additional obligations not otherwise imposed or to detract from any existing obligation.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07381, filed 11/30/87.]

WAC 296-62-07383 Appendix A—Substance safety data sheet for ethylene oxide (nonmandatory). (1) Substance identification

(a) Substance: Ethylene oxide (C₂H₄O).

(b) Synonyms: Dihydrooxirene, dimethylene oxide, EO, 1,2-epoxyethane, EtO, ETO, oxacyclopropane, oxane, oxidoethane, alpha/beta-oxidoethane, oxiran, oxirane.

(c) Ethylene oxide can be found as a liquid or vapor.

(d) EtO is used in the manufacture of ethylene glycol, surfactants, ethanalamines, glycol ethers, and other organic chemicals. EtO is also used as a sterilant and fumigant.

(e) Appearance and odor: Colorless liquid below 10.7°C (51.3°F) or colorless gas with ether-like odor detected at approximately 700 parts EtO per million parts of air (700 ppm).

(f) Permissible exposure: Exposure may not exceed 1 part EtO per million parts of air averaged over the 8-hour work day.

(2) Health hazard data

(a) Ethylene oxide can cause bodily harm if you inhale the vapor, if it comes into contact with your eyes or skin, or if you swallow it.

(b) Effects of overexposure:

(i) Ethylene oxide in liquid form can cause eye irritation and injury to the cornea, frostbite, and severe irritation and blistering of the skin upon prolonged or confined contact. Ingestion of EtO can cause gastric irritation and liver injury. Acute effects from inhalation of EtO vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis (blue or purple coloring of skin). Exposure has also been associated with the occurrence of cancer, reproductive effects, mutagenic changes, neurotoxicity, and sensitization.

(ii) EtO has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Adverse reproductive effects and chromosome damage may also occur from EtO exposure.

(c) Reporting signs and symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to EtO.

(3) Emergency first aid procedures

(a) Eye exposure: If EtO gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper eyelids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

(b) Skin exposure: If EtO gets on your skin, immediately wash the contaminated skin with water. If EtO soaks through your clothing, especially your shoes, remove the clothing immediately and wash the skin with water using an emergency deluge shower. Get medical attention immediately. Thoroughly wash contaminated clothing before reusing. Contaminated leather shoes or other leather articles should not be reused and should be discarded.

(c) Inhalation: If large amounts of EtO are inhaled, the exposed person must be moved to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Keep the affected person warm and at rest. Get medical attention immediately.

(d) Swallowing: When EtO has been swallowed, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him or her touch the back of the throat with his or her finger. Do not make an unconscious person vomit. Get medical attention immediately.

(e) Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, attempt rescue only after notifying at least one other person of the emergency and putting into effect established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

(4) Respirators and protective clothing

(a) Respirators:

(i) You may be required to wear a respirator for nonroutine activities, in emergencies, while your employer is in the process of reducing EtO exposure through engineering controls, and where engineering controls are not feasible. As of the effective date of the standard, only air supplied positive-pressure, full-facepiece respirators are approved for protection against EtO. If air-purifying respirators are worn in the future, they must have a joint Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH) label of approval for use with ethylene oxide. For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required.

(ii) EtO does not have a detectable odor except at levels well above the permissible exposure limits. If you can smell EtO while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

(b) Protective clothing:

(i) You may be required to wear impermeable clothing, gloves, a face shield, or other appropriate protective clothing to prevent skin contact with liquid EtO or EtO-containing solutions. Where protective clothing is required, your employer must provide clean garments to you as necessary to assure that the clothing protects you adequately.

(ii) Replace or repair protective clothing that has become torn or otherwise damaged.

(iii) EtO must never be allowed to remain on the skin. Clothing and shoes which are not impermeable to EtO should not be allowed to become contaminated with EtO, and if they do, the clothing should be promptly removed and decontaminated. Contaminated leather shoes should be discarded. Once EtO penetrates shoes or other leather articles, they should not be worn again.

(c) Eye protection: You must wear splashproof safety goggles in areas where liquid EtO or EtO-containing solutions may contact your eyes. In addition, contact lenses should not be worn in areas where eye contact with EtO can occur.

(5) Precautions for safe use, handling, and storage

(a) EtO is a flammable liquid, and its vapors can easily form explosive mixtures in air.

(b) EtO must be stored in tightly closed containers in a cool, well-ventilated area, away from heat, sparks, flames, strong oxidizers, alkalines, and acids, strong bases, acetylide forming metals such as copper, silver, mercury and their alloys.

(c) Sources of ignition such as smoking material, open flames and some electrical devices are prohibited wherever EtO is handled, used, or stored in a manner that could create a potential fire or explosion hazard.

(d) You should use nonsparking tools when opening or closing metal containers of EtO, and containers must be bonded and grounded in the rare instances in which liquid EtO is poured or transferred.

(e) Impermeable clothing wet with liquid EtO or EtO-containing solutions may be easily ignited. If you are wearing impermeable clothing and are splashed with liquid EtO or EtO-containing solution, you should immediately remove the clothing while under an emergency deluge shower.

(f) If your skin comes into contact with liquid EtO or EtO-containing solutions, you should immediately remove the EtO using an emergency deluge shower.

(g) You should not keep food, beverages, or smoking materials in regulated areas where employee exposures are above the permissible exposure limits.

(h) Fire extinguishers and emergency deluge showers for quick drenching should be readily available, and you should know where they are and how to operate them.

(i) Ask your supervisor where EtO is used in your work area and for any additional plant safety and health rules.

(6) Access to information

(a) Each year, your employer is required to inform you of the information contained in this standard and appendices for EtO. In addition, your employer must instruct you in the proper work practices for using EtO emergency procedures, and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to EtO. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.

(c) Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept by the employer for at least thirty years. Medical records must be kept for the period of your employment plus thirty years.

(d) Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

(7) Sterilant use of EtO in hospitals and health care facilities.

(a) This section of Appendix A, for informational purposes, sets forth EPA's recommendations for modifications in workplace design and practice in hospitals and health care facilities for which the Environmental Protection Agency has

registered EtO for uses as a sterilant or fumigant under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. 136 *et seq.* These new recommendations, published in the **Federal Register** by EPA at 49 FR 15268, as modified in today's **Register**, are intended to help reduce the exposure of hospital and health care workers to EtO to 1 ppm. EPA's recommended workplace design and workplace practice are as follows:

(i) Workplace design

(A) Installation of gas line hand valves. Hand valves must be installed on the gas supply line at the connection to the supply cylinders to minimize leakage during cylinder change.

(B) Installation of capture boxes. Sterilizer operations result in a gas/water discharge at the completion of the process. This discharge is routinely piped to a floor drain which is generally located in an equipment or an adjacent room. When the floor drain is not in the same room as the sterilizer and workers are not normally present, all that is necessary is that the room be well ventilated.

(C) The installation of a "capture box" will be required for those work place layouts where the floor drain is located in the same room as the sterilizer or in a room where workers are normally present. A "capture box" is a piece of equipment that totally encloses the floor drain where the discharge from the sterilizer is pumped. The "capture box" is to be vented directly to a nonrecirculating or dedicated ventilation system. Sufficient air intake should be allowed at the bottom of the box to handle the volume of air that is ventilated from the top of the box. The "capture box" can be made of metal, plastic, wood or other equivalent material. The box is intended to reduce levels of EtO discharged into the work room atmosphere. The use of a "capture box" is not required if: (I) The vacuum pump discharge floor drain is located in a well ventilated equipment or other room where workers are not normally present or (II) the water sealed vacuum pump discharges directly to a closed sealed sewer line (check local plumbing codes).

(D) If it is impractical to install a vented "capture box" and a well ventilated equipment or other room is not feasible, a box that can be sealed over the floor drain may be used if: (I) The floor drain is located in a room where workers are not normally present and EtO cannot leak into an occupied area, and (II) the sterilizer in use is less than 12 cubic feet in capacity (check local plumbing codes).

(ii) Ventilation of aeration units.

(A) Existing aeration units. Existing units must be vented to a nonrecirculating or dedicated system or vented to an equipment or other room where workers are not normally present and which is well ventilated. Aerator units must be positioned as close as possible to the sterilizer to minimize the exposure from the off-gassing of sterilized items.

(B) Installation of new aerator units (where none exist). New aerator units must be vented as described above for existing aerators. Aerators must be in place by July 1, 1986.

(iii) Ventilation during cylinder change. Workers may be exposed to short but relatively high levels of EtO during the change of gas cylinders. To reduce exposure from this route, users must select one of three alternatives designed to draw

off gas that may be released when the line from the sterilizer to the cylinder is disconnected:

(A) Location of cylinders in a well ventilated equipment room or other room where workers are not normally present.

(B) Installation of a flexible hose (at least four inches in diameter) to a nonrecirculating or dedicated ventilation system and located in the area of cylinder change in such a way that the hose can be positioned at the point where the sterilizer gas line is disconnected from the cylinder.

(C) Installation of a hood that is part of a nonrecirculating or dedicated system and positioned no more than one foot above the point where the change of cylinders takes place.

(iv) Ventilation of sterilizer door area. One of the major sources of exposure to EtO occurs when the sterilizer door is opened following the completion of the sterilization process. In order to reduce this avenue of exposure, a hood or metal canopy closed on each end must be installed over the sterilizer door. The hood or metal canopy must be connected to a nonrecirculating or dedicated ventilation system or one that exhausts gases to a well ventilated equipment or other room where workers are not normally present. A hood or canopy over the sterilizer door is required for use even with those sterilizers that have a purge cycle and must be in place by July 1, 1986.

(v) Ventilation of sterilizer relief valve. Sterilizers are typically equipped with a safety relief device to release gas in case of increased pressure in the sterilizer. Generally, such relief devices are used on pressure vessels. Although these pressure relief devices are rarely opened for hospital and health care sterilizers, it is suggested that they be designed to exhaust vapor from the sterilizer by one of the following methods:

(A) Through a pipe connected to the outlet of the relief valve ventilated directly outdoors at a point high enough to be away from passers by, and not near any windows that open, or near any air conditioning or ventilation air intakes.

(B) Through a connection to an existing or new nonrecirculating or dedicated ventilation system.

(C) Through a connection to a well ventilated equipment or other room where workers are not normally present.

(vi) Ventilation systems. Each hospital and health care facility affected by this notice that uses EtO for the sterilization of equipment and supplies must have a ventilation system which enables compliance with the requirements of (a)(i)(B) through (v) of this subsection in the manner described in these sections and within the timeframes allowed. Thus, each affected hospital and health care facility must have or install a nonrecirculating or dedicated ventilation equipment or other room where workers are not normally present in which to vent EtO.

(vii) Installation of alarm systems. An audible and visual indicator alarm system must be installed to alert personnel of ventilation system failures, i.e., when the ventilation fan motor is not working.

(b) Workplace practices

(i) All the workplace practices discussed in this unit must be permanently posted near the door of each sterilizer prior to use by any operator.

(ii) Changing of supply line filters.

Filters in the sterilizer liquid line must be changed when necessary, by the following procedure:

(A) Close the cylinder valve and the hose valve.

(B) Disconnect the cylinder hose (piping) from the cylinder.

(C) Open the hose valve and bleed slowly into a proper ventilating system at or near the in-use supply cylinders.

(D) Vacate the area until the line is empty.

(E) Change the filter.

(F) Reconnect the lines and reverse the valve position.

(G) Check hoses, filters, and valves for leaks with a fluorocarbon leak detector (for those sterilizers using the eighty-eight percent chlorofluorocarbon, twelve percent ethylene oxide mixture (12/88)).

(iii) Restricted access area.

(A) Areas involving use of EtO must be designated as restricted access areas. They must be identified with signs or floor marks near the sterilizer door, aerator, vacuum pump floor drain discharge, and in-use cylinder storage.

(B) All personnel must be excluded from the restricted area when certain operations are in progress, such as discharging a vacuum pump, emptying a sterilizer liquid line, or venting a nonpurge sterilizer with the door ajar or other operations where EtO might be released directly into the face of workers.

(iv) Door opening procedures.

(A) Sterilizers with purge cycles. A load treated in a sterilizer equipped with a purge cycle should be removed immediately upon completion of the cycle (provided no time is lost opening the door after cycle is completed). If this is not done, the purge cycle should be repeated before opening door.

(B) Sterilizers without purge cycles. For a load treated in a sterilizer not equipped with a purge cycle, the sterilizer door must be ajar six inches for fifteen minutes, and then fully opened for at least another fifteen minutes before removing the treated load. The length of time of the second period should be established by peak monitoring for one hour after the two fifteen-minute periods suggested. If the level is above 10 ppm time-weighted average for eight hours, more time should be added to the second waiting period (door wide open). However, in no case may the second period be shortened to less than fifteen minutes.

(v) Chamber unloading procedures.

(A) Procedures for unloading the chamber must include the use of baskets or rolling carts, or baskets and rolling tables to transfer treated loads quickly, thus avoiding excessive contact with treated articles, and reducing the duration of exposures.

(B) If rolling carts are used, they should be pulled not pushed by the sterilizer operators to avoid offgassing exposure.

(vi) Maintenance. A written log should be instituted and maintained documenting the date of each leak detection and any maintenance procedures undertaken. This is a suggested use practice and is not required.

(vii) Leak detection. Sterilizer door gaskets, cylinder and vacuum piping, hoses, filters, and valves must be checked for leaks under full pressure with a Fluorocarbon leak detector (for 12/88 systems only) every two weeks by maintenance personnel. Also, the cylinder piping connections must be

checked after changing cylinders. Particular attention in leak detection should be given to the automatic solenoid valves that control the flow of EtO to the sterilizer. Specifically, a check should be made at the EtO gasline entrance port to the sterilizer, while the sterilizer door is open and the solenoid valves are in a closed position.

(viii) Maintenance procedures. Sterilizer/aerator door gaskets, valves, and fittings must be replaced when necessary as determined by maintenance personnel in their biweekly checks; in addition, visual inspection of the door gaskets for cracks, debris, and other foreign substances should be conducted daily by the operator.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-62-07383, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-07383, filed 11/30/87.]

WAC 296-62-07385 Appendix B—Substance technical guidelines for ethylene oxide (nonmandatory). (1) Physical and chemical data:

(a) Substance identification:

(i) Synonyms: Dihydrooxirene, dimethylene oxide, EO, 1,2-epoxyethane, EtO, ETO, oxacyclopropane, oxane, oxidoethane, alpha/beta-oxidoethane, oxiran, oxirane.

(ii) Formula: (C₂H₄O).

(iii) Molecular weight: 44.06.

(b) Physical data:

(i) Boiling point (760 mm Hg): 10.70°C (51.3°F);

(ii) Specific gravity (water = 1): 0.87 (at 20°C or 68°F);

(iii) Vapor density (air = 1): 1.49;

(iv) Vapor pressure (at 20°C): 1,095 mm Hg;

(v) Solubility in water: Complete;

(vi) Appearance and odor: Colorless liquid; gas at temperature above 10.7°F or 51.3°C with ether-like odor above 700 ppm.

(2) Fire, explosion, and reactivity hazard data:

(a) Fire:

(i) Flash point; Less than 0°F (open cup);

(ii) Stability: Decomposes violently at temperatures above 800°F;

(iii) Flammable limits in air, percent by volume: Lower: 3, Upper: 100;

(iv) Extinguishing media: Carbon dioxide for small fires, polymer or alcohol foams for large fires;

(v) Special fire fighting procedures: Dilution of ethylene oxide with 23 volumes of water renders it nonflammable;

(vi) Unusual fire and explosion hazards: Vapors of EtO will burn without the presence of air or other oxidizers. EtO vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which EtO is being used.

(vii) For purposes of compliance with the requirements of WAC 296-24-330, EtO is classified as a flammable gas. For example, 7,500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

(viii) For purposes of compliance with WAC 296-24-585, EtO is classified as a Class B fire hazard.

(ix) For purpose of compliance with chapter 296-24 WAC Part L, locations classified as hazardous due to the presence of EtO shall be Class I.

(b) Reactivity:

(i) Conditions contributing to instability: EtO will polymerize violently if contaminated with aqueous alkalis, amines, mineral acids, metal chlorides, or metal oxides. Violent decomposition will also occur at temperatures above 800°F;

(ii) Incompatibilities: Alkalines and acids;

(iii) Hazardous decomposition products: Carbon monoxide and carbon dioxide.

(3) Spill, leak, and disposal procedures:

(a) If EtO is spilled or leaked, the following steps should be taken:

(i) Remove all ignition sources.

(ii) The area should be evacuated at once and re-entered only after the area has been thoroughly ventilated and washed down with water.

(b) Persons not wearing appropriate protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

(c) Waste disposal method: Waste material should be disposed of in a manner that is not hazardous to employees or to the general population. In selecting the method of waste disposal, applicable local, state, and federal regulations should be consulted.

(4) Monitoring and measurement procedures:

(a) Exposure above the permissible exposure limit:

(i) Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken with consecutive samples covering the full shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee.)

(ii) Monitoring techniques: The sampling and analysis under this section may be performed by collection of the EtO vapor on charcoal adsorption tubes or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by instruments such as real time continuous monitoring systems, portable direct reading instruments, or passive dosimeters as long as measurements taken using these methods accurately evaluate the concentration of EtO in employees' breathing zones.

(iii) Appendix D describes the validated method of sampling and analysis which has been tested by OSHA for use with EtO. Other available methods are also described in Appendix D. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his/her unique field conditions. The standard requires that the method of monitoring should be accurate, to a 95 percent confidence level, to plus or minus 25 percent for concentrations of EtO at 1 ppm, and to plus or minus 35 percent for concentrations at 0.5 ppm. In addition to the method described in Appendix D, there are numerous other methods available for monitoring for EtO in the workplace. Details on these other methods have been submitted by various companies to the rulemaking record, and are available at the OSHA Docket Office.

(b) Since many of the duties relating to employee exposure are dependent on the results of measurement procedures, employers should assure that the evaluation of employee exposures is performed by a technically qualified person.

(5) Protective clothing and equipment:

(a) Employees should be provided with and be required to wear appropriate protective clothing wherever there is significant potential for skin contact with liquid EtO or EtO-containing solutions. Protective clothing shall include impermeable coveralls or similar full-body work clothing, gloves, and head coverings, as appropriate to protect areas of the body which may come in contact with liquid EtO or EtO-containing solutions.

(b) Employers should ascertain that the protective garments are impermeable to EtO. Permeable clothing, including items made of rubber, and leather shoes should not be allowed to become contaminated with liquid EtO. If permeable clothing does become contaminated, it should be immediately removed, while the employer is under an emergency deluge shower. If leather footwear or other leather garments become wet from EtO they should be discarded and not be worn again, because leather absorbs EtO and holds it against the skin.

(c) Any protective clothing that has been damaged or is otherwise found to be defective should be repaired or replaced. Clean protective clothing should be provided to the employee as necessary to assure employee protection. Whenever impermeable clothing becomes wet with liquid EtO, it should be washed down with water before being removed by the employee. Employees are also required to wear splash-proof safety goggles where there is any possibility of EtO contacting the eyes.

(6) Miscellaneous precautions:

(a) Store EtO in tightly closed containers in a cool, well-ventilated area and take all necessary precautions to avoid any explosion hazard.

(b) Nonsparking tools must be used to open and close metal containers. These containers must be effectively grounded and bonded.

(c) Do not incinerate EtO cartridges, tanks or other containers.

(d) Employers should advise employees of all areas and operations where exposure to EtO occurs.

(7) Common operations:

Common operations in which exposure to EtO is likely to occur include the following: (a) Manufacture of EtO, (b) surfactants, (c) ethanolamines, (d) glycol ethers, (e) specialty chemicals, and (f) use as a sterilant in the hospital, health product and spice industries.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-07385, filed 11/22/91, effective 12/24/91; 88-14-108 (Order 88-11), § 296-62-07385, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-07385, filed 11/30/87.]

WAC 296-62-07387 Appendix C—Medical surveillance guidelines for ethylene oxide (nonmandatory). (1) Route of entry: Inhalation.

(2) Toxicology:

(a) Clinical evidence of adverse effects associated with the exposure to EtO is present in the form of increased incidence of cancer in laboratory animals (leukemia, stomach,

brain), mutation in offspring in animals, and resorptions and spontaneous abortions in animals and human populations respectively. Findings in humans and experimental animals exposed to airborne concentrations of EtO also indicate damage to the genetic material (DNA). These include hemoglobin alkylation, unscheduled DNA synthesis, sister chromatid exchange, chromosomal aberration, and functional sperm abnormalities.

(b) Ethylene oxide in liquid form can cause eye irritation and injury to the cornea, frostbite, severe irritation, and blistering of the skin upon prolonged or confined contact. Ingestion of EtO can cause gastric irritation and liver injury. Other effects from inhalation of EtO vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, dyspnea and cyanosis.

(3) Signs and symptoms of acute overexposure:

(a) The early effects of acute overexposure to EtO are nausea and vomiting, headache, and irritation of the eyes and respiratory passages. The patient may notice a "peculiar taste" in the mouth. Delayed effects can include pulmonary edema, drowsiness, weakness, and incoordination. Studies suggest that blood cell changes, an increase in chromosomal aberrations, and spontaneous abortion may also be casually related to acute overexposure to EtO.

(b) Skin contact with liquid or gaseous EtO causes characteristic burns and possible even an allergic-type sensitization. The edema and erythema occurring from skin contact with EtO progress to vesiculation with a tendency to coalesce into blebs with desquamation. Healing occurs within three weeks, but there may be a residual brown pigmentation. A 40-80% solution is extremely dangerous, causing extensive blistering after only brief contact. Pure liquid EtO causes frostbite because of rapid evaporation. In contrast, the eye is relatively insensitive to EtO, but there may be some irritation of the cornea.

(c) Most reported acute effects of occupational exposure to EtO are due to contact with EtO in liquid phase. The liquid readily penetrates rubber and leather, and will produce blistering if clothing or footwear contaminated with EtO are not removed.

(4) Surveillance and preventive considerations:

(a) As noted above, exposure to EtO has been linked to an increased risk of cancer and reproductive effects including decreased male fertility, fetotoxicity, and spontaneous abortion. EtO workers are more likely to have chromosomal damage than similar groups not exposed to EtO. At the present, limited studies of chronic effects in humans resulting from exposure to EtO suggest a causal association with leukemia. Animal studies indicate leukemia and cancers at other sites (brain, stomach) as well. The physician should be aware of the findings of these studies in evaluating the health of employees exposed to EtO.

(b) Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to EtO do not presently exist. Laboratory tests may, however, give evidence to suggest that an employee is potentially overexposed to EtO. It is important for the physician to become familiar with the operating conditions in which exposure to EtO is likely to occur. The physician also must become familiar with the signs and symp-

toms that indicate a worker is receiving otherwise unrecognized and unacceptable exposure to EtO. These elements are especially important in evaluating the medical and work histories and in conducting the physical exam. When an unacceptable exposure in an active employee is identified by the physician, measures taken by the employer to lower exposure should also lower the risk of serious long-term consequences.

(c) The employer is required to institute a medical surveillance program for all employees who are or will be exposed to EtO at or above the action level (0.5 ppm) for at least 30 days per year, without regard to respirator use. All examinations and procedures must be performed by or under the supervision of a licensed physician at a reasonable time and place for the employee and at no cost to the employee.

(d) Although broad latitude in prescribing specific tests to be included in the medical surveillance program is extended to the examining physician, WISHA requires inclusion of the following elements in the routine examination:

(i) Medical and work histories with special emphasis directed to symptoms related to the pulmonary, hematologic, neurologic, and reproductive systems and to the eyes and skin.

(ii) Physical examination with particular emphasis given to the pulmonary, hematologic, neurologic, and reproductive systems and to the eyes and skin.

(iii) Complete blood count to include at least a white cell count (including differential cell count), red cell count, hematocrit, and hemoglobin.

(iv) Any laboratory or other test which the examining physician deems necessary by sound medical practice.

(e) If requested by the employee, the medical examinations shall include pregnancy testing or laboratory evaluation of fertility as deemed appropriate by the physician.

(f) In certain cases, to provide sound medical advice to the employer and the employee, the physician must evaluate situations not directly related to EtO. For example, employees with skin diseases may be unable to tolerate wearing protective clothing. In addition those with chronic respiratory diseases may not tolerate the wearing of negative pressure (air purifying) respirators. Additional tests and procedures that will help the physician determine which employees are medically unable to wear such respirators should include: An evaluation of cardiovascular function, a baseline chest x-ray to be repeated at five year intervals, and a pulmonary function test to be repeated every three years. The pulmonary function test should include measurement of the employee's forced vital capacity (FVC), forced expiratory volume at one second (FEV1), as well as calculation of the ratios of FEV1 to FVC, and measured FVC and measured FEV1 to expected values corrected for variation due to age, sex, race, and height.

(g) The employer is required to make the prescribed tests available at least annually to employees who are or will be exposed at or above the action level, for 30 or more days per year; more often than specified if recommended by the examining physician; and upon the employee's termination of employment or reassignment to another work area. While little is known about the long-term consequences of high short-term exposures, it appears prudent to monitor such affected employees closely in light of existing health data. The

employer shall provide physician recommended examinations to any employee exposed to EtO in emergency conditions. Likewise, the employer shall make available medical consultations including physician recommended exams to employees who believe they are suffering signs or symptoms of exposure to EtO.

(h) The employer is required to provide the physician with the following information: A copy of this standard and its appendices; a description of the affected employee's duties as they relate to the employee exposure level; and information from the employee's previous medical examinations which is not readily available to the examining physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, when required.

(i) The employer is required to obtain a written opinion from the examining physician containing the results of the medical examinations; the physician's opinion as to whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of his or her health from exposure to EtO; any recommended restrictions upon the employee's exposure to EtO, or upon the use of protective clothing or equipment such as respirators; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions which require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to occupational exposure to EtO, and a copy of the opinion must be provided to the affected employee.

(j) The purpose in requiring the examining physician to supply the employer with a written opinion is to provide the employer with a medical basis to aid in the determination of initial placement of employees and to assess the employee's ability to use protective clothing and equipment.

[Statutory Authority: Chapter 49.17 RCW, 88-14-108 (Order 88-11), § 296-62-07387, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-07387, filed 11/30/87.]

WAC 296-62-07389 Appendix D—Sampling and analytical methods for ethylene oxide (nonmandatory).

(1) A number of methods are available for monitoring employee exposures to EtO. Most of these involve the use of charcoal tubes and sampling pumps, followed by analysis of the samples by gas chromatograph. The essential differences between the charcoal tube methods include, among others, the use of different desorbing solvents, the use of different lots of charcoal, and the use of different equipment for analysis of the samples. Besides charcoal, methods using passive dosimeters, gas sampling bags, impingers, and detector tubes have been utilized for determination of EtO exposure. In addition, there are several commercially available portable gas analyzers and monitoring units. This appendix contains details for the method which has been tested at the OSHA Analytical Laboratory in Salt Lake City. Inclusion of this method in the appendix does not mean that this method is the only one which will be satisfactory. Copies of descriptions of other methods available are available in the rulemaking record, and may be obtained from the OSHA Docket Office. These include the Union Carbide, Dow Chemical, 3M, and

DuPont methods, as well as NIOSH Method S-286. These methods are briefly described at the end of this appendix.

(2) Employers who note problems with sample breakthrough using the OSHA or other charcoal methods should try larger charcoal tubes. Tubes of larger capacity are available. In addition, lower flow rates and shorter sampling times should be beneficial in minimizing breakthrough problems. Whatever method the employer chooses, he/she must assure himself/herself of the method's accuracy and precision under the unique conditions present in his workplace.

(3) Ethylene oxide:

(a) Method No.: 30.

(b) Matrix: Air.

(i) Target concentration: 1.0 ppm (1.8 mg/m³)

(ii) Procedure: Samples are collected on two charcoal tubes in series and desorbed with 1% CS₂ in benzene. The samples are derivatized with HBr and treated with sodium carbonate. Analysis is done by gas chromatography with an electron capture detector.

(iii) Recommended air volume and sampling rate: 1 liter and 0.05 Lpm.

(iv) Detection limit of the overall procedure: 13.3 ppb (0.024 mg/m³) (based on 1.0 liter air sample).

(v) Reliable quantitation limit: 52.2 ppb (0.094 mg/m³) (based on 1.0 liter air sample).

(vi) Standard error of estimate: 6.59% (see backup section 4.6).

(vii) Special requirements: Samples must be analyzed within 15 days of sampling date.

(viii) Status of method: The sampling and analytical method has been subject to the established evaluation procedures of the Organic Method Evaluations Branch.

(c) Date: August 1981.

(d) Chemist: Wayne D. Potter

(e) Organic Solvents Branch, OSHA Analytical Laboratory, Salt Lake City, Utah

(f) General discussion:

(i) Background.

(A) History of procedure.

(I) Ethylene oxide samples analyzed at the OSHA laboratory have normally been collected on activated charcoal and desorbed with carbon disulfide. The analysis is performed with a gas chromatograph equipped with a FID (flame ionization detector) as described in NIOSH Method S286 (Ref. (3)(j)(i)). This method is based on a PEL of 50 ppm and has a detection limit of about 1 ppm.

(II) Recent studies have prompted the need for a method to analyze and detect ethylene oxide at very low concentrations.

(III) Several attempts were made to form an ultraviolet (UV) sensitive derivative with ethylene oxide for analysis with HPLC. Among those tested that gave no detectable product were: p-anisidine, methylimidazole, aniline, and 2,3,6-trichlorobenzoic acid. Each was tested with catalysts such as triethylamine, aluminum chloride, methylene chloride and sulfuric acid but no detectable derivative was produced.

(IV) The next derivatization attempt was to react ethylene oxide with HBr to form 2-bromoethanol. This reaction was successful. An ECD (electron capture detector) gave a

very good response for 2-bromoethanol due to the presence of bromine. The use of carbon disulfide as the desorbing solvent gave too large a response and masked the 2-bromoethanol. Several other solvents were tested for both their response on the ECD and their ability to desorb ethylene oxide from the charcoal. Among those tested were toluene, xylene, ethyl benzene, hexane, cyclohexane and benzene. Benzene was the only solvent tested that gave a suitable response on the ECD and a high desorption. It was found that the desorption efficiency was improved by using 1% CS₂ with the benzene. The carbon disulfide did not significantly improve the recovery with the other solvents. SKC Lot 120 was used in all tests done with activated charcoal.

(B) Physical properties (Ref. (3)(j)(ii)-(iv)):

(I) Synonyms: Oxirane; dimethylene oxide; 1,2-epoxyethane; oxane; C₂H₄O; ETO;

(II) Molecular weight: 44.06;

(III) Boiling point: 10.7°C (51.3°);

(IV) Melting point: -111°C;

(V) Description: Colorless, flammable gas;

(VI) Vapor pressure: 1095 mm. at 20°C;

(VII) Odor: Ether-like odor;

(VIII) Lower explosive limits: 3.0% (by volume);

(IX) Flash point (TOC): Below 0°F;

(X) Molecular structure: CH₂—CH₂;

(ii) Limit defining parameters:

(A) Detection limit of the analytical procedure. The detection limit of the analytical procedure is 12.0 picograms of ethylene oxide per injection. This is the amount of analyte which will give a peak whose height is five times the height of the baseline noise. (See backup data section (3)(i)(i).)

(B) Detection limit of the overall procedure.

(I) The detection limit of the overall procedure is 24.0 ng of ethylene oxide per sample.

(II) This is the amount of analyte spiked on the sampling device which allows recovery of an amount of analyte equivalent to the detection limit of the analytical procedure. (See backup data section (3)(i)(ii).)

(C) Reliable quantitation limit.

(I) The reliable quantitation limit is 94.0 nanograms of ethylene oxide per sample. This is the smallest amount of analyte which can be quantitated within the requirements of 75% recovery and 95% confidence limits. (See backup data section (3)(i)(ii).)

(II) It must be recognized that the reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an analyte is exceptionally higher than these limits, they may not be attainable at the routine operating parameters. In this case, the limits reported on analysis reports will be based on the operating parameters used during the analysis of the samples.

(D) Sensitivity.

(I) The sensitivity of the analytical procedure over a concentration range representing 0.5 to 2 times the target concentration based on the recommended air volume is 34105 area units per ug/mL. The sensitivity is determined by the slope of the calibration curve (see backup data section (3)(i)(iii)).

(II) The sensitivity will vary somewhat with the particular instrument used in the analysis.

(E) Recovery. The recovery of analyte from the collection medium must be 75% or greater. The average recovery from spiked samples over the range of 0.5 to 2 times the target concentration is 88.0% (see backup section (3)(i)(iv)). At lower concentrations the recovery appears to be nonlinear.

(F) Precision (analytical method only). The pooled coefficient of variation obtained from replicate determination of analytical standards at 0.5X, 1X and 2X the target concentration is 0.036 (see backup data section (3)(i)(v)).

(G) Precision (overall procedure).

(I) The overall procedure must provide results at the target concentration that are 25% or better at the 95% confidence level. The precision at the 95% confidence level for the 15 day storage test is plus or minus 12.9% (see backup data section (3)(i)(vi)).

(II) This includes an additional plus or minus 5% for sampling error.

(iii) Advantages.

(A) The sampling procedure is convenient.

(B) The analytical procedure is very sensitive and reproducible.

(C) Reanalysis of samples is possible.

(D) Samples are stable for at least 15 days at room temperature.

(E) Interferences are reduced by the longer GC retention time of the new derivative.

(iv) Disadvantages.

(A) Two tubes in series must be used because of possible breakthrough and migration.

(B) The precision of the sampling rate may be limited by the reproducibility of the pressure drop across the tubes. The pumps are usually calibrated for one tube only.

(C) The use of benzene as the desorption solvent increases the hazards of analysis because of the potential carcinogenic effects of benzene.

(D) After repeated injections there can be a buildup of residue formed on the electron capture detector which decreases sensitivity.

(E) Recovery from the charcoal tubes appears to be nonlinear at low concentrations.

(g) Sampling procedure.

(i) Apparatus.

(A) A calibrated personal sampling pump whose flow can be determined within plus or minus 5% of the recommended flow.

(B) SKC Lot 120 Charcoal tubes: Glass tube with both ends flame sealed, 7 cm long with a 6 mm O.D. and a 4-mm I.D., containing 2 sections of coconut shell charcoal separated by a 2-mm portion of urethane foam. The adsorbing section contains 100 mg of charcoal, the backup section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the backup section. A plug of silylated glass wool is placed in front of the adsorbing section.

(ii) Reagents.

None required.

(iii) Sampling technique.

(A) Immediately before sampling, break the ends of the charcoal tubes. All tubes must be from the same lot.

(B) Connect two tubes in series to the sampling pump with a short section of flexible tubing. A minimum amount of tubing is used to connect the two sampling tubes together. The tube closer to the pump is used as a backup. This tube should be identified as the backup tube.

(C) The tubes should be placed in a vertical position during sampling to minimize channeling.

(D) Air being sampled should not pass through any hose or tubing before entering the charcoal tubes.

(E) Seal the charcoal tubes with plastic caps immediately after sampling. Also, seal each sample with OSHA seals lengthwise.

(F) With each batch of samples, submit at least one blank tube from the same lot used for samples. This tube should be subjected to exactly the same handling as the samples (break, seal, transport) except that no air is drawn through it.

(G) Transport the samples (and corresponding paperwork) to the lab for analysis.

(H) If bulk samples are submitted for analysis, they should be transported in glass containers with Teflon-lined caps. These samples must be mailed separately from the container used for the charcoal tubes.

(iv) Breakthrough.

The breakthrough (5% breakthrough) volume for a 3.0 mg/m³ ethylene oxide sample stream at approximately 85% relative humidity, 22°C and 633 mm is 2.6 liters sampled at 0.05 liters per minute. This is equivalent to 7.8 µg of ethylene oxide. Upon saturation of the tube it appeared that the water may be displacing ethylene oxide during sampling.

(v) Desorption efficiency.

(A) The desorption efficiency, from liquid injection onto charcoal tubes, averaged 88.0% from 0.5 to 2.0 x the target concentration for a 1.0 liter air sample. At lower ranges it appears that the desorption efficiency is nonlinear (see backup data section (3)(i)(ii)).

(B) The desorption efficiency may vary from one laboratory to another and also from one lot of charcoal to another. Thus, it is necessary to determine the desorption efficiency for a particular lot of charcoal.

(vi) Recommended air volume and sampling rate.

(A) The recommended air volume is 1.0 liter.

(B) The recommended maximum sampling rate is 0.05 Lpm.

(vii) Interferences.

(A) Ethylene glycol and Freon 12 at target concentration levels did not interfere with the collection of ethylene oxide.

(B) Suspected interferences should be listed on the sample data sheets.

(C) The relative humidity may affect the sampling procedure.

(viii) Safety precautions.

(A) Attach the sampling equipment to the employee so that it does not interfere with work performance.

(B) Wear safety glasses when breaking the ends of the sampling tubes.

(C) If possible, place the sampling tubes in a holder so the sharp end is not exposed while sampling.

(h) Analytical method.

(i) Apparatus.

(A) Gas chromatograph equipped with a linearized electron capture detector.

(B) GC column capable of separating the derivative of ethylene oxide (2-bromoethanol) from any interferences and the 1% CS₂ in benzene solvent. The column used for validation studies was: 10 ft x 1/8 inch stainless steel 20% SP-2100, .1% Carbowax 1500 on 100/120 Supelcoport.

(C) An electronic integrator or some other suitable method of measuring peak areas.

(D) Two milliliter vials with Teflon-lined caps.

(E) Gas tight syringe—500 µL or other convenient sizes for preparing standards.

(F) Microliter syringes—10 µL or other convenient sizes for diluting standards and 1 µL for sample injections.

(G) Pipets for dispensing the 1% CS₂ in benzene solvent. The Glenco 1 mL dispenser is adequate and convenient.

(H) Volumetric flasks—5 mL and other convenient sizes for preparing standards.

(I) Disposable Pasteur pipets.

(ii) Reagents.

(A) Benzene, reagent grade.

(B) Carbon disulfide, reagent grade.

(C) Ethylene oxide, 99.7% pure.

(D) Hydrobromic acid, 48% reagent grade.

(E) Sodium carbonate, anhydrous, reagent grade.

(F) Desorbing reagent, 99% Benzene/1% CS₂.

(iii) Sample preparation.

(A) The front and back sections of each sample are transferred to separate 2-mL vials.

(B) Each sample is desorbed with 1.0 mL of desorbing reagent.

(C) The vials are sealed immediately and allowed to desorb for one hour with occasional shaking.

(D) Desorbing reagent is drawn off the charcoal with a disposable pipet and put into clean 2-mL vials.

(E) One drop of HBr is added to each vial. Vials are resealed and HBr is mixed well with the desorbing reagent.

(F) About 0.15 gram of sodium carbonate is carefully added to each vial. Vials are again resealed and mixed well.

(iv) Standard preparation.

(A) Standards are prepared by injecting the pure ethylene oxide gas into the desorbing reagent.

(B) A range of standards are prepared to make a calibration curve. A concentration of 1.0 µL of ethylene oxide gas per 1 mL desorbing reagent is equivalent to 1.0 ppm air concentration (all gas volumes at 25°C and 760 mm) for the recommended 1 liter air sample. This amount is uncorrected for desorption efficiency (see backup data section (3)(i)(ii), for desorption efficiency corrections).

(C) One drop of HBr per mL of standard is added and mixed well.

(D) About 0.15 grams of sodium carbonate is carefully added for each drop of HBr (a small reaction will occur).

(v) Analysis.

(A) GC conditions.

Nitrogen flow rate—10mL/min.

Injector temperature—250°C

Detector temperature—300°C

Column temperature—100°C

Injection size—0.8 µL

Elution time—3.9 minutes

(B) Peak areas are measured by an integrator or other suitable means.

(C) The integrator results are in area units and a calibration curve is set up with concentration vs. area units.

(vi) Interferences.

(A) Any compound having the same retention time of 2-bromoethanol is a potential interference. Possible interferences should be listed on the sample data sheets.

(B) GC parameters may be changed to circumvent interferences.

(C) There are usually trace contaminants in benzene.

These contaminants, however, posed no problem of interference.

(D) Retention time data on a single column is not considered proof of chemical identity. Samples over the 1.0 ppm target level should be confirmed by GC/Mass Spec or other suitable means.

(vii) Calculations.

(A) The concentration in µg/mL for a sample is determined by comparing the area of a particular sample to the calibration curve, which has been prepared from analytical standards.

(B) The amount of analyte in each sample is corrected for desorption efficiency by use of a desorption curve.

(C) Analytical results, A, from the two tubes that compose a particular air sample are added together.

(D) The concentration for a sample is calculated by the following equation:

$$\text{ETO, mg/m}^3 = \frac{\text{AXB}}{\text{C}}$$

where:

A = µg/mL

B = desorption volume in milliliters

C = air volume in liters.

(E) To convert mg/m³ to parts per million (ppm) the following relationship is used:

$$\text{ETO, ppm} = \frac{\text{mg/m}^3 \times 24.45}{44.05}$$

where:

mg/m³ = results from 3.7.4

24.45 = molar volume at 25°C and 760mm Hg

44.05 = air volume in liters.

(viii) Safety precaution

(A) Ethylene oxide and benzene are potential carcinogens and care must be exercised when working with these compounds.

(B) All work done with the solvents (preparation of standards, desorption of samples, etc.) should be done in a hood.

(C) Avoid any skin contact with all of the solvents.

(D) Wear safety glasses at all times.

(E) Avoid skin contact with HBr because it is highly toxic and a strong irritant to eyes and skin.

(i) Backup data.

(i) Detection limit data.

The detection limit was determined by injecting 0.8 µL of a 0.015 µg/mL standard of ethylene oxide into 1% CS₂ in benzene. The detection limit of the analytical procedure is taken to be 1.20 x 10⁻⁵ µg per injection. This is equivalent to 8.3 ppb (0.015 mg/m³) for the recommended air volume.

(ii) Desorption efficiency. Ethylene oxide was spiked into charcoal tubes and the following recovery data was obtained:

Amount spiked (µg)	Amount recovered (µg)	Percent recovery
4.5	4.32	96.0
3.0	2.61	87.0
2.25	2.025	90.0
1.5	1.365	91.0
1.5	1.38	92.0
.75	6525	87.0
.375	.315	84.0
.375	.312	83.2
.1875	.151	80.5
.094	.070	74.5

Note: At lower amounts the recovery appears to be nonlinear.

(iii) Sensitivity data. The following data was used to determine the calibration curve:

	0.5 x .75 µg/mL	1 x 1.5 µg/mL	2 x 3.0 µg/mL
Injection			
1.....	30904	59567	111778
2.....	30987	62914	106016
3.....	32555	58578	106122
4.....	32242	57173	109716
X.....	31672	59558	108408

Slope = 34.105.

(iv) Recovery. The recovery was determined by spiking ethylene oxide onto lot 120 charcoal tubes and desorbing with 1% CS₂ in Benzene. Recoveries were done at 0.5, 1.0, and 2.0 X the target concentration (1 ppm) for the recommended air volume.

Sample	Percent Recovery		
	0.5x	1.0x	2.0x
1.....	88.7	95.0	91.7
2.....	83.8	95.0	87.3
3.....	84.2	91.0	86.0
4.....	88.0	91.0	83.0
5.....	88.0	86.0	85.0
X.....	86.5	90.5	87.0

Weighted average = 88.2

(v) Precision of the analytical procedure. The following data was used to determine the precision of the analytical method:

Concentration	0.5 x .75 µg/mL	1 x 1.5 µg/mL	2 x 3.0 µg/mL
Injection	.7421	1.4899	3.1184
	.7441	1.5826	3.0447
	.7831	1.4628	2.9149
	.7753	1.4244	2.9185
	.7612	1.4899	2.9991
Average Standard Deviation	.0211	.0674	.0998
CV.....	.0277	.0452	.0333

$$3(.0277)^2 + 3(.0452)^2 + 3(.0333)^2$$

$$CV = \frac{3(.0277)^2 + 3(.0452)^2 + 3(.0333)^2}{3 + 3 + 3}$$

$$CV + 0.036$$

(vi) Storage data. Samples were generated at 1.5 mg/m³ ethylene oxide at 85% relative humidity, 22°C and 633 mm. All samples were taken for 20 minutes at 0.05 Lpm. Six samples were analyzed as soon as possible and fifteen samples were stored at refrigerated temperature (5°C) and fifteen samples were stored at ambient temperature (23°C). These stored samples were analyzed over a period of nineteen days.

Percent Recovery

Day analyzed	Refrigerated	Ambient
1.....	87.0	87.0
1.....	93.0	93.0
1.....	94.0	94.0
1.....	92.0	92.0
4.....	92.0	91.0
4.....	93.0	88.0
4.....	91.0	89.0
6.....	92.0	—
6.....	92.0	—
8.....	—	92.0
8.....	—	86.0
10.....	91.7	—
10.....	95.5	—
10.....	95.7	—
11.....	—	90.0
11.....	—	82.0
13.....	78.0	—
13.....	81.4	—
13.....	82.4	—
14.....	—	78.5
14.....	—	72.1
18.....	66.0	—
18.....	68.0	—
19.....	—	64.0
19.....	—	77.0

(vii) Breakthrough data.

(A) Breakthrough studies were done at 2 ppm (3.6 mg/m³) at approximately 85% relative humidity at 22°C (ambient temperature). Two charcoal tubes were used in series. The backup tube was changed every 10 minutes and analyzed for breakthrough. The flow rate was 0.050 Lpm.

Tube No.	Time (Minutes)	Percent break- through
1.....	10	(¹)
2.....	20	(¹)
3.....	30	(¹)
4.....	40	1.23
5.....	50	3.46
6.....	60	18.71
7.....	70	39.2
8.....	80	53.3
9.....	90	72.0
10.....	100	96.0
11.....	110	113.0
12.....	120	133.9

¹None.

(B) The 5% breakthrough volume was reached when 2.6 liters of test atmosphere were drawn through the charcoal tubes.

(j) References.

(i) "NIOSH Manual of Analytical Methods," 2nd ed. NIOSH: Cincinnati, 1977; Method S 286.

(ii) "IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man." International Agency for Research on Cancer: Lyon, 1976; Vol. II, p. 157.

(iii) Sax, N.I. "Dangerous Properties of Industrial Materials," 4th ed.; Van Nostrand Reinhold Company, New York, 1975; p. 741.

(iv) "The Condensed Chemical Dictionary," 9th ed.; Hawley, G.G., ed.; Van Nostrand Reinhold Company, New York, 1977; p. 361.

(4) Summary of other sampling procedures. OSHA believes that several other types of monitoring equipment and techniques exist for monitoring time-weighted averages. Considerable research and method development is currently being performed, which will lead to improvements and a wider variety of monitoring techniques. A combination of monitoring procedures can be used. There probably is no one best method for monitoring personal exposure to ethylene oxide in all cases. There are advantages, disadvantages, and limitations to each method. The method of choice will depend on the need and requirements. Some commonly used methods include the use of charcoal tubes, passive dosimeters, Tedlar gas sampling bags, detector tubes, photoionization detection units, infrared detection units and gas chromatographs. A number of these methods are described below.

(a) Charcoal tube sampling procedures.

(i) Qazi-Ketcham method (Ex-11-133)—This method consists of collecting EtO on Columbia JXC activated carbon, desorbing the EtO with carbon disulfide and analyzing by gas chromatography with flame ionization detection. Union Carbide has recently updated and revalidated this monitoring procedure. This method is capable of determining both eight-hour time-weighted average exposures and short-term exposures. The method was validated to 0.5 ppm. Like other charcoal collecting procedures, the method requires considerable analytical expertise.

(ii) *ASTM-proposed method*—The Ethylene Oxide Industry Council (EOIC) has contracted with Clayton Envi-

ronmental Consultants, Inc. to conduct a collaborative study for the proposed method. The ASTM-Proposed method is similar to the method published by Qazi and Ketcham in the November 1977 American Industrial Hygiene Association Journal, and to the method of Pilney and Coyne, presented at the 1979 American Industrial Hygiene Conference. After the air to be sampled is drawn through an activated charcoal tube, the ethylene oxide is desorbed from the tube using carbon disulfide and is quantitated by gas chromatography utilizing a flame ionization detector. The ASTM-proposed method specifies a large two-section charcoal tube, shipment in dry ice, storage at less than -5°C, and analysis within three weeks to prevent migration and sample loss. Two types of charcoal tubes are being tested—Pittsburgh Coconut-Based (PCB) and Columbia JXC charcoal. This collaborative study will give an indication of the inter- and intralaboratory precision and accuracy of the ASTM/proposed method. Several laboratories have considerable expertise using the Qazi-Ketcham and Dow methods.

(b) Passive monitors—Ethylene oxide diffuses into the monitor and is collected in the sampling media. The DuPont Pro-Tek badge collects EtO in an absorbing solution, which is analyzed colorimetrically to determine the amount of EtO present. The 3M 350 badge collects the EtO on chemically treated charcoal. Other passive monitors are currently being developed and tested. Both 3M and DuPont have submitted data indicating their dosimeters meet the precision and accuracy requirements of the proposed ethylene oxide standard. Both presented laboratory validation data to 0.2 ppm (Exs. 11-65, 4-20, 108, 109, 130).

(c) Tedlar gas sampling bags—samples are collected by drawing a known volume of air into a Tedlar gas sampling bag. The ethylene oxide concentration is often determined on-site using a portable gas chromatograph or portable infrared spectrometer.

(d) Detector tubes—A known volume of air is drawn through a detector tube using a small hand pump. The concentration of EtO is related to the length of stain developed in the tube. Detector tubes are economical, easy to use, and give an immediate readout. Unfortunately, partly because they are nonspecific, their accuracy is often questionable. Since the sample is taken over a short period of time, they may be useful for determining the source of leaks.

(e) Direct reading instruments:

(i) There are numerous types of direct reading instruments, each having its own strengths and weaknesses (Exs. 135B, 135C, 107, 11-78, 11-153). Many are relatively new, offering greater sensitivity and specificity. Popular ethylene oxide direct reading instruments include infrared detection units, photoionization detection units, and gas chromatographs.

(ii) Portable infrared analyzers provide an immediate, continuous indication of a concentration value; making them particularly useful for locating high concentration pockets, in leak detection and in ambient air monitoring. In infrared detection units, the amount of infrared light absorbed by the gas being analyzed at selected infrared wavelengths is related to the concentration of a particular component. Various models have either fixed or variable infrared filters, differing cell

pathlengths, and microcomputer controls for greater sensitivity, automation, and interference elimination.

(iii) A fairly recent detection system is photoionization detection. The molecules are ionized by high energy ultraviolet light. The resulting current is measured. Since different substances have different ionization potentials, other organic compounds may be ionized. The lower the lamp energy, the better the selectivity. As a continuous monitor, photoionization detection can be useful for locating high concentration pockets, in leak detection, and continuous ambient air monitoring. Both portable and stationary gas chromatographs are available with various types of detectors, including photoionization detectors. A gas chromatograph with a photoionization detector retains the photoionization sensitivity, but minimizes or eliminates interferences. For several GC/PID units, the sensitivity is in the 0.1-0.2 ppm EtO range. The GC/PID with microprocessors can sample up to 20 sample points sequentially, calculate and record data, and activate alarms or ventilation systems. Many are quite flexible and can be configured to meet the specific analysis needs for the workplace.

(iv) **DuPont presented their laboratory validation data of the accuracy of the Qazi-Ketcham charcoal tube, the PCB charcoal tube, Miran 103 IR analyzer, 3M #3550 monitor and the DuPont C-70 badge. Quoting Elbert V. Kring:**

(v) We also believe that OSHA's proposed accuracy in this standard is appropriate. At plus or minus 25 percent at one part per million, and plus or minus 35 percent below that. And, our data indicates there's only one monitoring method, right now, that we've tested thoroughly, that meets that accuracy requirements. That is the DuPont Pro-Tek badge***. We also believe that this kind of data should be confirmed by another independent laboratory, using the same type dynamic chamber testing (Tr. 1470).

Additional data by an independent laboratory following their exact protocol was not submitted. However, information was submitted on comparisons and precision and accuracy of those monitoring procedures which indicate far better precision and accuracy of those monitoring procedures than that obtained by DuPont (Ex. 4-20, 130, 11-68, 11-133, 130, 135A)

(vi) The accuracy of any method depends to a large degree upon the skills and experience of those who not only collect the samples but also those who analyze the samples. Even for methods that are collaboratively tested, some laboratories are closer to the true values than others. Some laboratories may meet the precision and accuracy requirements of the method; others may consistently far exceed them for the same method.

[Statutory Authority: Chapter 49.17 RCW. 88-14-108 (Order 88-11), § 296-62-07389, filed 7/6/88; 87-24-051 (Order 87-24), § 296-62-07389, filed 11/30/87.]

WAC 296-62-074 Cadmium.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-074, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07401 Scope. This standard applies to all occupational exposures to cadmium and cadmium compounds, in all forms, and in all industries covered by the Washington Industrial Safety and Health Act, except the con-

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struction-related industries, which are covered under WAC 296-155-174.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07401, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07403 Definitions. (1) Action level (AL) is defined as an airborne concentration of cadmium of 2.5 micrograms per cubic meter of air ($2.5 \mu\text{g}/\text{m}^3$), calculated as an 8-hour time-weighted average (TWA).

(2) Authorized person means any person authorized by the employer and required by work duties to be present in regulated areas or any person authorized by the WISH Act or regulations issued under it to be in regulated areas.

(3) Director means the director of the department of labor and industries, or authorized representatives.

(4) Employee exposure and similar language referring to the air cadmium level to which an employee is exposed means the exposure to airborne cadmium that would occur if the employee were not using respiratory protective equipment.

(5) Final medical determination is the written medical opinion of the employee's health status by the examining physician under WAC 296-62-07423 (3) through (12) or, if multiple physician review under WAC 296-62-07423(13) or the alternative physician determination under WAC 296-62-07423(14) is invoked, it is the final, written medical finding, recommendation or determination that emerges from that process.

(6) High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of mono-dispersed particles of 0.3 micrometers in diameter.

(7) Regulated area means an area demarcated by the employer where an employee's exposure to airborne concentrations of cadmium exceeds, or can reasonably be expected to exceed the permissible exposure limit (PEL).

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07403, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07403, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07405 Permissible exposure limit (PEL). The employer shall assure that no employee is exposed to an airborne concentration of cadmium in excess of five micrograms per cubic meter of air ($5 \mu\text{g}/\text{m}^3$), calculated as an 8-hour time-weighted average exposure (TWA).

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07405, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07407 Exposure monitoring. (1) General.

(a) Each employer who has a workplace or work operation covered by this section shall determine if any employee may be exposed to cadmium at or above the action level.

(b) Determinations of employee exposure shall be made from breathing zone air samples that reflect the monitored employee's regular, daily 8-hour TWA exposure to cadmium.

(c) 8-hour TWA exposures shall be determined for each employee on the basis of one or more personal breathing zone air samples reflecting full shift exposure on each shift, for each job classification, in each work area. Where several employees perform the same job tasks, in the same job clas-

sification, on the same shift, in the same work area, and the length, duration, and level of cadmium exposures are similar, an employer may sample a representative fraction of the employees instead of all employees in order to meet this requirement. In representative sampling, the employer shall sample the employee(s) expected to have the highest cadmium exposures.

(2) Specific.

(a) Initial monitoring. Except as provided for in (b) and (c) of this subsection, the employer shall monitor employee exposures and shall base initial determinations on the monitoring results.

(b) Where the employer has monitored after September 14, 1991, under conditions that in all important aspects closely resemble those currently prevailing and where that monitoring satisfies all other requirements of this section, including the accuracy and confidence levels of subsection (6) of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of WAC 296-62-07427 (2)(a).

(c) Where the employer has objective data, as defined in WAC 296-62-07427(2), demonstrating that employee exposure to cadmium will not exceed the action level under the expected conditions of processing, use, or handling, the employer may rely upon such data instead of implementing initial monitoring.

(3) Monitoring frequency (periodic monitoring).

(a) If the initial monitoring or periodic monitoring reveals employee exposures to be at or above the action level, the employer shall monitor at a frequency and pattern needed to represent the levels of exposure of employees and where exposures are above the PEL to assure the adequacy of respiratory selection and the effectiveness of engineering and work practice controls. However, such exposure monitoring shall be performed at least every six months. The employer, at a minimum, shall continue these semiannual measurements unless and until the conditions set out in (b) of this subsection are met.

(b) If the initial monitoring or the periodic monitoring indicates that employee exposures are below the action level and that result is confirmed by the results of another monitoring taken at least seven days later, the employer may discontinue the monitoring for those employees whose exposures are represented by such monitoring.

(4) Additional monitoring. The employer also shall institute the exposure monitoring required under (2)(a) and (3) of this section whenever there has been a change in the raw materials, equipment, personnel, work practices, or finished products that may result in additional employees being exposed to cadmium at or above the action level or in employees already exposed to cadmium at or above the action level being exposed above the PEL, or whenever the employer has any reason to suspect that any other change might result in such further exposure.

(5) Employee notification of monitoring results.

(a) Within fifteen working days after the receipt of the results of any monitoring performed under this section, the employer shall notify each affected employee individually in writing of the results. In addition, within the same time period the employer shall post the results of the exposure monitoring

in an appropriate location that is accessible to all affected employees.

(b) Wherever monitoring results indicate that employee exposure exceeds the PEL, the employer shall include in the written notice a statement that the PEL has been exceeded and a description of the corrective action being taken by the employer to reduce employee exposure to or below the PEL.

(6) Accuracy of measurement. The employer shall use a method of monitoring and analysis that has an accuracy of not less than plus or minus twenty-five percent, with a confidence level of ninety-five percent, for airborne concentrations of cadmium at or above the action level, the permissible exposure limit (PEL), and the separate engineering control air limit (SECAL).

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07407, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07409 Regulated areas. (1) Establishment. The employer shall establish a regulated area wherever an employee's exposure to airborne concentrations of cadmium is, or can reasonably be expected to be in excess of the permissible exposure limit (PEL).

(2) Demarcation. Regulated areas shall be demarcated from the rest of the workplace in any manner that adequately establishes and alerts employees of the boundaries of the regulated area.

(3) Access. Access to regulated areas shall be limited to authorized persons.

(4) Provision of respirators. Each person entering a regulated area shall be supplied with and required to use a respirator, selected in accordance with WAC 296-62-07413(2).

(5) Prohibited activities. The employer shall assure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas, carry the products associated with these activities into regulated areas, or store such products in those areas.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07409, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07411 Methods of compliance. (1) Compliance hierarchy.

(a) Except as specified in (b), (c), and (d) of this subsection, the employer shall implement engineering and work practice controls to reduce and maintain employee exposure to cadmium at or below the PEL, except to the extent that the employer can demonstrate that such controls are not feasible.

(b) Except as specified in (c) and (d) of this subsection, in industries where a separate engineering control air limit (SECAL) has been specified for particular processes (Table 1 of this subsection), the employer shall implement engineering and work practice controls to reduce and maintain employee exposure at or below the SECAL, except to the extent that the employer can demonstrate that such controls are not feasible.

Table I.—Separate Engineering Control Airborne Limits (SECALs) for Processes in Selected Industries

Industry	Process	SECAL ($\mu\text{g}/\text{m}^3$)
Nickel cadmium battery	Plate making, plate preparation	50
	All other processes	15
Zinc/Cadmium refining*	Cadmium refining, casting, melting, oxide production, sinter plant	50
	Calcine, crushing, milling, blending	50
Pigment manufacture	All other processes	15
	Cadmium oxide charging, crushing, drying, blending	50
Stabilizers*	Sinter plant, blast furnace, bag-house, yard area	50
Lead smelting*	Mechanical plating	15

* Processes in these industries that are not specified in this table must achieve the PEL using engineering controls and work practices as required in (a) of this subsection.

(c) The requirement to implement engineering and work practice controls to achieve the PEL or, where applicable, the SECAL does not apply where the employer demonstrates the following:

- (i) The employee is only intermittently exposed; and
- (ii) The employee is not exposed above the PEL on thirty or more days per year (twelve consecutive months).

(d) Wherever engineering and work practice controls are required and are not sufficient to reduce employee exposure to or below the PEL or, where applicable, the SECAL, the employer nonetheless shall implement such controls to reduce exposures to the lowest levels achievable. The employer shall supplement such controls with respiratory protection that complies with the requirements of WAC 296-62-07413 and the PEL.

(e) The employer shall not use employee rotation as a method of compliance.

(2) Compliance program.

(a) Where the PEL is exceeded, the employer shall establish and implement a written compliance program to reduce employee exposure to or below the PEL by means of engineering and work practice controls, as required by subsection (1) of this section. To the extent that engineering and work practice controls cannot reduce exposures to or below the PEL, the employer shall include in the written compliance program the use of appropriate respiratory protection to achieve compliance with the PEL.

(b) Written compliance programs shall include at least the following:

(i) A description of each operation in which cadmium is emitted; e.g., machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices;

(ii) A description of the specific means that will be employed to achieve compliance, including engineering plans and studies used to determine methods selected for controlling exposure to cadmium, as well as, where necessary, the use of appropriate respiratory protection to achieve the PEL;

(iii) A report of the technology considered in meeting the PEL;

(iv) Air monitoring data that document the sources of cadmium emissions;

(v) A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;

(vi) A work practice program that includes items required under WAC 296-62-07415, 296-62-07417, and 296-62-07419;

(vii) A written plan for emergency situations, as specified in WAC 296-62-07415; and

(viii) Other relevant information.

(c) The written compliance programs shall be reviewed and updated at least annually, or more often if necessary, to reflect significant changes in the employer's compliance status.

(d) Written compliance programs shall be provided upon request for examination and copying to affected employees, designated employee representatives, and the director.

(3) Mechanical ventilation.

(a) When ventilation is used to control exposure, measurements that demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made as necessary to maintain its effectiveness.

(b) Measurements of the system's effectiveness in controlling exposure shall be made as necessary within five working days of any change in production, process, or control that might result in a significant increase in employee exposure to cadmium.

(c) Recirculation of air. If air from exhaust ventilation is recirculated into the workplace, the system shall have a high efficiency filter and be monitored to assure effectiveness.

(d) Procedures shall be developed and implemented to minimize employee exposure to cadmium when maintenance of ventilation systems and changing of filters is being conducted.

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07411, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07411, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07413 Respirator protection. (1) General. Where respirators are required by this section, the employer shall provide them at no cost to the employee and shall assure that they are used in compliance with the requirements of this section. Respirators shall be used in the following circumstances:

(a) Where exposure levels exceed the PEL, during the time period necessary to install or implement feasible engineering and work practice controls;

(b) In those maintenance and repair activities and during those brief or intermittent operations where exposures exceed the PEL and engineering and work practice controls are not feasible or are not required;

(c) In regulated areas, as prescribed in WAC 296-62-07409;

(d) Where the employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL;

(e) In emergencies;

(f) Wherever an employee who is exposed to cadmium at or above the action level requests a respirator;

(g) Wherever an employee is exposed above the PEL in an industry to which a SECAL is applicable; and

(h) Wherever an employee is exposed to cadmium above the PEL and engineering controls are not required under WAC 296-62-07411 (1)(c).

(2) Respirator selection.

(a) Where respirators are required under this section, the employer shall select and provide the appropriate respirator as specified in Table 2. The employer shall select respirators from among those jointly approved as acceptable protection against cadmium dust, fume, and mist by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR part 11.

Table 2.—Respiratory Protection for Cadmium

Airborne concentration or condition of use ^a	Required respirator type ^b
10 x or less	A half mask, air-purifying respirator equipped with a HEPA ^c filter ^d .
25 x or less	A powered air-purifying respirator ("PAPR") with a loose-fitting hood or helmet equipped with a HEPA filter, or a supplied-air respirator with a loose-fitting hood or helmet facepiece operated in the continuous flow mode.
50 x or less	A full facepiece air-purifying respirator equipped with a HEPA filter, or a powered air-purifying respirator with a tight-fitting half mask equipped with a HEPA filter, or a supplied air respirator with a tight-fitting half mask operated in the continuous flow mode.
250 x or less	A powered air-purifying respirator with a tight-fitting full facepiece equipped with a HEPA filter, or a supplied-air respirator with a tight-fitting full facepiece operated in the continuous flow mode.
1000 x or less	A supplied-air respirator with half mask or full facepiece operated in the pressure demand or other positive pressure mode.
>1000 x or unknown concentrations	A self-contained breathing apparatus with a full facepiece operated in the pressure demand or other positive pressure mode, or a supplied-air respirator with a

Table 2.—Respiratory Protection for Cadmium

	full facepiece operated in the pressure demand or other positive pressure mode and equipped with an auxiliary escape type self-contained breathing apparatus operated in the pressure demand mode.
Fire fighting	A self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

^a Concentrations expressed as multiple of the PEL.

^b Respirators assigned for higher environmental concentrations may be used at lower exposure levels. Quantitative fit testing is required for all tight-fitting air purifying respirators where airborne concentration of cadmium exceeds 10 times the TWA PEL (10x5 µg/m³=50 µg/m³). A full facepiece respirator is required when eye irritation is experienced.

^c HEPA means High Efficiency Particulate Air.

^d Fit testing, qualitative or quantitative, is required.

SOURCE: Respiratory Decision Logic, NIOSH, 1987

(b) The employer shall provide a powered, air-purifying respirator (PAPR) in lieu of a negative pressure respirator wherever:

(i) An employee entitled to a respirator chooses to use this type of respirator; and

(ii) This respirator will provide adequate protection to the employee.

(3) Respirator program.

(a) Where respiratory protection is required, the employer shall institute a respirator protection program in accordance with chapter 296-62 WAC, Part E.

(b) The employer shall permit each employee who is required to use an air purifying respirator to leave the regulated area to change the filter elements or replace the respirator whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(c) The employer shall also permit each employee who is required to wear a respirator to leave the regulated area to wash his or her face and the respirator facepiece whenever necessary to prevent skin irritation associated with respirator use.

(d) If an employee exhibits difficulty in breathing while wearing a respirator during a fit test or during use, the employer shall make available to the employee a medical examination in accordance with WAC 296-62-07423 (6)(b) to determine if the employee can wear a respirator while performing the required duties.

(e) No employee shall be assigned a task requiring the use of a respirator if, based upon his or her most recent examination, an examining physician determines that the employee will be unable to continue to function normally while wearing a respirator. If the physician determines the employee must be limited in, or removed from his or her current job because of the employee's inability to wear a respirator, the limitation or removal shall be in accordance with WAC 296-62-07423 (11) and (12).

(4) Respirator fit testing.

(a) The employer shall assure that the respirator issued to the employee is fitted properly and exhibits the least possible facepiece leakage.

(b) For each employee wearing a tight-fitting, air purifying respirator (either negative or positive pressure) who is exposed to airborne concentrations of cadmium that do not exceed 10 times the PEL ($10 \times 5 \mu\text{g}/\text{m}^3 = 50 \mu\text{g}/\text{m}^3$), the employer shall perform either quantitative or qualitative fit testing at the time of initial fitting and at least annually thereafter. If quantitative fit testing is used for a negative pressure respirator, a fit factor that is at least 10 times the protection factor for that class of respirators (Table 2 in subsection (2)(a) of this section) shall be achieved at testing.

(c) For each employee wearing a tight-fitting air purifying respirator (either negative or positive pressure) who is exposed to airborne concentrations of cadmium that exceed 10 times the PEL ($10 \times 5 \mu\text{g}/\text{m}^3 = 50 \mu\text{g}/\text{m}^3$), the employer shall perform quantitative fit testing at the time of initial fitting and at least annually thereafter. For negative-pressure respirators, a fit factor that is at least 10 times the protection factor for that class of respirators (Table 2 in subsection (2)(a) of this section) shall be achieved during quantitative fit testing.

(d) For each employee wearing a tight-fitting, supplied-air respirator or self-contained breathing apparatus, the employer shall perform quantitative fit testing at the time of initial fitting and at least annually thereafter. This shall be accomplished by fit testing an air purifying respirator of identical type facepiece, make, model, and size as the supplied air respirator or self-contained breathing apparatus that is equipped with HEPA filters and tested as a surrogate (substitute) in the negative pressure mode. A fit factor that is at least 10 times the protection factor for that class of respirators (Table 2 in subsection (2)(a) of this section) shall be achieved during quantitative fit testing. A supplied-air respirator or self-contained breathing apparatus with the same type facepiece, make, model, and size as the air purifying respirator with which the employee passed the quantitative fit test may then be used by that employee up to the protection factor listed in Table 2 for that class of respirators.

(e) Fit testing shall be conducted in accordance with WAC 296-62-07445, Appendix C.

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07413, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07413, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07415 Emergency situations. The employer shall develop and implement a written plan for dealing with emergency situations involving substantial releases of airborne cadmium. The plan shall include provisions for the use of appropriate respirators and personal protective equipment. In addition, employees not essential to correcting the emergency situation shall be restricted from the area and normal operations halted in that area until the emergency is abated.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07415, filed 3/13/93, effective 4/27/93.]

(1999 Ed.)

WAC 296-62-07417 Protective work clothing and equipment. (1) Provision and use. If an employee is exposed to airborne cadmium above the PEL or where skin or eye irritation is associated with cadmium exposure at any level, the employer shall provide at no cost to the employee, and assure that the employee uses, appropriate protective work clothing and equipment that prevents contamination of the employee and the employee's garments. Protective work clothing and equipment includes, but is not limited to:

(a) Coveralls or similar full-body work clothing;

(b) Gloves, head coverings, and boots or foot coverings; and

(c) Face shields, vented goggles, or other appropriate protective equipment that complies with chapter 296-24 WAC, Part A-2.

(2) Removal and storage.

(a) The employer shall assure that employees remove all protective clothing and equipment contaminated with cadmium at the completion of the work shift and do so only in change rooms provided in accordance with WAC 296-62-07419(1).

(b) The employer shall assure that no employee takes cadmium-contaminated protective clothing or equipment from the workplace, except for employees authorized to do so for purposes of laundering, cleaning, maintaining, or disposing of cadmium contaminated protective clothing and equipment at an appropriate location or facility away from the workplace.

(c) The employer shall assure that contaminated protective clothing and equipment, when removed for laundering, cleaning, maintenance, or disposal, is placed and stored in sealed, impermeable bags or other closed, impermeable containers that are designed to prevent dispersion of cadmium dust.

(d) The employer shall assure that bags or containers of contaminated protective clothing and equipment that are to be taken out of the change rooms or the workplace for laundering, cleaning, maintenance, or disposal shall bear labels in accordance with WAC 296-62-07425(3).

(3) Cleaning, replacement, and disposal.

(a) The employer shall provide the protective clothing and equipment required by subsection (1) of this section in a clean and dry condition as often as necessary to maintain its effectiveness, but in any event at least weekly. The employer is responsible for cleaning and laundering the protective clothing and equipment required by this paragraph to maintain its effectiveness and is also responsible for disposing of such clothing and equipment.

(b) The employer also is responsible for repairing or replacing required protective clothing and equipment as needed to maintain its effectiveness. When rips or tears are detected while an employee is working they shall be immediately mended, or the worksuit shall be immediately replaced.

(c) The employer shall prohibit the removal of cadmium from protective clothing and equipment by blowing, shaking, or any other means that disperses cadmium into the air.

(d) The employer shall assure that any laundering of contaminated clothing or cleaning of contaminated equipment in the workplace is done in a manner that prevents the release of

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airborne cadmium in excess of the permissible exposure limit prescribed in WAC 296-62-07405.

(e) The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with cadmium of the potentially harmful effects of exposure to cadmium and that the clothing and equipment should be laundered or cleaned in a manner to effectively prevent the release of airborne cadmium in excess of the PEL.

[Statutory Authority: Chapter 49.17 RCW, 94-20-057 (Order 94-16), § 296-62-07417, filed 9/30/94, effective 11/20/94; 93-21-075 (Order 93-06), § 296-62-07417, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07417, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07419 Hygiene areas and practices. (1)

General. For employees whose airborne exposure to cadmium is above the PEL, the employer shall provide clean change rooms, handwashing facilities, showers, and lunchroom facilities that comply with WAC 296-24-120.

(2) Change rooms. The employer shall assure that change rooms are equipped with separate storage facilities for street clothes and for protective clothing and equipment, which are designed to prevent dispersion of cadmium and contamination of the employee's street clothes.

(3) Showers and handwashing facilities.

(a) The employer shall assure that employees who are exposed to cadmium above the PEL shower during the end of the work shift.

(b) The employer shall assure that employees whose airborne exposure to cadmium is above the PEL wash their hands and faces prior to eating, drinking, smoking, chewing tobacco or gum, or applying cosmetics.

(4) Lunchroom facilities.

(a) The employer shall assure that the lunchroom facilities are readily accessible to employees, that tables for eating are maintained free of cadmium, and that no employee in a lunchroom facility is exposed at any time to cadmium at or above a concentration of 2.5 $\mu\text{g}/\text{m}^3$.

(b) The employer shall assure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface cadmium has been removed from the clothing and equipment by HEPA vacuuming or some other method that removes cadmium dust without dispersing it.

[Statutory Authority: Chapter 49.17 RCW, 93-07-044 (Order 93-01), § 296-62-07419, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07421 Housekeeping. (1) All surfaces shall be maintained as free as practicable of accumulations of cadmium.

(2) All spills and sudden releases of material containing cadmium shall be cleaned up as soon as possible.

(3) Surfaces contaminated with cadmium shall, wherever possible, be cleaned by vacuuming or other methods that minimize the likelihood of cadmium becoming airborne.

(4) HEPA-filtered vacuuming equipment or equally effective filtration methods shall be used for vacuuming. The equipment shall be used and emptied in a manner that minimizes the reentry of cadmium into the workplace.

(5) Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other methods that minimize

the likelihood of cadmium becoming airborne have been tried and found not to be effective.

(6) Compressed air shall not be used to remove cadmium from any surface unless the compressed air is used in conjunction with a ventilation system designed to capture the dust cloud created by the compressed air.

(7) Waste, scrap, debris, bags, containers, personal protective equipment, and clothing contaminated with cadmium and consigned for disposal shall be collected and disposed of in sealed impermeable bags or other closed, impermeable containers. These bags and containers shall be labeled in accordance with WAC 296-62-07425(2).

[Statutory Authority: Chapter 49.17 RCW, 93-07-044 (Order 93-01), § 296-62-07421, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07423 Medical surveillance. (1) General.

(a) Scope.

(i) Currently exposed. The employer shall institute a medical surveillance program for all employees who are or may be exposed to cadmium at or above the action level unless the employer demonstrates that the employee is not, and will not be, exposed at or above the action level on thirty or more days per year (twelve consecutive months); and

(ii) Previously exposed. The employer shall also institute a medical surveillance program for all employees who prior to the effective date of this section might previously have been exposed to cadmium at or above the action level by the employer, unless the employer demonstrates that the employee did not prior to the effective date of this section work for the employer in jobs with exposure to cadmium for an aggregated total of more than sixty months.

(b) To determine an employee's fitness for using a respirator, the employer shall provide the limited medical examination specified in subsection (6) of this section.

(c) The employer shall assure that all medical examinations and procedures required by this standard are performed by or under the supervision of a licensed physician, who has read and is familiar with the health effects WAC 296-62-07441, Appendix A, the regulatory text of this section, the protocol for sample handling and laboratory selection in WAC 296-62-07451, Appendix F and the questionnaire of WAC 296-62-07447, Appendix D. These examinations and procedures shall be provided without cost to the employee and at a time and place that is reasonable and convenient to employees.

(d) The employer shall assure that the collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine ($\beta_2\text{-M}$) taken from employees under this section is done in a manner that assures their reliability and that analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine ($\beta_2\text{-M}$) taken from employees under this section is performed in laboratories with demonstrated proficiency for that particular analyte. (See WAC 296-62-07451, Appendix F.)

(2) Initial examination.

(a) The employer shall provide an initial (preplacement) examination to all employees covered by the medical surveillance program required in subsection (1)(a) of this section. The examination shall be provided to those employees within

thirty days after initial assignment to a job with exposure to cadmium or no later than ninety days after the effective date of this section, whichever date is later.

(b) The initial (preplacement) medical examination shall include:

(i) A detailed medical and work history, with emphasis on: Past, present, and anticipated future exposure to cadmium; any history of renal, cardiovascular, respiratory, hematopoietic, reproductive, and/or musculo-skeletal system dysfunction; current usage of medication with potential nephrotoxic side-effects; and smoking history and current status; and

(ii) Biological monitoring that includes the following tests:

(A) Cadmium in urine (CdU), standardized to grams of creatinine (g/Cr);

(B) Beta-2 microglobulin in urine (β_2 -M), standardized to grams of creatinine (g/Cr), with pH specified, as described in WAC 296-62-07451, Appendix F; and

(C) Cadmium in blood (CdB), standardized to liters of whole blood (lwb).

(c) Recent examination: An initial examination is not required to be provided if adequate records show that the employee has been examined in accordance with the requirements of (b) of this subsection within the past twelve months. In that case, such records shall be maintained as part of the employee's medical record and the prior exam shall be treated as if it were an initial examination for the purposes of subsections (3) and (4) of this section.

(3) Actions triggered by initial biological monitoring:

(a) If the results of the initial biological monitoring tests show the employee's CdU level to be at or below 3 $\mu\text{g/g}$ Cr, β_2 -M level to be at or below 300 $\mu\text{g/g}$ Cr and CdB level to be at or below 5 $\mu\text{g/lwb}$, then:

(i) For currently exposed employees, who are subject to medical surveillance under subsection (1)(a)(i) of this section, the employer shall provide the minimum level of periodic medical surveillance in accordance with the requirements in subsection (4)(a) of this section; and

(ii) For previously exposed employees, who are subject to medical surveillance under subsection (1)(a)(ii) of this section, the employer shall provide biological monitoring for CdU, β_2 -M, and CdB one year after the initial biological monitoring and then the employer shall comply with the requirements of subsection (4)(e) of this section.

(b) For all employees who are subject to medical surveillance under subsection (1)(a) of this section, if the results of the initial biological monitoring tests show the level of CdU to exceed 3 $\mu\text{g/g}$ Cr, the level of β_2 -M to exceed 300 $\mu\text{g/g}$ Cr, or the level of CdB to exceed 5 $\mu\text{g/lwb}$, the employer shall:

(i) Within two weeks after receipt of biological monitoring results, reassess the employee's occupational exposure to cadmium as follows:

(A) Reassess the employee's work practices and personal hygiene;

(B) Reevaluate the employee's respirator use, if any, and the respirator program;

(C) Review the hygiene facilities;

(D) Reevaluate the maintenance and effectiveness of the relevant engineering controls;

(E) Assess the employee's smoking history and status;

(ii) Within thirty days after the exposure reassessment, specified in (b)(i) of this subsection, take reasonable steps to correct any deficiencies found in the reassessment that may be responsible for the employee's excess exposure to cadmium; and,

(iii) Within ninety days after receipt of biological monitoring results, provide a full medical examination to the employee in accordance with the requirements of WAC 296-62-07423 (4)(b). After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the employee. If the physician determines that medical removal is not necessary, then until the employee's CdU level falls to or below 3 $\mu\text{g/g}$ Cr, β_2 -M level falls to or below 300 $\mu\text{g/g}$ Cr and CdB level falls to or below 5 $\mu\text{g/lwb}$, the employer shall:

(A) Provide biological monitoring in accordance with subsection (2)(b)(ii) of this section on a semiannual basis; and

(B) Provide annual medical examinations in accordance with subsection (4)(b) of this section.

(c) For all employees who are subject to medical surveillance under subsection (1)(a) of this section, if the results of the initial biological monitoring tests show the level of CdU to be in excess of 15 $\mu\text{g/g}$ Cr, or the level of CdB to be in excess of 15 $\mu\text{g/lwb}$, or the level of β_2 -M to be in excess of 1,500 $\mu\text{g/g}$ Cr, the employer shall comply with the requirements of (b)(i) and (ii) of this subsection. Within ninety days after receipt of biological monitoring results, the employer shall provide a full medical examination to the employee in accordance with the requirements of subsection (4)(b) of this section. After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the employee. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 15 $\mu\text{g/g}$ Cr; or CdB exceeds 15 $\mu\text{g/lwb}$; or β_2 -M exceeds 1500 $\mu\text{g/g}$ Cr, and in addition CdU exceeds 3 $\mu\text{g/g}$ Cr or CdB exceeds 5 $\mu\text{g/liter}$ of whole blood, then the physician shall medically remove the employee from exposure to cadmium at or above the action level. If the second set of biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the employee is not required to be removed by the mandatory provisions of this section. If the employee is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the employee's CdU level falls to or below 3 $\mu\text{g/g}$ Cr, β_2 -M level falls to or below 300 $\mu\text{g/g}$ Cr and CdB level falls to or below 5 $\mu\text{g/lwb}$, the employer shall:

(i) Periodically reassess the employee's occupational exposure to cadmium;

(ii) Provide biological monitoring in accordance with subsection (2)(b)(ii) of this section on a quarterly basis; and

(iii) Provide semiannual medical examinations in accordance with subsection (4)(b) of this section.

(d) For all employees to whom medical surveillance is provided, beginning on January 1, 1999, and in lieu of (a) through (c) of this subsection:

(i) If the results of the initial biological monitoring tests show the employee's CdU level to be at or below 3 µg/g Cr, β₂-M level to be at or below 300 µg/g Cr and CdB level to be at or below 5 µg/lwb, then for currently exposed employees, the employer shall comply with the requirements of (a)(i) of this subsection and for previously exposed employees, the employer shall comply with the requirements of (a)(ii) of this subsection;

(ii) If the results of the initial biological monitoring tests show the level of CdU to exceed 3 µg/g Cr, the level of β₂-M to exceed 300 µg/g Cr, or the level of CdB to exceed 5 µg/lwb, the employer shall comply with the requirements of (b)(i) through (iii) of this subsection; and

(iii) If the results of the initial biological monitoring tests show the level of CdU to be in excess of 7 µg/g Cr, or the level of CdB to be in excess of 10 µg/lwb, or the level of β₂-M to be in excess of 750 µg/g Cr, the employer shall: Comply with the requirements of (b)(i) through (ii) of this subsection; and, within ninety days after receipt of biological monitoring results, provide a full medical examination to the employee in accordance with the requirements of subsection (4)(b) of this section. After completing the medical examination, the examining physician shall determine in a written medical opinion whether to medically remove the employee. However, if the initial biological monitoring results and the biological monitoring results obtained during the medical examination both show that: CdU exceeds 7 µg/g Cr; or CdB exceeds 10 µg/lwb; or β₂-M exceeds 750 µg/g Cr, and in addition CdU exceeds 3 µg/g Cr or CdB exceeds 5 µg/liter of whole blood, then the physician shall medically remove the employee from exposure to cadmium at or above the action level. If the second set of biological monitoring results obtained during the medical examination does not show that a mandatory removal trigger level has been exceeded, then the employee is not required to be removed by the mandatory provisions of this section. If the employee is not required to be removed by the mandatory provisions of this section or by the physician's determination, then until the employee's CdU level falls to or below 3 µg/g Cr, β₂-M level falls to or below 300 µg/g Cr and CdB level falls to or below 5 µg/lwb, the employer shall: periodically reassess the employee's occupational exposure to cadmium; provide biological monitoring in accordance with subsection (2)(b)(ii) of this section on a quarterly basis; and provide semiannual medical examinations in accordance with subsection (4)(b) of this section.

(4) Periodic medical surveillance.

(a) For each employee who is covered under subsection (1)(a)(i) of this section, the employer shall provide at least the minimum level of periodic medical surveillance, which consists of periodic medical examinations and periodic biological monitoring. A periodic medical examination shall be provided within one year after the initial examination required by subsection (2) of this section and thereafter at least bienni-

ally. Biological sampling shall be provided at least annually, either as part of a periodic medical examination or separately as periodic biological monitoring.

(b) The periodic medical examination shall include:

(i) A detailed medical and work history, or update thereof, with emphasis on: Past, present and anticipated future exposure to cadmium; smoking history and current status; reproductive history; current use of medications with potential nephrotoxic side-effects; any history of renal, cardiovascular, respiratory, hematopoietic, and/or musculoskeletal system dysfunction; and as part of the medical and work history, for employees who wear respirators, questions 3-11 and 25-32 in WAC 296-62-07447, Appendix D;

(ii) A complete physical examination with emphasis on: Blood pressure, the respiratory system, and the urinary system;

(iii) A 14 inch by 17 inch, or a reasonably standard sized posterior-anterior chest X-ray (after the initial X-ray, the frequency of chest X-rays is to be determined by the examining physician);

(iv) Pulmonary function tests, including forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV1);

(v) Biological monitoring, as required in subsection (2)(b)(ii) of this section;

(vi) Blood analysis, in addition to the analysis required under this section, including blood urea nitrogen, complete blood count, and serum creatinine;

(vii) Urinalysis, in addition to the analysis required under subsection (2)(b)(ii) of this section, including the determination of albumin, glucose, and total and low molecular weight proteins;

(viii) For males over forty years old, prostate palpation, or other at least as effective diagnostic test(s); and

(ix) Any additional tests deemed appropriate by the examining physician.

(c) Periodic biological monitoring shall be provided in accordance with subsection (2)(b)(ii) of this section.

(d) If the results of periodic biological monitoring or the results of biological monitoring performed as part of the periodic medical examination show the level of the employee's CdU, β₂-M, or CdB to be in excess of the levels specified in subsection (3)(b) or (c) of this section; or, beginning on January 1, 1999, in excess of the levels specified in subsection (3)(b) or (d) of this section, the employer shall take the appropriate actions specified in subsection (3)(b) through (d) of this section.

(e) For previously exposed employees under subsection (1)(a)(ii) of this section:

(i) If the employee's levels of CdU did not exceed 3 µg/g Cr, CdB did not exceed 5 µg/lwb, and β₂-M did not exceed 300 µg/g Cr in the initial biological monitoring tests, and if the results of the followup biological monitoring required by subsection (3)(a)(ii) of this section one year after the initial examination confirm the previous results, the employer may discontinue all periodic medical surveillance for that employee.

(ii) If the initial biological monitoring results for CdU, CdB, or β₂-M were in excess of the levels specified in subsec-

tion (3)(a) of this section, but subsequent biological monitoring results required by subsection (3)(b) through (e) of this section show that the employee's CdU levels no longer exceed 3 µg/g Cr, CdB levels no longer exceed 5 µg/lwb, and β₂-M levels no longer exceed 300 µg/g Cr, the employer shall provide biological monitoring for CdU, CdB, and β₂-M one year after these most recent biological monitoring results. If the results of the followup biological monitoring, specified in this section, confirm the previous results, the employer may discontinue all periodic medical surveillance for that employee.

(iii) However, if the results of the follow-up tests specified in (e)(i) or (ii) of this subsection indicate that the level of the employee's CdU, β₂-M, or CdB exceeds these same levels, the employer is required to provide annual medical examinations in accordance with the provisions of (b) of this subsection until the results of biological monitoring are consistently below these levels or the examining physician determines in a written medical opinion that further medical surveillance is not required to protect the employee's health.

(f) A routine, biennial medical examination is not required to be provided in accordance with subsections (3)(a) and (4) of this section if adequate medical records show that the employee has been examined in accordance with the requirements of (b) of this subsection within the past twelve months. In that case, such records shall be maintained by the employer as part of the employee's medical record, and the next routine, periodic medical examination shall be made available to the employee within two years of the previous examination.

(5) Actions triggered by medical examinations.

If the results of a medical examination carried out in accordance with this section indicate any laboratory or clinical finding consistent with cadmium toxicity that does not require employer action under subsections (2), (3), or (4) of this section, the employer, within thirty days, shall reassess the employee's occupational exposure to cadmium and take the following corrective action until the physician determines they are no longer necessary:

(a) Periodically reassess: The employee's work practices and personal hygiene; the employee's respirator use, if any; the employee's smoking history and status; the respiratory protection program; the hygiene facilities; and the maintenance and effectiveness of the relevant engineering controls;

(b) Within thirty days after the reassessment, take all reasonable steps to correct the deficiencies found in the reassessment that may be responsible for the employee's excess exposure to cadmium;

(c) Provide semiannual medical reexaminations to evaluate the abnormal clinical sign(s) of cadmium toxicity until the results are normal or the employee is medically removed; and

(d) Where the results of tests for total proteins in urine are abnormal, provide a more detailed medical evaluation of the toxic effects of cadmium on the employee's renal system.

(6) Examination for respirator use.

(a) To determine an employee's fitness for respirator use, the employer shall provide a medical examination that includes the elements specified in (a)(i) through (iv) of this

subsection. This examination shall be provided prior to the employee's being assigned to a job that requires the use of a respirator or no later than ninety days after this section goes into effect, whichever date is later, to any employee without a medical examination within the preceding twelve months that satisfies the requirements of this paragraph.

(i) A detailed medical and work history, or update thereof, with emphasis on: Past exposure to cadmium; smoking history and current status; any history of renal, cardiovascular, respiratory, hematopoietic, and/or musculoskeletal system dysfunction; a description of the job for which the respirator is required; and questions 3 through 11 and 25 through 32 in WAC 296-62-07447, Appendix D;

(ii) A blood pressure test;

(iii) Biological monitoring of the employee's levels of CdU, CdB and β₂-M in accordance with the requirements of subsection (2)(b)(ii) of this section, unless such results already have been obtained within the previous twelve months; and

(iv) Any other test or procedure that the examining physician deems appropriate.

(b) After reviewing all the information obtained from the medical examination required in (a) of this subsection, the physician shall determine whether the employee is fit to wear a respirator.

(c) Whenever an employee has exhibited difficulty in breathing during a respirator fit test or during use of a respirator, the employer, as soon as possible, shall provide the employee with a periodic medical examination in accordance with subsection (4)(b) of this section to determine the employee's fitness to wear a respirator.

(d) Where the results of the examination required under (a), (b), or (c) of this subsection are abnormal, medical limitation or prohibition of respirator use shall be considered. If the employee is allowed to wear a respirator, the employee's ability to continue to do so shall be periodically evaluated by a physician.

(7) Emergency examinations.

(a) In addition to the medical surveillance required in subsections (2) through (6) of this section, the employer shall provide a medical examination as soon as possible to any employee who may have been acutely exposed to cadmium because of an emergency.

(b) The examination shall include the requirements of subsection (4)(b) of this section, with emphasis on the respiratory system, other organ systems considered appropriate by the examining physician, and symptoms of acute overexposure, as identified in WAC 296-62-07441 (2)(b)(i) through (ii) and (4), Appendix A.

(8) Termination of employment examination.

(a) At termination of employment, the employer shall provide a medical examination in accordance with subsection (4)(b) of this section, including a chest x-ray, to any employee to whom at any prior time the employer was required to provide medical surveillance under subsection (1)(a) or (7) of this section. However, if the last examination satisfied the requirements of subsection (4)(b) of this section and was less than six months prior to the date of termination, no further examination is required unless otherwise specified in subsection (3) or (5) of this section;

(b) However, for employees covered by subsection (1)(a)(ii) of this section, if the employer has discontinued all periodic medical surveillance under subsection (4)(e) of this section, no termination of employment medical examination is required.

(9) Information provided to the physician. The employer shall provide the following information to the examining physician:

(a) A copy of this standard and appendices;

(b) A description of the affected employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to cadmium;

(c) The employee's former, current, and anticipated future levels of occupational exposure to cadmium;

(d) A description of any personal protective equipment, including respirators, used or to be used by the employee, including when and for how long the employee has used that equipment; and

(e) Relevant results of previous biological monitoring and medical examinations.

(10) Physician's written medical opinion.

(a) The employer shall promptly obtain a written, signed medical opinion from the examining physician for each medical examination performed on each employee. This written opinion shall contain:

(i) The physician's diagnosis for the employee;

(ii) The physician's opinion as to whether the employee has any detected medical condition(s) that would place the employee at increased risk of material impairment to health from further exposure to cadmium, including any indications of potential cadmium toxicity;

(iii) The results of any biological or other testing or related evaluations that directly assess the employee's absorption of cadmium;

(iv) Any recommended removal from, or limitation on the activities or duties of the employee or on the employee's use of personal protective equipment, such as respirators;

(v) A statement that the physician has clearly and carefully explained to the employee the results of the medical examination, including all biological monitoring results and any medical conditions related to cadmium exposure that require further evaluation or treatment, and any limitation on the employee's diet or use of medications.

(b) The employer promptly shall obtain a copy of the results of any biological monitoring provided by an employer to an employee independently of a medical examination under subsections (2) and (4) of this section, and, in lieu of a written medical opinion, an explanation sheet explaining those results.

(c) The employer shall instruct the physician not to reveal orally or in the written medical opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to cadmium.

(11) Medical removal protection (MRP).

(a) General.

(i) The employer shall temporarily remove an employee from work where there is excess exposure to cadmium on each occasion that medical removal is required under subsection (3), (4), or (6) of this section and on each occasion that a physician determines in a written medical opinion that the

employee should be removed from such exposure. The physician's determination may be based on biological monitoring results, inability to wear a respirator, evidence of illness, other signs or symptoms of cadmium-related dysfunction or disease, or any other reason deemed medically sufficient by the physician.

(ii) The employer shall medically remove an employee in accordance with this subsection regardless of whether at the time of removal a job is available into which the removed employee may be transferred.

(iii) Whenever an employee is medically removed under this subsection, the employer shall transfer the removed employee to a job where the exposure to cadmium is within the permissible levels specified in that subsection as soon as one becomes available.

(iv) For any employee who is medically removed under the provisions of (a) of this subsection, the employer shall provide follow-up biological monitoring in accordance with subsection (2)(b)(ii) of this section at least every three months and follow-up medical examinations semiannually at least every six months until in a written medical opinion the examining physician determines that either the employee may be returned to his/her former job status as specified under (d) through (e) of this subsection or the employee must be permanently removed from excess cadmium exposure.

(v) The employer may not return an employee who has been medically removed for any reason to his/her former job status until a physician determines in a written medical opinion that continued medical removal is no longer necessary to protect the employee's health.

(b) Where an employee is found unfit to wear a respirator under subsection (6)(b) of this section, the employer shall remove the employee from work where exposure to cadmium is above the PEL.

(c) Where removal is based on any reason other than the employee's inability to wear a respirator, the employer shall remove the employee from work where exposure to cadmium is at or above the action level.

(d) Except as specified in (e) of this subsection, no employee who was removed because his/her level of CdU, CdB and/or β_2 -M exceeded the medical removal trigger levels in subsection (3) or (4) of this section may be returned to work with exposure to cadmium at or above the action level until the employee's levels of CdU fall to or below 3 $\mu\text{g/g}$ Cr, CdB falls to or below 5 $\mu\text{g/lwb}$, and β_2 -M falls to or below 300 $\mu\text{g/g}$ Cr.

(e) However, when in the examining physician's opinion continued exposure to cadmium will not pose an increased risk to the employee's health and there are special circumstances that make continued medical removal an inappropriate remedy, the physician shall fully discuss these matters with the employee, and then in a written determination may return a worker to his/her former job status despite what would otherwise be unacceptably high biological monitoring results. Thereafter, the returned employee shall continue to be provided with medical surveillance as if he/she were still on medical removal until the employee's levels of CdU fall to or below 3 $\mu\text{g/g}$ Cr, CdB falls to or below 5 $\mu\text{g/lwb}$, and β_2 -M falls to or below 300 $\mu\text{g/g}$ Cr.

(f) Where an employer, although not required by (a) through (c) of this subsection to do so, removes an employee from exposure to cadmium or otherwise places limitations on an employee due to the effects of cadmium exposure on the employee's medical condition, the employer shall provide the same medical removal protection benefits to that employee under subsection (12) of this section as would have been provided had the removal been required under (a) through (c) of this subsection.

(12) Medical removal protection benefits (MRPB).

(a) The employer shall provide MRPB for up to a maximum of eighteen months to an employee each time and while the employee is temporarily medically removed under subsection (11) of this section.

(b) For purposes of this section, the requirement that the employer provide MRPB means that the employer shall maintain the total normal earnings, seniority, and all other employee rights and benefits of the removed employee, including the employee's right to his/her former job status, as if the employee had not been removed from the employee's job or otherwise medically limited.

(c) Where, after eighteen months on medical removal because of elevated biological monitoring results, the employee's monitoring results have not declined to a low enough level to permit the employee to be returned to his/her former job status:

(i) The employer shall make available to the employee a medical examination pursuant in order to obtain a final medical determination as to whether the employee may be returned to his/her former job status or must be permanently removed from excess cadmium exposure; and

(ii) The employer shall assure that the final medical determination indicates whether the employee may be returned to his/her former job status and what steps, if any, should be taken to protect the employee's health.

(d) The employer may condition the provision of MRPB upon the employee's participation in medical surveillance provided in accordance with this section.

(13) Multiple physician review.

(a) If the employer selects the initial physician to conduct any medical examination or consultation provided to an employee under this section, the employee may designate a second physician to:

(i) Review any findings, determinations, or recommendations of the initial physician; and

(ii) Conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(b) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician provided by the employer conducts a medical examination or consultation pursuant to this section. The employer may condition its participation in, and payment for, multiple physician review upon the employee doing the following within fifteen days after receipt of this notice, or receipt of the initial physician's written opinion, whichever is later:

(i) Informing the employer that he or she intends to seek a medical opinion; and

(ii) Initiating steps to make an appointment with a second physician.

(c) If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(d) If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee, through their respective physicians, shall designate a third physician to:

(i) Review any findings, determinations, or recommendations of the other two physicians; and

(ii) Conduct such examinations, consultations, laboratory tests, and discussions with the other two physicians as the third physician deems necessary to resolve the disagreement among them.

(e) The employer shall act consistently with the findings, determinations, and recommendations of the third physician, unless the employer and the employee reach an agreement that is consistent with the recommendations of at least one of the other two physicians.

(14) Alternate physician determination. The employer and an employee or designated employee representative may agree upon the use of any alternate form of physician determination in lieu of the multiple physician review provided by subsection (13) of this section, so long as the alternative is expeditious and at least as protective of the employee.

(15) Information the employer must provide the employee.

(a) The employer shall provide a copy of the physician's written medical opinion to the examined employee within two weeks after receipt thereof.

(b) The employer shall provide the employee with a copy of the employee's biological monitoring results and an explanation sheet explaining the results within two weeks after receipt thereof.

(c) Within thirty days after a request by an employee, the employer shall provide the employee with the information the employer is required to provide the examining physician under subsection (9) of this section.

(16) Reporting. In addition to other medical events that are required to be reported on the OSHA Form No. 200, the employer shall report any abnormal condition or disorder caused by occupational exposure to cadmium associated with employment as specified in WAC 296-27-060.

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07423, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07423, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07425 Communication of cadmium hazards to employees. (1) General. In communications concerning cadmium hazards, employers shall comply with the requirements of WISHA's Hazard Communication Standard, chapter 296-62 WAC, Part C, including but not limited to the requirements concerning warning signs and labels, material safety data sheets (MSDS), and employee information and training. In addition, employers shall comply with the following requirements:

(2) Warning signs.

(a) Warning signs shall be provided and displayed in regulated areas. In addition, warning signs shall be posted at all approaches to regulated areas so that an employee may read the signs and take necessary protective steps before entering the area.

(b) Warning signs required by (a) of this subsection shall bear the following information:

DANGER CADMIUM CANCER HAZARD CAN CAUSE LUNG
AND KIDNEY DISEASE AUTHORIZED PERSONNEL ONLY
RESPIRATORS REQUIRED IN THIS AREA

(c) The employer shall assure that signs required by this subsection are illuminated, cleaned, and maintained as necessary so that the legend is readily visible.

(3) Warning labels.

(a) Shipping and storage containers containing cadmium, cadmium compounds, or cadmium contaminated clothing, equipment, waste, scrap, or debris shall bear appropriate warning labels, as specified in (b) of this subsection.

(b) The warning labels shall include at least the following information:

DANGER CONTAINS CADMIUM CANCER HAZARD AVOID
CREATING DUST CAN CAUSE LUNG AND KIDNEY DISEASE

(c) Where feasible, installed cadmium products shall have a visible label or other indication that cadmium is present.

(4) Employee information and training.

(a) The employer shall institute a training program for all employees who are potentially exposed to cadmium, assure employee participation in the program, and maintain a record of the contents of such program.

(b) Training shall be provided prior to or at the time of initial assignment to a job involving potential exposure to cadmium and at least annually thereafter.

(c) The employer shall make the training program understandable to the employee and shall assure that each employee is informed of the following:

(i) The health hazards associated with cadmium exposure, with special attention to the information incorporated in WAC 296-62-07441, Appendix A;

(ii) The quantity, location, manner of use, release, and storage of cadmium in the workplace and the specific nature of operations that could result in exposure to cadmium, especially exposures above the PEL;

(iii) The engineering controls and work practices associated with the employee's job assignment;

(iv) The measures employees can take to protect themselves from exposure to cadmium, including modification of such habits as smoking and personal hygiene, and specific procedures the employer has implemented to protect employees from exposure to cadmium such as appropriate work practices, emergency procedures, and the provision of personal protective equipment;

(v) The purpose, proper selection, fitting, proper use, and limitations of respirators and protective clothing;

(vi) The purpose and a description of the medical surveillance program required by WAC 296-62-07423;

(vii) The contents of this section and its appendices; and

(viii) The employee's rights of access to records under WAC 296-62-05213.

(d) Additional access to information and training program and materials.

(i) The employer shall make a copy of this section and its appendices readily available without cost to all affected employees and shall provide a copy if requested.

(ii) The employer shall provide to the director, upon request, all materials relating to the employee information and the training program.

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07425, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07425, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07427 Recordkeeping. (1) Exposure monitoring.

(a) The employer shall establish and keep an accurate record of all air monitoring for cadmium in the workplace.

(b) This record shall include at least the following information:

(i) The monitoring date, duration, and results in terms of an 8-hour TWA of each sample taken;

(ii) The name, Social Security number, and job classification of the employees monitored and of all other employees whose exposures the monitoring is intended to represent;

(iii) A description of the sampling and analytical methods used and evidence of their accuracy;

(iv) The type of respiratory protective device, if any, worn by the monitored employee;

(v) A notation of any other conditions that might have affected the monitoring results.

(c) The employer shall maintain this record for at least thirty years, in accordance with chapter 296-62 WAC, Part B.

(2) Objective data for exemption from requirement for initial monitoring.

(a) For purposes of this section, objective data are information demonstrating that a particular product or material containing cadmium or a specific process, operation, or activity involving cadmium cannot release dust or fumes in concentrations at or above the action level even under the worst-case release conditions. Objective data can be obtained from an industry-wide study or from laboratory product test results from manufacturers of cadmium-containing products or materials. The data the employer uses from an industry-wide survey must be obtained under workplace conditions closely resembling the processes, types of material, control methods, work practices and environmental conditions in the employer's current operations.

(b) The employer shall establish and maintain a record of the objective data for at least thirty years.

(3) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee covered by medical surveillance under WAC 296-62-07423 (1)(a).

(b) The record shall include at least the following information about the employee:

(i) Name, Social Security number, and description of the duties;

(ii) A copy of the physician's written opinions and an explanation sheet for biological monitoring results;

(iii) A copy of the medical history, and the results of any physical examination and all test results that are required to be provided by this section, including biological tests, x-rays, pulmonary function tests, etc., or that have been obtained to further evaluate any condition that might be related to cadmium exposure;

(iv) The employee's medical symptoms that might be related to exposure to cadmium; and

(v) A copy of the information provided to the physician as required by WAC 296-62-07423 (9)(b) through (e).

(c) The employer shall assure that this record is maintained for the duration of employment plus thirty years, in accordance with chapter 296-62 WAC, Part B.

(4) Training. The employer shall certify that employees have been trained by preparing a certification record which includes the identity of the person trained, the signature of the employer or the person who conducted the training, and the date the training was completed. The certification records shall be prepared at the completion of training and shall be maintained on file for one year beyond the date of training of that employee.

(5) Availability.

(a) Except as otherwise provided for in this section, access to all records required to be maintained by subsections (1) through (4) of this section shall be in accordance with the provisions of chapter 296-62 WAC, Part B.

(b) Within fifteen days after a request, the employer shall make an employee's medical records required to be kept by subsection (3) of this section available for examination and copying to the subject employee, to designated representatives, to anyone having the specific written consent of the subject employee, and after the employee's death or incapacitation, to the employee's family members.

(6) Transfer of records. Whenever an employer ceases to do business and there is no successor employer to receive and retain records for the prescribed period or the employer intends to dispose of any records required to be preserved for at least thirty years, the employer shall comply with the requirements concerning transfer of records set forth in WAC 296-62-05215.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07427, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07429 Observation of monitoring. (1) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to cadmium.

(2) Observation procedures. When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with that clothing and equipment and shall assure that the observer uses such clothing and equipment and complies with all other applicable safety and health procedures.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07429, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07431 Dates. (1) Effective date. This section shall become effective April 30, 1993.

(1999 Ed.)

(2) Start-up dates. All obligations of this section commence on the effective date except as follows:

(a) Exposure monitoring. Except for small businesses (nineteen or fewer employees), initial monitoring required by WAC 296-62-07407(2) shall be completed as soon as possible and in any event no later than sixty days after the effective date of this standard. For small businesses, initial monitoring required by WAC 296-62-07407(2) shall be completed as soon as possible and in any event no later than one hundred twenty days after the effective date of this standard.

(b) Regulated areas. Except for small business, defined under (a) of this subsection, regulated areas required to be established by WAC 296-62-07409 shall be set up as soon as possible after the results of exposure monitoring are known and in any event no later than ninety days after the effective date of this section. For small businesses, regulated areas required to be established by WAC 296-62-07409 shall be set up as soon as possible after the results of exposure monitoring are known and in any event no later than one hundred fifty days after the effective date of this section.

(c) Respiratory protection. Except for small businesses, defined under (a) of this subsection, respiratory protection required by WAC 296-62-07413 shall be provided as soon as possible and in any event no later than ninety days after the effective date of this section. For small businesses, respiratory protection required by WAC 296-62-07413 shall be provided as soon as possible and in any event no later than one hundred fifty days after the effective date of this section.

(d) Compliance program. Written compliance programs required by WAC 296-62-07411(2) shall be completed and available for inspection and copying as soon as possible and in any event no later than one year after the effective date of this section.

(e) Methods of compliance. The engineering controls required by WAC 296-62-07411(1) shall be implemented as soon as possible and in any event no later than two years after the effective date of this section. Work practice controls shall be implemented as soon as possible. Work practice controls that are directly related to engineering controls to be implemented in accordance with the compliance plan shall be implemented as soon as possible after such engineering controls are implemented.

(f) Hygiene and lunchroom facilities.

(i) Handwashing facilities, permanent or temporary, shall be provided in accordance with WAC 296-24-12009 as soon as possible and in any event no later than sixty days after the effective date of this section.

(ii) Change rooms, showers, and lunchroom facilities shall be completed as soon as possible and in any event no later than one year after the effective date of this section.

(g) Employee information and training. Except for small businesses, defined under (a) of this subsection, employee information and training required by WAC 296-62-07425(4) shall be provided as soon as possible and in any event no later than ninety days after the effective date of this standard. For small businesses, employee information and training required by WAC 296-62-07425(4) shall be provided as soon as possible and in any event no later than one hundred eighty days after the effective date of this standard.

(h) Medical surveillance. Except for small businesses, defined under (a) of this subsection, initial medical examinations required by WAC 296-62-07423 shall be provided as soon as possible and in any event no later than ninety days after the effective date of this standard. For small businesses, initial medical examinations required by WAC 296-62-07423 shall be provided as soon as possible and in any event no later than one hundred eighty days after the effective date of this standard.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07431, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07433 Appendices. (1) WAC 296-62-07445, Appendix C is incorporated as part of this section, and compliance with its contents is mandatory.

(2) Except where portions of WAC 296-62-07441, appendix A; WAC 296-62-07443, appendix B; WAC 296-62-07447, appendix D; WAC 296-62-07449, appendix E; and WAC 296-62-07451, appendix F are expressly incorporated in requirements of WAC 296-62-07433, these appendices are purely informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07433, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07441 Appendix A, substance safety data sheet—Cadmium. (1) Substance identification.

(a) Substance: Cadmium.

(b) 8-Hour, time-weighted-average, permissible exposure limit (TWA PEL):

(c) TWA PEL: Five micrograms of cadmium per cubic meter of air $5 \mu\text{g}/\text{m}^3$, time-weighted average (TWA) for an 8-hour workday.

(d) Appearance: Cadmium metal—soft, blue-white, malleable, lustrous metal or grayish-white powder. Some cadmium compounds may also appear as a brown, yellow, or red powdery substance.

(2) Health hazard data.

(a) Routes of exposure. Cadmium can cause local skin or eye irritation. Cadmium can affect your health if you inhale it or if you swallow it.

(b) Effects of overexposure.

(i) Short-term (acute) exposure: Cadmium is much more dangerous by inhalation than by ingestion. High exposures to cadmium that may be immediately dangerous to life or health occur in jobs where workers handle large quantities of cadmium dust or fume; heat cadmium-containing compounds or cadmium-coated surfaces; weld with cadmium solders or cut cadmium-containing materials such as bolts.

(ii) Severe exposure may occur before symptoms appear. Early symptoms may include mild irritation of the upper respiratory tract, a sensation of constriction of the throat, a metallic taste and/or a cough. A period of one to ten hours may precede the onset of rapidly progressing shortness of breath, chest pain, and flu-like symptoms with weakness, fever, headache, chills, sweating, and muscular pain. Acute pulmonary edema usually develops within twenty-four hours and reaches a maximum by three days. If death from

asphyxia does not occur, symptoms may resolve within a week.

(iii) Long-term (chronic) exposure. Repeated or long-term exposure to cadmium, even at relatively low concentrations, may result in kidney damage and an increased risk of cancer of the lung and of the prostate.

(c) Emergency first aid procedures.

(i) Eye exposure: Direct contact may cause redness or pain. Wash eyes immediately with large amounts of water, lifting the upper and lower eyelids. Get medical attention immediately.

(ii) Skin exposure: Direct contact may result in irritation. Remove contaminated clothing and shoes immediately. Wash affected area with soap or mild detergent and large amounts of water. Get medical attention immediately.

(iii) Ingestion: Ingestion may result in vomiting, abdominal pain, nausea, diarrhea, headache, and sore throat. Treatment for symptoms must be administered by medical personnel. Under no circumstances should the employer allow any person whom he/she retains, employs, supervises, or controls to engage in therapeutic chelation. Such treatment is likely to translocate cadmium from pulmonary or other tissue to renal tissue. Get medical attention immediately.

(iv) Inhalation: If large amounts of cadmium are inhaled, the exposed person must be moved to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Administer oxygen if available. Keep the affected person warm and at rest. Get medical attention immediately.

(v) Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, attempt rescue only after notifying at least one other person of the emergency and putting into effect established emergency procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the location of the emergency equipment before the need arises.

(3) Employee information.

(a) Protective clothing and equipment.

(i) Respirators: You may be required to wear a respirator for nonroutine activities; in emergencies; while your employer is in the process of reducing cadmium exposures through engineering controls; and where engineering controls are not feasible. If respirators are worn in the future, they must have a joint Mine Safety and Health Administration (MSHA) and National Institute for Occupational Safety and Health (NIOSH) label of approval. Cadmium does not have a detectable odor except at levels well above the permissible exposure limits. If you can smell cadmium while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

(ii) Protective clothing: You may be required to wear impermeable clothing, gloves, foot gear, a face shield, or other appropriate protective clothing to prevent skin contact with cadmium. Where protective clothing is required, your employer must provide clean garments to you as necessary to assure that the clothing protects you adequately. The employer must replace or repair protective clothing that has become torn or otherwise damaged.

(iii) Eye protection: You may be required to wear splash-proof or dust resistant goggles to prevent eye contact with cadmium.

(b) Employer requirements.

(i) Medical: If you are exposed to cadmium at or above the action level, your employer is required to provide a medical examination, laboratory tests and a medical history according to the medical surveillance provisions under WAC 296-62-07423. (See summary chart and tables in this section, appendix A.) These tests shall be provided without cost to you. In addition, if you are accidentally exposed to cadmium under conditions known or suspected to constitute toxic exposure to cadmium, your employer is required to make special tests available to you.

(ii) Access to records: All medical records are kept strictly confidential. You or your representative are entitled to see the records of measurements of your exposure to cadmium. Your medical examination records can be furnished to your personal physician or designated representative upon request by you to your employer.

(iii) Observation of monitoring: Your employer is required to perform measurements that are representative of your exposure to cadmium and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear the protective clothing and equipment.

(c) Employee requirements. You will not be able to smoke, eat, drink, chew gum or tobacco, or apply cosmetics while working with cadmium in regulated areas. You will also not be able to carry or store tobacco products, gum, food, drinks, or cosmetics in regulated areas because these products easily become contaminated with cadmium from the workplace and can therefore create another source of unnecessary cadmium exposure. Some workers will have to change out of work clothes and shower at the end of the day, as part of their workday, in order to wash cadmium from skin and hair. Handwashing and cadmium-free eating facilities shall be provided by the employer and proper hygiene should always be performed before eating. It is also recommended that you do not smoke or use tobacco products, because among other things, they naturally contain cadmium. For further information, read the labeling on such products.

(4) Physician information.

(a) Introduction. The medical surveillance provisions of WAC 296-62-07423 generally are aimed at accomplishing three main interrelated purposes: First, identifying employees at higher risk of adverse health effects from excess, chronic exposure to cadmium; second, preventing cadmium-induced disease; and third, detecting and minimizing existing cadmium-induced disease. The core of medical surveillance in this standard is the early and periodic monitoring of the employee's biological indicators of:

- (i) Recent exposure to cadmium;
- (ii) Cadmium body burden; and

(iii) Potential and actual kidney damage associated with exposure to cadmium. The main adverse health effects associated with cadmium overexposure are lung cancer and kidney dysfunction. It is not yet known how to adequately biologically monitor human beings to specifically prevent cadmium-induced lung cancer. By contrast, the kidney can be monitored to provide prevention and early detection of cadmium-induced kidney damage. Since, for noncarcinogenic effects, the kidney is considered the primary target organ of chronic exposure to cadmium, the medical surveillance provisions of this standard effectively focus on cadmium-induced kidney disease. Within that focus, the aim, where possible, is to prevent the onset of such disease and, where necessary, to minimize such disease as may already exist. The by-products of successful prevention of kidney disease are anticipated to be the reduction and prevention of other cadmium-induced diseases.

(b) Health effects. The major health effects associated with cadmium overexposure are described below.

(i) Kidney: The most prevalent nonmalignant disease observed among workers chronically exposed to cadmium is kidney dysfunction. Initially, such dysfunction is manifested as proteinuria. The proteinuria associated with cadmium exposure is most commonly characterized by excretion of low-molecular weight proteins (15,000 to 40,000 MW) accompanied by loss of electrolytes, uric acid, calcium, amino acids, and phosphate. The compounds commonly excreted include: beta-2-microglobulin (β_2 -M), retinol binding protein (RBP), immunoglobulin light chains, and lysozyme. Excretion of low molecular weight proteins are characteristic of damage to the proximal tubules of the kidney (Iwao et al., 1980). It has also been observed that exposure to cadmium may lead to urinary excretion of high-molecular weight proteins such as albumin, immunoglobulin G, and glycoproteins (Ex. 29). Excretion of high-molecular weight proteins is typically indicative of damage to the glomeruli of the kidney. Bernard et al., (1979) suggest that damage to the glomeruli and damage to the proximal tubules of the kidney may both be linked to cadmium exposure but they may occur independently of each other. Several studies indicate that the onset of low-molecular weight proteinuria is a sign of irreversible kidney damage (Friberg et al., 1974; Roels et al., 1982; Piscator 1984; Elinder et al., 1985; Smith et al., 1986). Above specific levels of β_2 -M associated with cadmium exposure it is unlikely that β_2 -M levels return to normal even when cadmium exposure is eliminated by removal of the individual from the cadmium work environment (Friberg, Ex. 29, 1990). Some studies indicate that such proteinuria may be progressive; levels of β_2 -M observed in the urine increase with time even after cadmium exposure has ceased. See, for example, Elinder et al., 1985. Such observations, however, are not universal, and it has been suggested that studies in which proteinuria has not been observed to progress may not have tracked patients for a sufficiently long time interval (Jarup, Ex. 8-661). When cadmium exposure continues after the onset of proteinuria, chronic nephrotoxicity may occur (Friberg, Ex. 29). Uremia results from the inability of the glomerulus to adequately filter blood. This leads to severe disturbance of electrolyte concentrations and

may lead to various clinical complications including kidney stones (L-140-50). After prolonged exposure to cadmium, glomerular proteinuria, glucosuria, aminoaciduria, phosphaturia, and hypercalciuria may develop (Exs. 8-86, 4-28, 14-18). Phosphate, calcium, glucose, and amino acids are essential to life, and under normal conditions, their excretion should be regulated by the kidney. Once low molecular weight proteinuria has developed, these elements dissipate from the human body. Loss of glomerular function may also occur, manifested by decreased glomerular filtration rate and increased serum creatinine. Severe cadmium-induced renal damage may eventually develop into chronic renal failure and uremia (Ex. 55). Studies in which animals are chronically exposed to cadmium confirm the renal effects observed in humans (Friberg et al., 1986). Animal studies also confirm problems with calcium metabolism and related skeletal effects which have been observed among humans exposed to cadmium in addition to the renal effects. Other effects commonly reported in chronic animal studies include anemia, changes in liver morphology, immunosuppression and hypertension. Some of these effects may be associated with co-factors. Hypertension, for example, appears to be associated with diet as well as cadmium exposure. Animals injected with cadmium have also shown testicular necrosis (Ex. 8-86B).

(ii) Biological markers. It is universally recognized that the best measures of cadmium exposures and its effects are measurements of cadmium in biological fluids, especially urine and blood. Of the two, CdU is conventionally used to determine body burden of cadmium in workers without kidney disease. CdB is conventionally used to monitor for recent exposure to cadmium. In addition, levels of CdU and CdB historically have been used to predict the percent of the population likely to develop kidney disease (Thun et al., Ex. L-140-50; WHO, Ex. 8-674; ACGIH, Exs. 8-667, 140-50). The third biological parameter upon which WISHA relies for medical surveillance is beta-2-microglobulin in urine (β_2 -M), a low molecular weight protein. Excess β_2 -M has been widely accepted by physicians and scientists as a reliable indicator of functional damage to the proximal tubule of the kidney (Exs. 8-447, 144-3-C, 4-47, L-140-45, 19-43-A). Excess β_2 -M is found when the proximal tubules can no longer reabsorb this protein in a normal manner. This failure of the proximal tubules is an early stage of a kind of kidney disease that commonly occurs among workers with excessive cadmium exposure. Used in conjunction with biological test results indicating abnormal levels of CdU and CdB, the finding of excess β_2 -M can establish for an examining physician that any existing kidney disease is probably cadmium-related (Trs. 6/6/90, pp. 82-86, 122, 134). The upper limits of normal levels for cadmium in urine and cadmium in blood are 3 $\mu\text{g Cd/gram creatinine}$ in urine and 5 $\mu\text{gCd/liter whole blood}$, respectively. These levels were derived from broad-based population studies. Three issues confront the physicians in the use of β_2 -M as a marker of kidney dysfunction and material impairment. First, there are a few other causes of elevated levels of β_2 -M not related to cadmium exposures, some of which may be rather common diseases and some of which are serious diseases (e.g., myeloma or transient flu, Exs. 29 and 8-086).

These can be medically evaluated as alternative causes (Friberg, Ex. 29). Also, there are other factors that can cause β_2 -M to degrade so that low levels would result in workers with tubular dysfunction. For example, regarding the degradation of β_2 -M, workers with acidic urine ($\text{pH}<6$) might have β_2 -M levels that are within the "normal" range when in fact kidney dysfunction has occurred (Ex. L-140-1) and the low molecular weight proteins are degraded in acid urine. Thus, it is very important that the pH of urine be measured, that urine samples be buffered as necessary (See WAC 296-62-07451, appendix F.), and that urine samples be handled correctly, i.e., measure the pH of freshly voided urine samples, then if necessary, buffer to $\text{pH}>6$ (or above for shipping purposes), measure pH again and then, perhaps, freeze the sample for storage and shipping. (See also WAC 296-62-07451, appendix F.) Second, there is debate over the pathological significance of proteinuria, however, most world experts believe that β_2 -M levels greater than 300 $\mu\text{g/g Cr}$ are abnormal (Elinder, Ex. 55, Friberg, Ex. 29). Such levels signify kidney dysfunction that constitutes material impairment of health. Finally, detection of β_2 -M at low levels has often been considered difficult, however, many laboratories have the capability of detecting excess β_2 -M using simple kits, such as the Phadebas Delphia test, that are accurate to levels of 100 $\mu\text{g } \beta_2\text{-M/g Cr U}$ (Ex. L-140-1). Specific recommendations for ways to measure β_2 -M and proper handling of urine samples to prevent degradation of β_2 -M have been addressed by WISHA in WAC 296-62-07451, appendix F, in the section on laboratory standardization. All biological samples must be analyzed in a laboratory that is proficient in the analysis of that particular analyte, under WAC 296-62-07423 (1)(d). (See WAC 296-62-07451, appendix F). Specifically, under WAC 296-62-07423 (1)(d), the employer is to assure that the collecting and handling of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (β_2 -M) taken from employees is collected in a manner that assures reliability. The employer must also assure that analysis of biological samples of cadmium in urine (CdU), cadmium in blood (CdB), and beta-2 microglobulin in urine (β_2 -M) taken from employees is performed in laboratories with demonstrated proficiency for that particular analyte. (See WAC 296-62-07451, appendix F).

(iii) Lung and prostate cancer. The primary sites for cadmium-associated cancer appear to be the lung and the prostate (L-140-50). Evidence for an association between cancer and cadmium exposure derives from both epidemiological studies and animal experiments. Mortality from prostate cancer associated with cadmium is slightly elevated in several industrial cohorts, but the number of cases is small and there is not clear dose-response relationship. More substantive evidence exists for lung cancer. The major epidemiological study of lung cancer was conducted by Thun et al., (Ex. 4-68). Adequate data on cadmium exposures were available to allow evaluation of dose-response relationships between cadmium exposure and lung cancer. A statistically significant excess of lung cancer attributed to cadmium exposure was observed in this study even when confounding variables such as co-exposure to arsenic and smoking habits were taken into

consideration (Ex. L-140-50). The primary evidence for quantifying a link between lung cancer and cadmium exposure from animal studies derives from two rat bioassay studies; one by Takenaka et al., (1983), which is a study of cadmium chloride and a second study by Oldiges and Glaser (1990) of four cadmium compounds. Based on the above cited studies, the U.S. Environmental Protection Agency (EPA) classified cadmium as "B1", a probable human carcinogen, in 1985 (Ex. 4-4). The International Agency for Research on Cancer (IARC) in 1987 also recommended that cadmium be listed as "2A", a probable human carcinogen (Ex. 4-15). The American Conference of Governmental Industrial Hygienists (ACGIH) has recently recommended that cadmium be labeled as a carcinogen. Since 1984, NIOSH has concluded that cadmium is possibly a human carcinogen and has recommended that exposures be controlled to the lowest level feasible.

(iv) Noncarcinogenic effects. Acute pneumonitis occurs 10 to 24 hours after initial acute inhalation of high levels of cadmium fumes with symptoms such as fever and chest pain (Exs. 30, 8-86B). In extreme exposure cases pulmonary edema may develop and cause death several days after exposure. Little actual exposure measurement data is available on the level of airborne cadmium exposure that causes such immediate adverse lung effects, nonetheless, it is reasonable to believe a cadmium concentration of approximately 1 mg/m³ over an eight hour period is "immediately dangerous" (55 FR 4052, ANSI; Ex. 8-86B). In addition to acute lung effects and chronic renal effects, long term exposure to cadmium may cause other severe effects on the respiratory system. Reduced pulmonary function and chronic lung disease indicative of emphysema have been observed in workers who have had prolonged exposure to cadmium dust or fumes (Exs. 4-29, 4-22, 4-42, 4-50, 4-63). In a study of workers conducted by Kazantzis et al., a statistically significant excess of worker deaths due to chronic bronchitis was found, which in his opinion was directly related to high cadmium exposures of 1 mg/m³ or more (Tr. 6/8/90, pp. 156-157). Cadmium need not be respirable to constitute a hazard. Inspirable cadmium particles that are too large to be respirable but small enough to enter the tracheobronchial region of the lung can lead to bronchoconstriction, chronic pulmonary disease, and cancer of that portion of the lung. All of these diseases have been associated with occupational exposure to cadmium (Ex. 8-86B). Particles that are constrained by their size to the extra-thoracic regions of the respiratory system such as the nose and maxillary sinuses can be swallowed through mucociliary clearance and be absorbed into the body (ACGIH, Ex. 8-692). The impaction of these particles in the upper airways can lead to anosmia, or loss of sense of smell, which is an early indication of overexposure among workers exposed to heavy metals. This condition is commonly reported among cadmium-exposed workers (Ex. 8-86-B).

(c) Medical surveillance. In general, the main provisions of the medical surveillance section of the standard, under WAC 296-62-07423 (1) through (16), are as follows:

- (i) Workers exposed above the action level are covered;
- (ii) Workers with intermittent exposures are not covered;
- (iii) Past workers who are covered receive biological monitoring for at least one year;

(iv) Initial examinations include a medical questionnaire and biological monitoring of cadmium in blood (CdB), cadmium in urine (CdU), and Beta-2-microglobulin in urine (β_2 -M);

(v) Biological monitoring of these three analytes is performed at least annually; full medical examinations are performed biennially;

(vi) Until five years from the effective date of the standard, medical removal is required when CdU is greater than 15 μ g/gram creatinine (g Cr), or CdB is greater than 15 μ g/liter whole blood (lwb), or β_2 -M is greater than 1500 μ g/g Cr, and CdB is greater than 5 μ g/lwb or CdU is greater than 3 μ g/g Cr;

(vii) Beginning five years after the standard is in effect, medical removal triggers will be reduced;

(viii) Medical removal protection benefits are to be provided for up to eighteen months;

(ix) Limited initial medical examinations are required for respirator usage;

(x) Major provisions are fully described under WAC 296-62-07423; they are outlined here as follows:

- (A) Eligibility.
- (B) Biological monitoring.
- (C) Actions triggered by levels of CdU, CdB, and β_2 -M (See Summary Charts and Tables in WAC 296-62-07441(5).)
- (D) Periodic medical surveillance.
- (E) Actions triggered by periodic medical surveillance (See appendix A Summary Chart and Tables in WAC 296-62-07441(5).)
- (F) Respirator usage.
- (G) Emergency medical examinations.
- (H) Termination examination.
- (I) Information to physician.
- (J) Physician's medical opinion.
- (K) Medical removal protection.
- (L) Medical removal protection benefits.
- (M) Multiple physician review.
- (N) Alternate physician review.
- (O) Information employer gives to employee.
- (P) Recordkeeping.
- (Q) Reporting on OSHA form 200.

(xi) The above mentioned summary of the medical surveillance provisions, the summary chart, and tables for the actions triggered at different levels of CdU, CdB and β_2 -M (in subsection (5) of this section, Attachment 1) are included only for the purpose of facilitating understanding of the provisions of WAC 296-62-07423(3) of the final cadmium standard. The summary of the provisions, the summary chart, and the tables do not add to or reduce the requirements in WAC 296-62-07423(3).

(d) Recommendations to physicians.

(i) It is strongly recommended that patients with tubular proteinuria are counseled on: The hazards of smoking; avoidance of nephrotoxins and certain prescriptions and over-the-counter medications that may exacerbate kidney symptoms; how to control diabetes and/or blood pressure; proper hydration, diet, and exercise (Ex. 19-2). A list of prominent or common nephrotoxins is attached. (See subsection (6) of this section, Attachment 2.)

(ii) DO NOT CHELATE; KNOW WHICH DRUGS ARE NEPHROTOXINS OR ARE ASSOCIATED WITH NEPHRITIS.

(iii) The gravity of cadmium-induced renal damage is compounded by the fact there is no medical treatment to prevent or reduce the accumulation of cadmium in the kidney (Ex. 8-619). Dr. Friberg, a leading world expert on cadmium toxicity, indicated in 1992, that there is no form of chelating agent that could be used without substantial risk. He stated that tubular proteinuria has to be treated in the same way as other kidney disorders (Ex. 29).

(iv) After the results of a workers' biological monitoring or medical examination are received the employer is required to provide an information sheet to the patient, briefly explaining the significance of the results. (See subsection (7) of this section.)

(v) For additional information the physician is referred to the following additional resources:

(A) The physician can always obtain a copy of the OSHA final rule preamble, with its full discussion of the health effects, from OSHA's Computerized Information System (OCIS).

(B) The OSHA Docket Officer maintains a record of the OSHA rulemaking. The Cadmium Docket (H-057A), is located at 200 Constitution Ave. NW., Room N-2625, Washington, DC 20210; telephone: (202) 219-7894.

(C) The following articles and exhibits in particular from that docket (H- 057A):

Exhibit number	Author and paper title
8-447	Lauwerys et. al., Guide for physicians, "Health Maintenance of Workers Exposed to Cadmium," published by the Cadmium Council.
4-67	Takenaka, S., H. Oldiges, H. Konig, D. Hochrainer, G. Oberdorster. "Carcinogenicity of Cadmium Chloride Aerosols in Wistar Rats". JNCI 70:367-373, 1983. (32)
4-68	Thun, M.J., T.M. Schnoor, A.B. Smith, W.E. Halperin, R.A. Lemen. "Mortality Among a Cohort of U.S. Cadmium Production Workers—An Update." JNCI 74(2):325-33, 1985. (8)
4-25	Elinder, C.G., Kjellstrom, T., Hogstedt, C., et al., "Cancer Mortality of Cadmium Workers." Brit. J. Ind. Med. 42:651-655, 1985. (14)
4-26	Ellis, K.J. et al., "Critical Concentrations of Cadmium in Human Renal Cortex: Dose Effect Studies to Cadmium Smelter Workers." J. Toxicol. Environ. Health 7:691-703, 1981. (76)
4-27	Ellis, K.J., S.H. Cohn and T.J. Smith. "Cadmium Inhalation Exposure Estimates: Their Significance with Respect to Kidney and Liver Cadmium Burden." J. Toxicol. Environ. Health 15:173-187, 1985.

Exhibit number	Author and paper title
4-28	Falck, F.Y., Jr., Fine, L.J., Smith, R.G., McClatchey, K.D., Annesley, T., England, B., and Schork, A.M. "Occupational Cadmium Exposure and Renal Status." Am. J. Ind. Med. 4:541, 1983. (64)
8-86A	Friberg, L., C.G. Elinder, et al., "Cadmium and Health a Toxicological and Epidemiological Appraisal, Volume I, Exposure, Dose, and Metabolism." CRC Press, Inc., Boca Raton, FL, 1986. (Available from the OSHA Technical Data Center)
8-86B	Friberg, L., C.G. Elinder, et al., "Cadmium and Health: A Toxicological and Epidemiological Appraisal, Volume II, Effects and Response." CRC Press, Inc., Boca Raton, FL, 1986. (Available from the OSHA Technical Data Center)
L-140-45	Elinder, C.G., "Cancer Mortality of Cadmium Workers", Brit. J. Ind. Med., 42, 651-655, 1985.
L-140-50	Thun, M., Elinder, C.G., Friberg, L., "Scientific Basis for an Occupational Standard for Cadmium, Am. J. Ind. Med., 20; 629-642, 1991.

(5) Information sheet. The information sheet (subsection (8) of this section, Attachment 3) or an equally explanatory one should be provided to you after any biological monitoring results are reviewed by the physician, or where applicable, after any medical examination.

(6) Attachment 1—Appendix A, summary chart and Tables A and B of actions triggered by biological monitoring.

(a) Summary chart: WAC 296-62-07423(3) Medical surveillance—Categorizing biological monitoring results.

(i) Biological monitoring results categories are set forth in Table A for the periods ending December 31, 1998, and for the period beginning January 1, 1999.

(ii) The results of the biological monitoring for the initial medical exam and the subsequent exams shall determine an employee's biological monitoring result category.

(b) Actions triggered by biological monitoring.

(i) The actions triggered by biological monitoring for an employee are set forth in Table B.

(ii) The biological monitoring results for each employee under WAC 296-62-07423(3) shall determine the actions required for that employee. That is, for any employee in biological monitoring category C, the employer will perform all of the actions for which there is an X in column C of Table B.

(iii) An employee is assigned the alphabetical category ("A" being the lowest) depending upon the test results of the three biological markers.

(iv) An employee is assigned category A if monitoring results for all three biological markers fall at or below the levels indicated in the table listed for category A.

(v) An employee is assigned category B if any monitoring result for any of the three biological markers fall within the range of levels indicated in the table listed for category B, providing no result exceeds the levels listed for category B.

(vi) An employee is assigned category C if any monitoring result for any of the three biological markers are above the levels listed for category C.

(c) The user of Tables A and B should know that these tables are provided only to facilitate understanding of the relevant provisions of WAC 296-62-07423. Tables A and B are not meant to add to or subtract from the requirements of those provisions.

Table A
Categorization of Biological Monitoring Results

Applicable Through 1998 Only

Biological marker	Monitoring result categories		
	A	B	C
Cadmium in urine (CdU) ($\mu\text{g/g}$ creatinine)	≤ 3	>3 and ≤ 15	>15
β_2 -microglobulin (β_2 -M) ($\mu\text{g/g}$ creatinine)	≤ 300	>300 and ≤ 1500	$>1500^*$
Cadmium in blood (CdB) ($\mu\text{g/liter}$ whole blood)	≤ 5	>5 and ≤ 15	>15

* If an employee's β_2 -M levels are above 1,500 $\mu\text{g/g}$ creatinine, in order for mandatory medical removal to be required (See WAC 296-62-07441, Appendix A Table B.), either the employee's CdU level must also be >3 $\mu\text{g/g}$ creatinine or CdB level must also be >5 $\mu\text{g/liter}$ whole blood.

Applicable Beginning January 1, 1999

Biological marker	Monitoring result categories		
	A	B	C
Cadmium in urine (CdU) ($\mu\text{g/g}$ creatinine)	≤ 3	>3 and ≤ 7	>7
β_2 -microglobulin (β_2 -M) ($\mu\text{g/g}$ creatinine)	≤ 300	>300 and ≤ 750	$>750^*$
Cadmium in blood (CdB) ($\mu\text{g/liter}$ whole blood)	≤ 5	>5 and ≤ 10	>10

* If an employee's β_2 -M levels are above 750 $\mu\text{g/g}$ creatinine, in order for mandatory medical removal to be required (See WAC 296-62-07441, Appendix A Table B.), either the employee's CdU level must also be >3 $\mu\text{g/g}$ creatinine or CdB level must also be >5 $\mu\text{g/liter}$ whole blood.

Table B—Actions determined by biological monitoring.

This table presents the actions required based on the monitoring result in Table A. Each item is a separate requirement in citing noncompliance. For example, a medical examination within ninety days for an employee in category B is separate from the requirement to administer a periodic medical examination for category B employees on an annual basis.

Table B
Monitoring result category

	A ¹	B ¹	C ¹
Required actions			
(1) Biological monitoring:			
(a) Annual.	X		
(b) Semiannual		X	
(c) Quarterly			X
(2) Medical examination:			
(a) Biennial	X		
(b) Annual.		X	

(1999 Ed.)

Table B
Monitoring result category

	A ¹	B ¹	C ¹
(c) Semiannual.			X
(d) Within 90 days		X	X
(3) Assess within two weeks:			
(a) Excess cadmium exposure		X	X
(b) Work practices		X	X
(c) Personal hygiene		X	X
(d) Respirator usage		X	X
(e) Smoking history		X	X
(f) Hygiene facilities		X	X
(g) Engineering controls		X	X
(h) Correct within 30 days		X	X
(i) Periodically assess exposures			X
(4) Discretionary medical removal		X	X
(5) Mandatory medical removal			X ²

¹ For all employees covered by medical surveillance exclusively because of exposures prior to the effective date of this standard, if they are in Category A, the employer shall follow the requirements of WAC 296-62-07423 (3)(a)(ii) and (4)(e)(i). If they are in Category B or C, the employer shall follow the requirements of WAC 296-62-07423 (4)(e)(ii) and (iii).

² See footnote in Table A.

(7) Attachment 2, list of medications.

(a) A list of the more common medications that a physician, and the employee, may wish to review is likely to include some of the following:

(i) Anticonvulsants: Paramethadione, phenytoin, trimethadone;

(ii) Antihypertensive drugs: Captopril, methyldopa;

(iii) Antimicrobials: Aminoglycosides, amphotericin B, cephalosporins, ethambutol;

(iv) Antineoplastic agents: Cisplatin, methotrexate, mitomycin-C, nitrosoureas, radiation;

(v) Sulfonamide diuretics: Acetazolamide, chlorthalidone, furosemide, thiazides;

(vi) Halogenated alkanes, hydrocarbons, and solvents that may occur in some settings: Carbon tetrachloride, ethylene glycol, toluene; iodinated radiographic contrast media; nonsteroidal anti-inflammatory drugs; and

(vii) Other miscellaneous compounds: Acetaminophen, allopurinol, amphetamines, azathioprine, cimetidine, cyclosporine, lithium, methoxyflurane, methysergide, D-penicillamine, phenacetin, phenendione.

(b) A list of drugs associated with acute interstitial nephritis includes:

(i) Antimicrobial drugs: Cephalosporins, chloramphenicol, colistin, erythromycin, ethambutol, isoniazid, para-aminosalicylic acid, penicillins, polymyxin B, rifampin, sulfonamides, tetracyclines, and vancomycin;

(ii) Other miscellaneous drugs: Allopurinol, antipyrine, azathioprine, captopril, cimetidine, clofibrate, methyldopa, phenindione, phenylpropanolamine, phenytoin, probenecid, sulfapyrazone, sulfonamide diuretics, triamterene; and

(iii) Metals: Bismuth, gold. This list has been derived from commonly available medical textbooks (e.g., Ex. 14-18). The list has been included merely to facilitate the physician's, employer's, and employee's understanding. The list

does not represent an official OSHA opinion or policy regarding the use of these medications for particular employees. The use of such medications should be under physician discretion.

(8) Attachment 3—Biological monitoring and medical examination results.

Employee _____

Testing _____

Date _____

Cadmium in Urine ___ $\mu\text{g/g Cr}$ —Normal Levels:

$\leq 3 \mu\text{g/g Cr}$.

Cadmium in Blood ___ $\mu\text{g/lwb}$ —Normal Levels:

$\leq 5 \mu\text{g/lwb}$.

Beta-2-microglobulin in Urine ___ $\mu\text{g/g Cr}$ —Normal

Levels: $\leq 300 \mu\text{g/g Cr}$.

Physical Examination Results: N/A ___

Satisfactory ___

Unsatisfactory ___ (see physician again).

Physician's Review of Pulmonary Function Test:

N/A ___ Normal ___

Abnormal ___

Next biological monitoring or medical examination scheduled for _____

(a) The biological monitoring program has been designed for three main purposes:

(i) To identify employees at risk of adverse health effects from excess, chronic exposure to cadmium;

(ii) To prevent cadmium-induced disease(s); and

(iii) To detect and minimize existing cadmium-induced disease(s).

(b) The levels of cadmium in the urine and blood provide an estimate of the total amount of cadmium in the body. The amount of a specific protein in the urine (beta-2-microglobulin) indicates changes in kidney function. All three tests must be evaluated together. A single mildly elevated result may not be important if testing at a later time indicates that the results are normal and the workplace has been evaluated to decrease possible sources of cadmium exposure. The levels of cadmium or beta-2-microglobulin may change over a period of days to months and the time needed for those changes to occur is different for each worker.

(c) If the results for biological monitoring are above specific "high levels" (cadmium urine greater than 10 micrograms per gram of creatinine $\mu\text{g/g Cr}$), cadmium blood greater than 10 micrograms per liter of whole blood ($\mu\text{g/lwb}$), or beta-2-microglobulin greater than 1000 micrograms per gram of creatinine ($\mu\text{g/g Cr}$), the worker has a much greater chance of developing other kidney diseases.

(d) One way to measure for kidney function is by measuring beta-2-microglobulin in the urine. Beta-2-microglobulin is a protein which is normally found in the blood as it is being filtered in the kidney, and the kidney reabsorbs or returns almost all of the beta-2-microglobulin to the blood. A very small amount (less than 300 $\mu\text{g/g Cr}$ in the urine) of beta-2-microglobulin is not reabsorbed into the blood, but is released in the urine. If cadmium damages the kidney, the amount of beta-2-microglobulin in the urine increases because the kidney cells are unable to reabsorb the beta-2-

microglobulin normally. An increase in the amount of beta-2-microglobulin in the urine is a very early sign of kidney dysfunction. A small increase in beta-2-microglobulin in the urine will serve as an early warning sign that the worker may be absorbing cadmium from the air, cigarettes contaminated in the workplace, or eating in areas that are cadmium contaminated.

(e) Even if cadmium causes permanent changes in the kidney's ability to reabsorb beta-2-microglobulin, and the beta-2-microglobulin is above the "high levels," the loss of kidney function may not lead to any serious health problems. Also, renal function naturally declines as people age. The risk for changes in kidney function for workers who have biological monitoring results between the "normal values" and the "high levels" is not well known. Some people are more cadmium-tolerant, while others are more cadmium-susceptible.

(f) For anyone with even a slight increase of beta-2-microglobulin, cadmium in the urine, or cadmium in the blood, it is very important to protect the kidney from further damage. Kidney damage can come from other sources than excess cadmium-exposure so it is also recommended that if a worker's levels are "high" he/she should receive counseling about drinking more water; avoiding cadmium-tainted tobacco and certain medications (nephrotoxins, acetaminophen); controlling diet, vitamin intake, blood pressure and diabetes; etc.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07441, filed 7/20/94, effective 9/20/94; 93-21-075 (Order 93-06), § 296-62-07441, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07441, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07443 Appendix B—Substance technical guidelines for cadmium. (1) Cadmium metal.

(a) Physical and chemical data.

(i) Substance identification.

Chemical name: Cadmium.

Formula: Cd.

Molecular Weight: 112.4.

Chemical Abstracts Service (CAS) Registry No.: 7740-43-9.

Other identifiers: RETCS EU9800000; EPA D006; DOT 2570 53.

Synonyms: Colloidal Cadmium: Kadmium (German); CI 77180.

(ii) Physical data.

Boiling point: (760 mm Hg): 765 degrees C.

Melting point: 321 degrees C.

Specific gravity: ($\text{H}_2\text{O}=@ 20^\circ\text{C}$): 8.64.

Solubility: Insoluble in water; soluble in dilute nitric acid and in sulfuric acid.

Appearance: Soft, blue-white, malleable, lustrous metal or grayish-white powder.

(b) Fire, explosion, and reactivity data.

(i) Fire.

Fire and explosion hazards: The finely divided metal is pyrophoric, that is the dust is a severe fire hazard and moderate explosion hazard when exposed to heat or flame. Burning material reacts violently with extinguishing agents such as water, foam, carbon dioxide, and halons.

Flash point: Flammable (dust).

Extinguishing media: Dry sand, dry dolomite, dry graphite, or sodium chloride.

(ii) Reactivity.

Conditions contributing to instability: Stable when kept in sealed containers under normal temperatures and pressure, but dust may ignite upon contact with air. Metal tarnishes in moist air.

(iii) Incompatibilities: Ammonium nitrate, fused: Reacts violently or explosively with cadmium dust below 20°C. Hydrozoic acid: Violent explosion occurs after thirty minutes. Acids: Reacts violently, forms hydrogen gas. Oxidizing agents or metals: Strong reaction with cadmium dust. Nitryl fluoride at slightly elevated temperature: Glowing or white incandescence occurs. Selenium: Reacts exothermically. Ammonia: Corrosive reaction. Sulfur dioxide: Corrosive reaction. Fire extinguishing agents (water, foam, carbon dioxide, and halons): Reacts violently. Tellurium: Incandescent reaction in hydrogen atmosphere.

(iv) Hazardous decomposition products: The heated metal rapidly forms highly toxic, brownish fumes of oxides of cadmium.

(c) Spill, leak, and disposal procedures.

(i) Steps to be taken if the materials is released or spilled. Do not touch spilled material. Stop leak if you can do it without risk. Do not get water inside container. For large spills, dike spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry.

(ii) The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (one pound) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center (800) 424-8802; in Washington, DC metropolitan area (202) 426-2675.

(2) Cadmium oxide.

(a) Physical and chemical data.

(i) Substance identification.

Chemical name: Cadmium oxide.

Formula: CdO.

Molecular Weight: 128.4.

CAS No.: 1306-19-0.

Other identifiers: RTECS EV1929500.

Synonyms: Kadmu tlenek (Polish).

(ii) Physical data.

Boiling point (760 mm Hg): 950 degrees C decomposes.

Melting point: 1500°C.

Specific gravity: (H₂O=1 @ 20°C): 7.0.

Solubility: Insoluble in water; soluble in acids and alkalines.

Appearance: Red or brown crystals.

(b) Fire, explosion, and reactivity data.

(i) Fire.

Fire and explosion hazards: Negligible fire hazard when exposed to heat or flame.

Flash point: Nonflammable.

Extinguishing media: Dry chemical, carbon dioxide, water spray or foam.

(ii) Reactivity.

Conditions contributing to instability: Stable under normal temperatures and pressures.

(iii) Incompatibilities: Magnesium may reduce CdO₂ explosively on heating.

(iv) Hazardous decomposition products: Toxic fumes of cadmium.

(c) Spill, leak, and disposal procedures.

(i) Steps to be taken if the material is released or spilled. Do not touch spilled material. Stop leak if you can do it without risk. For small spills, take up with sand or other absorbent material and place into containers for later disposal. For small dry spills, use a clean shovel to place material into clean, dry container and then cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard area and deny entry.

(ii) The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (one pound) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center (800) 424-8802; in Washington, DC metropolitan area (202) 426-2675.

(3) Cadmium sulfide.

(a) Physical and chemical data.

(i) Substance identification.

Chemical name: Cadmium sulfide.

Formula: CdS.

Molecular weight: 144.5.

CAS No. 1306-23-6.

Other identifiers: RTECS EV3150000.

Synonyms: Aurora yellow; Cadmium Golden 366; Cadmium Lemon Yellow 527; Cadmium Orange; Cadmium Primrose 819; Cadmium Sulphide; Cadmium Yellow; Cadmium Yellow 000; Cadmium Yellow Conc. Deep; Cadmium Yellow Conc. Golden; Cadmium Yellow Conc. Lemon; Cadmium Yellow Conc. Primrose; Cadmium Yellow Oz. Dark; Cadmium Yellow Primrose 47-1400; Cadmium Yellow 10G Conc.; Cadmium Yellow 892; Cadmopur Golden Yellow N; Cadmopur Yellow: Capsebon; C.I. 77199; C.I. Pigment Orange 20; CI Pigment Yellow 37; Ferro Lemon Yellow; Ferro Orange Yellow; Ferro Yellow; Greenockite; NCI-C02711.

(ii) Physical data.

Boiling point (760 mm. Hg): sublimes in N₂ at 980°C.

Melting point: 1750 degrees C (100 atm).

Specific gravity: (H₂O=1 @ 20°C): 4.82.

Solubility: Slightly soluble in water; soluble in acid.

Appearance: Light yellow or yellow-orange crystals.

(b) Fire, explosion, and reactivity data.

(i) Fire.

Fire and explosion hazards: Negligible fire hazard when exposed to heat or flame.

Flash point: Nonflammable.

Extinguishing media: Dry chemical, carbon dioxide, water spray or foam.

(ii) Reactivity. Conditions contributing to instability: Generally nonreactive under normal conditions. Reacts with acids to form toxic hydrogen sulfide gas.

(iii) Incompatibilities: Reacts vigorously with iodine-monochloride.

(iv) Hazardous decomposition products: Toxic fumes of cadmium and sulfur oxides.

(c) Spill, leak, and disposal procedures.

(i) Steps to be taken if the material is released or spilled. Do not touch spilled material. Stop leak if you can do it without risk. For small, dry spills, with a clean shovel place material into clean, dry container and cover. Move containers from spill area.

(ii) For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard and deny entry.

(4) Cadmium chloride.

(a) Physical and chemical data.

(i) Substance identification.

Chemical name: Cadmium chloride.

Formula: $CdCl_2$.

Molecular weight: 183.3.

CAS No. 10108-64-2.

Other identifiers: RTECS EY0175000.

Synonyms: Caddy; Cadmium dichloride; NA 2570 (DOT); UI-CAD; dichlorocadmium.

(ii) Physical data.

Boiling point (760 mm Hg): 960 degrees C.

Melting point: 568 degrees C.

Specific gravity: ($H_2O = 1 @ 20^\circ C$): 4.05.

Solubility: Soluble in water (140 g/100 cc); soluble in acetone.

Appearance: Small, white crystals.

(b) Fire, explosion, and reactivity data.

(i) Fire.

Fire and explosion hazards: Negligible fire and negligible explosion hazard in dust form when exposed to heat or flame.

Flash point: Nonflammable.

Extinguishing media: Dry chemical, carbon dioxide, water spray, or foam.

(ii) Reactivity. Conditions contributing to instability: Generally stable under normal temperatures and pressures.

(iii) Incompatibilities: Bromine trifluoride [trifluoride] rapidly attacks cadmium chloride. A mixture of potassium and cadmium chloride may produce a strong explosion on impact.

(iv) Hazardous decomposition products: Thermal decomposition may release toxic fumes of hydrogen chloride, chloride, chlorine or oxides of cadmium.

(c) Spill, leak, and disposal procedures.

(i) Steps to be taken if the materials is released or spilled. Do not touch spilled material. Stop leak if you can do it without risk. For small, dry spills, with a clean shovel place material into clean, dry container and cover. Move containers from spill area. For larger spills, dike far ahead of spill for later disposal. Keep unnecessary people away. Isolate hazard and deny entry.

(ii) The Superfund Amendments and Reauthorization Act of 1986 Section 304 requires that a release equal to or greater than the reportable quantity for this substance (one hundred pounds) must be immediately reported to the local emergency planning committee, the state emergency response commission, and the National Response Center

(800) 424-8802; in Washington, DC Metropolitan area (202) 426-2675.

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07443, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07445 Appendix C—Qualitative and quantitative fit testing procedures—(Fit test protocols).

(1) General: The employer shall include the following provisions in the fit test procedures. These provisions apply to both qualitative fit testing (QLFT) and quantitative fit testing (QNFT). All testing is to be conducted annually.

(a) The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least three sizes of elastomeric facepieces of the type of respirator that is to be tested, i.e., three sizes of half mask; or three sizes of full facepiece. Respirators of each size must be provided from at least two manufacturers.

(b) Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a comfortable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the respirator. This instruction may not constitute the subject's formal training on respirator use; it is only a review.

(c) The test subject shall be informed that he/she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape, and if fitted, maintained and used properly, will provide substantial protection.

(d) The test subject shall be instructed to hold each facepiece up to the face and eliminate those which obviously do not give a comfortable fit.

(e) The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in (f) of this subsection. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

(f) Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

(i) Position of the mask on the nose;

(ii) Room for eye protection;

(iii) Room to talk; and

(iv) Position of mask on face and cheeks.

(g) The following criteria shall be used to help determine the adequacy of the respirator fit:

(i) Chin properly placed;

(ii) Adequate strap tension, not overly tightened;

(iii) Fit across nose bridge;

(iv) Respirator of proper size to span distance from nose to chin;

(v) Tendency of respirator to slip; and

(vi) Self-observation in mirror to evaluate fit and respirator position.

(h) The test subject shall conduct the negative and positive pressure fit checks as described below or in ANSI Z88.2-1980. Before conducting the negative or positive pressure test, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the fit check tests.

(i) Positive pressure test. Close off the exhalation valve and exhale gently onto the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

(ii) Negative pressure test. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s). Inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

(i) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, or long sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

(j) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory disease or pulmonary medicine to determine, in accordance with WAC 296-62-07423 (2) and (3), whether the test subject can wear a respirator while performing her or his duties.

(k) The test subject shall be given the opportunity to wear the successfully fitted respirator for a period of two weeks. If at any time during this period the respirator becomes uncomfortable, the test subject shall be given the opportunity to select a different facepiece and to be retested.

(l) The employer shall maintain a record of the fit test administered to an employee. The record shall contain at least the following information:

- (i) Name of employee;
- (ii) Type of respirator;
- (iii) Brand, size of respirator;
- (iv) Date of test; and

(v) Where QNFT is used, the fit factor and strip chart recording or other recording of the results of the test. The record shall be maintained until the next fit test is administered.

(m) Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least five minutes before the start of the fit test.

(n) Test exercises. The test subject shall perform exercises, in the test environment, in the manner described below:

(i) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(ii) Deep breathing. In a normal standing position, without talking, the subject shall breathe slowly and deeply, taking care so as to not hyperventilate.

(iii) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(iv) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(v) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from one hundred, or recite a memorized poem or song.

(vi) Grimace. The test subject shall grimace by smiling or frowning.

(vii) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(viii) Normal breathing. Same as exercise one. Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for fifteen seconds. The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

(2) Qualitative fit test (QLFT) protocols.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator qualitative fit test program.

(ii) The employer shall assure that persons administering QLFTs are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and assure that test equipment is in proper working order.

(iii) The employer shall assure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

(b) Isoamyl acetate protocol.

(i) Odor threshold screening. The odor threshold screening test, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate.

(A) Three one-liter glass jars with metal lids are required.

(B) Odor free water (e.g., distilled or spring water) at approximately twenty-five degrees C shall be used for the solutions.

(C) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a one-liter jar and shaking for thirty seconds. A new solution shall be prepared at least weekly.

(D) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated and shall not be connected to the same recirculating ventilation system.

(E) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. The solution shall be shaken for thirty seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(F) A test blank shall be prepared in a third jar by adding 500 cc of odor free water.

(G) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. Labels shall be placed on the lids so they can be periodically peeled, dried off and switched to maintain the integrity of the test.

(H) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(I) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(J) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(K) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(ii) Isoamyl acetate fit test.

(A) The fit test chamber shall be similar to a clear fifty-five-gallon drum liner suspended inverted over a two-foot diameter frame so that the top of the chamber is about six inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(B) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

(C) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(D) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(E) Upon entering the test chamber, the test subject shall be given a six-inch by five-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

(F) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the head exercises; and to demonstrate some of the exercises.

(G) If at any time during the test, the subject detects the banana like odor of IAA, the respirator fit is inadequate. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(H) If the respirator fit was inadequate, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber and again begin the procedure described in (b)(ii)(A) through (G) of this subsection. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about five minutes before retesting. Odor sensitivity will usually have returned by this time.

(I) When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having the subject break the face seal and take a breath before exiting the chamber.

(J) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the test area from becoming contaminated, the used towels shall be kept in a self sealing bag so there is no significant IAA concentration build-up in the test chamber during subsequent tests.

(c) Irritant fume protocol.

(i) The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) filters.

(ii) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its characteristic odor.

(iii) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach one end of the smoke tube to a low flow air pump set to deliver two hundred milliliters per minute.

(iv) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

(v) The test conductor shall direct the stream of irritant smoke from the smoke tube towards the face seal area of the test subject. He/she shall begin at least twelve inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(vi) The exercises identified in subsection (1)(n) of this section shall be performed by the test subject while the respirator seal is being challenged by the smoke.

(vii) Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to evoke a response shall void the fit test.

(viii) The fit test shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agent.

(d) Saccharin solution aerosol protocol.

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(i) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(A) Threshold screening as well as fit testing subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(B) The test enclosure shall have a 3/4-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(C) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her wide open mouth with tongue extended.

(D) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(E) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the fit test solution (see (ii)(E) below) in 100 cc of distilled water.

(F) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(G) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(H) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(I) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(J) The test conductor will take note of the number of squeezes required to solicit a taste response.

(K) If the saccharin is not tasted after 30 squeezes (step (J)), the test subject may not perform the saccharin fit test.

(L) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(M) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

(N) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(ii) Saccharin solution aerosol fit test procedure.

(A) The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

(B) The fit test uses the same enclosure described in (i) above.

(C) The test subject shall don the enclosure while wearing the respirator selected in (1)(a) of this section. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(D) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(E) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

(F) As before, the test subject shall breathe through the open mouth with tongue extended.

(G) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same number of squeezes required to elicit a taste response in the screening test.

(H) After generating the aerosol the test subject shall be instructed to perform the exercises in (1)(n) of this section.

(I) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes as initially.

(J) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(K) If the taste of saccharin is detected, the fit is deemed unsatisfactory and a different respirator shall be tried.

(3) Quantitative fit test (QNFT) protocol.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator quantitative fit test program.

(ii) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and assure that test equipment is in proper working order.

(iii) The employer shall assure that QNFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

(b) Definitions.

(i) Quantitative fit test. The test is performed in a test chamber. The normal air-purifying element of the respirator is replaced by a high-efficiency particulate air (HEPA) filter in the case of particulate QNFT aerosols or a sorbent offering contaminant penetration protection equivalent to high-efficiency filters where the QNFT test agent is a gas or vapor.

(ii) Challenge agent means the aerosol, gas or vapor introduced into a test chamber so that its concentration inside and outside the respirator may be measured.

(iii) Test subject means the person wearing the respirator for quantitative fit testing.

(iv) Normal standing position means standing erect and straight with arms down along the sides and looking straight ahead.

(v) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(vi) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise

except the grimace exercise. Integrators or computers which calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(vii) "Fit factor" means the ration of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

(c) Apparatus

(i) Instrumentation. Aerosol generation, dilution, and measurement systems using corn oil or sodium chloride as test aerosols shall be used for quantitative fit testing.

(ii) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(iii) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate filter supplied by the same manufacturer.

(iv) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of the challenge agent concentration with each inspiration and expiration at fit factors of at least two thousand. Integrators or computers which integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(v) The combination of substitute air-purifying elements, challenge agent and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of an established exposure limit for the challenge agent at any time during the testing process.

(vi) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times and so that there is no interference with the fit or performance of the respirator.

(vii) The test chamber and test set up shall permit the person administering the test to observe the test subject inside the chamber during the test.

(viii) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent inside the test chamber constant to within a ten percent variation for the duration of the test.

(ix) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event inside the test chamber and its being recorded.

(x) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(xi) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release.

(xii) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed fifty percent.

(xiii) The limitations of instrument detection shall be taken into account when determining the fit factor.

(xiv) Test respirators shall be maintained in proper working order and inspected for deficiencies such as cracks, missing valves and gaskets, etc.

(d) Procedural requirements.

(i) When performing the initial positive or negative pressure test the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these tests.

(ii) An abbreviated screening isoamyl acetate test or irritant fume test may be utilized in order to quickly identify poor fitting respirators which passed the positive and/or negative pressure test and thus reduce the amount of QNFT time. When performing a screening isoamyl acetate test, combination high-efficiency organic vapor cartridges/canisters shall be used.

(iii) A reasonably stable challenge agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain type of test units the determination of the challenge agent stability may be established after the test subject has entered the test environment.

(iv) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed five percent for a half mask or one percent for a full facepiece respirator.

(v) A stable challenge concentration shall be obtained prior to the actual start of testing.

(vi) Respirator restraining straps shall not be overtightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonable comfortable fit typical of normal use.

(vii) The test shall be terminated whenever any single peak penetration exceeds five percent for half masks and one percent for full facepiece respirators. The test subject shall be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(viii) In order to successfully complete a QNFT, three successful fit tests are required. The results of each of the three independent fit tests must exceed the minimum fit factor needed for the class of respirator (e.g., half mask respirator, full facepiece respirator).

(ix) Calculation of fit factors.

(A) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration inside the respirator.

(B) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and at the end of the test.

(C) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(I) Average peak concentration;

(II) Maximum peak concentration;

(III) Integration by calculation of the area under the individual peak for each exercise. This includes computerized integration.

(x) Interpretation of test results. The fit factor established by the quantitative fit testing shall be the lowest of the three fit factor values calculated from the three required fit tests.

(xi) The test subject shall not be permitted to wear a half mask, or full facepiece respirator unless a minimum fit factor equivalent to at least ten times the hazardous exposure level is obtained.

(xii) Filters used for quantitative fit testing shall be replaced at least weekly, or whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily (when used) or sooner if there is any indication of breakthrough by a test agent.

[Statutory Authority: Chapter 49.17 RCW, 96-09-030, § 296-62-07445, filed 4/10/96, effective 6/1/96; 93-21-075 (Order 93-06), § 296-62-07445, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07445, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07447 Appendix D—Occupational health history interview with reference to cadmium exposure directions.

(To be read by employee and signed prior to the interview.)

Please answer the questions you will be asked as completely and carefully as you can. These questions are asked of everyone who works with cadmium. You will also be asked to give blood and urine samples. The doctor will give your employer a written opinion on whether you are physically capable of working with cadmium. Legally, the doctor cannot share personal information you may tell him/her with your employer. The following information is considered strictly confidential. The results of the tests will go to you, your doctor and your employer. You will also receive an information sheet explaining the results of any biological monitoring or physical examinations performed. If you are just being hired, the results of this interview and examination will be used to:

- (1) Establish your health status and see if working with cadmium might be expected to cause unusual problems;
(2) Determine your health status today and see if there are changes over time;
(3) See if you can wear a respirator safely. If you are not a new hire: WISHA says that everyone who works with cadmium can have periodic medical examinations performed by a doctor. The reasons for this are:
(a) If there are changes in your health, either because of cadmium or some other reason, to find them early;
(b) To prevent kidney damage.

Please sign below.

I have read these directions and understand them:

Employee signature

Date

Thank you for answering these questions. (Suggested Format)

Name.
Age.
Social Security #
Company
Job
Type of Preplacement Exam: [] Periodic [] Termination [] Initial [] Other
Blood Pressure
Pulse Rate

- 1. How long have you worked at the job listed above?
[] Not yet hired [] Number of months [] Number of years
2. Job Duties etc.
3. Have you ever been told by a doctor that you had bronchitis?
[] Yes [] No
If yes, how long ago? [] Number of months [] Number of years
4. Have you ever been told by a doctor that you had emphysema?
[] Yes [] No
If yes, how long ago? [] Number of years [] Number of months
5. Have you ever been told by a doctor that you had other lung problems?
[] Yes [] No
If yes, please describe type of lung problems and when you had these problems
6. In the past year, have you had a cough? [] Yes [] No
If yes, did you cough up sputum? [] Yes [] No
If yes, how long did the cough with sputum production last?
[] Less than 3 months [] 3 months or longer
If yes, for how many years have you had episodes of cough with sputum production lasting this long?
[] Less than one [] 1 [] 2 [] Longer than 2
7. Have you ever smoked cigarettes? [] Yes [] No
8. Do you now smoke cigarettes? [] Yes [] No
9. If you smoke or have smoked cigarettes, for how many years have you smoked, or did you smoke?
[] Less than 1 year [] Number of years
What is or was the greatest number of packs per day that you have smoked?
[] Number of packs
If you quit smoking cigarettes, how many years ago did you quit?
[] Less than 1 year [] Number of years
How many packs a day do you now smoke? [] Number of packs per day
10. Have you ever been told by a doctor that you had a kidney or urinary tract disease or disorder? [] Yes [] No
11. Have you ever had any of these disorders?
Kidney stones [] Yes [] No
Protein in urine [] Yes [] No
Blood in urine [] Yes [] No
Difficulty urinating [] Yes [] No
Other kidney/Urinary disorders [] Yes [] No
Please describe problems, age, treatment, and follow up for any kidney or urinary problems you have had:
12. Have you ever been told by a doctor or other health care provider who took your blood pressure that your blood pressure was high?
[] Yes [] No
13. Have you ever been advised to take any blood pressure medication?
[] Yes [] No
14. Are you presently taking any blood pressure medication?
[] Yes [] No
15. Are you presently taking any other medication? [] Yes [] No
16. Please list any blood pressure or other medications and describe how long you have been taking each one:
Medicine:
How Long Taken:
17. Have you ever been told by a doctor that you have diabetes? (sugar in your blood or urine) [] Yes [] No
If yes, do you presently see a doctor about your diabetes? [] Yes [] No
If yes, how do you control your blood sugar? [] Diet alone [] Diet plus oral medicine [] Diet plus insulin (injection)
18. Have you ever been told by a doctor that you had:
Anemia [] Yes [] No
A low blood count? [] Yes [] No

19. Do you presently feel that you tire or run out of energy sooner than normal or sooner than other people your age? Yes No
 If yes, for how long have you felt that you tire easily?
 Less than 1 year Number of years

20. Have you given blood within the last year? Yes No
 If yes, how many times? Number of times
 How long ago was the last time you gave blood?
 Less than 1 month Number of months

21. Within the last year have you had any injuries with heavy bleeding?
 Yes No
 If yes, how long ago? Less than 1 month Number of months describe:

22. Have you recently had any surgery? Yes No If yes, please describe:

23. Have you seen any blood lately in your stool or after a bowel movement?
 Yes No

24. Have you ever had a test for blood in your stool? Yes No
 If yes, did the test show any blood in the stool? Yes No
 What further evaluation and treatment were done?

The following questions pertain to the ability to wear a respirator. Additional information for the physician can be found in The Respiratory Protective Devices Manual.

25. Have you ever been told by a doctor that you have asthma?
 Yes No
 If yes, are you presently taking any medication for asthma?
 Mark all that apply. Shots Pills Inhaler

26. Have you ever had a heart attack? Yes No
 If yes, how long ago? Number of years Number of months

27. Have you ever had pains in your chest? Yes No
 If yes, when did it usually happen? While resting While working
 While exercising Activity didn't matter

28. Have you ever had a thyroid problem? Yes No

29. Have you ever had a seizure or fits? Yes No

30. Have you ever had a stroke (cerebrovascular accident)? Yes No

31. Have you ever had a ruptured eardrum or a serious hearing problem?
 Yes No

32. Do you now have a claustrophobia, meaning fear of crowded or closed in spaces or any psychological problems that would make it hard for you to wear a respirator? Yes No
 The following questions pertain to reproductive history.

33. Have you or your partner had a problem conceiving a child?
 Yes No
 If yes, specify: Self Present mate Previous mate

34. Have you or your partner consulted a physician for a fertility or other reproductive problem? Yes No
 If yes, specify who consulted the physician: Self Spouse/partner
 Self and partner
 If yes, specify diagnosis made:

35. Have you or your partner ever conceived a child resulting in a miscarriage, still birth or deformed offspring?
 Yes No
 If yes, specify: Miscarriage Still birth Deformed offspring
 If outcome was a deformed offspring, please specify type:

36. Was this outcome a result of a pregnancy of: Yours with present partner Yours with a previous partner

37. Did the timing of any abnormal pregnancy outcome coincide with present employment? Yes No
 List dates of occurrences:

38. What is the occupation of your spouse or partner?

For Women Only

39. Do you have menstrual periods? Yes No
 Have you had menstrual irregularities? Yes No
 If yes, specify type:

If yes, what was the approximated date this problem began?
 Approximate date problem stopped?

For Men Only

40. Have you ever been diagnosed by a physician as having prostate gland problem(s)? Yes No
 If yes, please describe type of problem(s) and what was done to evaluate and treat the problem(s):

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07447, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07447, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07449 Appendix E—Cadmium in workplace atmospheres.

Method number: ID-189 (OSHA); (ICP/MS) 0009 (WISHA)

Matrix: Air

WISHA permissible exposure limits: 5 µg/m³ (TWA), 2.5 µg/m³ (action level TWA)

Collection procedure: A known volume of air is drawn through a 37-mm diameter filter cassette containing a 0.8 µm mixed cellulose ester membrane filter (MCEF).

Recommended air volume: 960 L

Recommended sampling rate: 2.0 L/min

Analytical procedure: Air filter samples are digested with nitric acid. After digestion, a small amount of hydrochloric acid is added. The samples are then diluted to volume with deionized water and analyzed by either flame atomic absorption spectroscopy (AAS) or flameless atomic absorption spectroscopy using a heated graphite furnace atomizer (AAS-HGA).

Detection limits:

Qualitative: 0.2 µg/m³ for a 200 L sample by Flame AAS, 0.007 µg/m³ for a 60 L sample by AAS-HGA

Quantitative: 0.70 µg/m³ for a 200 L sample by Flame AAS, 0.025 µg/m³ for a 60 L sample by AAS-HGA

Precision and accuracy: (Flame AAS Analysis and AAS-HGA Analysis):

Validation level: 2.5 to 10 µg/m³ for a 400 L air vol, 1.25 to 5.0 µg/m³ for a 60 L air vol CV1 (pooled): 0.010, 0.043

Analytical bias: +4.0%, -5.8%

Overall analytical error: ±6.0%, ±14.2%

Method classification: Validated Date: June, 1992

Inorganic Service Branch II, OSHA Salt Lake Technical Center, Salt Lake City, Utah Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by USDOL-OSHA. Similar products from other sources can be substituted.

(1) Introduction.

(a) Scope.

This method describes the collection of airborne elemental cadmium and cadmium compounds on 0.8 µm mixed cellulose ester membrane filters and their subsequent analysis

by either flame atomic absorption spectroscopy (AAS) or flameless atomic absorption spectroscopy using a heated graphite furnace atomizer (AAS-HGA). It is applicable for both TWA and action level TWA permissible exposure level (PEL) measurements. The two atomic absorption analytical techniques included in the method do not differentiate between cadmium fume and cadmium dust samples. They also do not differentiate between elemental cadmium and its compounds.

(b) Principle.

Airborne elemental cadmium and cadmium compounds are collected on a 0.8 μm mixed cellulose ester membrane filter (MCEF). The air filter samples are digested with concentrated nitric acid to destroy the organic matrix and dissolve the cadmium analytes. After digestion, a small amount of concentrated hydrochloric acid is added to help dissolve other metals which may be present. The samples are diluted to volume with deionized water and then aspirated into the oxidizing air/acetylene flame of an atomic absorption spectrophotometer for analysis of elemental cadmium. If the concentration of cadmium in a sample solution is too low for quantitation by this flame AAS analytical technique, and the sample is to be averaged with other samples for TWA calculations, aliquots of the sample and a matrix modifier are later injected onto a L'vov platform in a pyrolytically-coated graphite tube of a Zeeman atomic absorption spectrophotometer/graphite furnace assembly for analysis of elemental cadmium. The matrix modifier is added to stabilize the cadmium metal and minimize sodium chloride as an interference during the high temperature charring step of the analysis subsection (5)(a) and (b) of this section.

(c) History.

Previously, two OSHA sampling and analytical methods for cadmium were used concurrently WAC 296-62-07449 (5)(c) and (d). Both of these methods also required 0.8 μm mixed cellulose ester membrane filters for the collection of air samples. These cadmium air filter samples were analyzed by either flame atomic absorption spectroscopy (subsection (5)(c) of this section) or inductively coupled plasma/atomic emission spectroscopy (ICP-AES) (subsection (5)(d) of this section). Neither of these two analytical methods have adequate sensitivity for measuring workplace exposure to airborne cadmium at the new lower TWA and action level TWA PEL levels when consecutive samples are taken on one employee and the sample results need to be averaged with other samples to determine a single TWA. The inclusion of two atomic absorption analytical techniques in the new sampling and analysis method for airborne cadmium permits quantitation of sample results over a broad range of exposure levels and sampling periods. The flame AAS analytical technique included in this method is similar to the previous procedure given in the General Metals Method ID-121 (subsection (5)(c) of this section) with some modifications. The sensitivity of the AAS-HGA analytical technique included in this method is adequate to measure exposure levels at 1/10 the action level TWA, or lower, when less than full-shift samples need to be averaged together.

(d) Properties (subsection (5)(e) of this section).

Elemental cadmium is a silver-white, blue-tinged, lustrous metal which is easily cut with a knife. It is slowly oxi-

dized by moist air to form cadmium oxide. It is insoluble in water, but reacts readily with dilute nitric acid. Some of the physical properties and other descriptive information of elemental cadmium are given below:

CAS No	7440-43-9
Atomic Number	48
Atomic Symbol	Cd
Atomic Weight	112.41
Melting Point	321°C
Boiling Point	765°C
Density	8.65 g/mL (25°C)

The properties of specific cadmium compounds are described in reference subsection (5)(e) of this section.

(e) Method performance.

A synopsis of method performance is presented below. Further information can be found in subsection (4) of this section.

(i) The qualitative and quantitative detection limits for the flame AAS analytical technique are 0.04 μg (0.004 $\mu\text{g/mL}$) and 0.14 μg (0.014 $\mu\text{g/mL}$) cadmium, respectively, for a 10 mL solution volume. These correspond, respectively, to 0.2 $\mu\text{g/m}^3$ and 0.70 $\mu\text{g/m}^3$ for a 200 L air volume.

(ii) The qualitative and quantitative detection limits for the AAS-HGA analytical technique are 0.44 ng (0.044 ng/mL) and 1.5 ng (0.15 ng/mL) cadmium, respectively, for a 10 mL solution volume. These correspond, respectively, to 0.007 $\mu\text{g/m}^3$ and 0.025 $\mu\text{g/m}^3$ for a 60 L air volume.

(iii) The average recovery by the flame AAS analytical technique of 17 spiked MCEF samples containing cadmium in the range of 0.5 to 2.0 times the TWA target concentration of 5 $\mu\text{g/m}^3$ (assuming a 400 L air volume) was 104.0% with a pooled coefficient of variation (CV^1) of 0.010. The flame analytical technique exhibited a positive bias of +4.0% for the validated concentration range. The overall analytical error (OAE) for the flame AAS analytical technique was $\pm 6.0\%$.

(iv) The average recovery by the AAS-HGA analytical technique of 18 spiked MCEF samples containing cadmium in the range of 0.5 to 2.0 times the action level TWA target concentration of 2.5 $\mu\text{g/m}^3$ (assuming a 60 L air volume) was 94.2% with a pooled coefficient of variation (CV^1) of 0.043. The AAS-HGA analytical technique exhibited a negative bias of -5.8% for the validated concentration range. The overall analytical error (OAE) for the AAS-HGA analytical technique was $\pm 14.2\%$.

(v) Sensitivity in flame atomic absorption is defined as the characteristic concentration of an element required to produce a signal of 1% absorbance (0.0044 absorbance units). Sensitivity values are listed for each element by the atomic absorption spectrophotometer manufacturer and have proved to be a very valuable diagnostic tool to determine if instrumental parameters are optimized and if the instrument is performing up to specification. The sensitivity of the spectrophotometer used in the validation of the flame AAS analytical technique agreed with the manufacturer specifications (subsection (5)(f) of this section); the 2 $\mu\text{g/mL}$ cadmium standard gave an absorbance reading of 0.350 abs. units.

(vi) Sensitivity in graphite furnace atomic absorption is defined in terms of the characteristic mass, the number of picograms required to give an integrated absorbance value of 0.0044 absorbance-second (subsection (5)(g) of this section). Data suggests that under stabilized temperature platform furnace (STPF) conditions (see (f)(ii) of this subsection), characteristic mass values are transferable between properly functioning instruments to an accuracy of about twenty percent (subsection (5)(b) of this section). The characteristic mass for STPF analysis of cadmium with Zeeman background correction listed by the manufacturer of the instrument used in the validation of the AAS-HGA analytical technique was 0.35 pg. The experimental characteristic mass value observed during the determination of the working range and detection limits of the AAS-HGA analytical technique was 0.41 pg.

(f) Interferences.

(i) High concentrations of silicate interfere in determining cadmium by flame AAS (subsection (5)(f) of this section). However, silicates are not significantly soluble in the acid matrix used to prepare the samples.

(ii) Interferences, such as background absorption, are reduced to a minimum in the AAS-HGA analytical technique by taking full advantage of the stabilized temperature platform furnace (STPF) concept. STPF includes all of the following parameters (subsection (5)(b) of this section):

- (A) Integrated absorbance;
 - (B) Fast instrument electronics and sampling frequency;
 - (C) Background correction;
 - (D) Maximum power heating;
 - (E) Atomization off the L'vov platform in a pyrolytically coated graphite tube;
 - (F) Gas stop during atomization;
 - (G) Use of matrix modifiers.
- (g) Toxicology (subsection (5)(n) of this section).

Information listed within this section is synopsis of current knowledge of the physiological effects of cadmium and is not intended to be used as the basis for WISHA policy. IARC classifies cadmium and certain of its compounds as Group 2A carcinogens (probably carcinogenic to humans). Cadmium fume is intensely irritating to the respiratory tract. Workplace exposure to cadmium can cause both chronic and acute effects. Acute effects include tracheobronchitis, pneumonitis, and pulmonary edema. Chronic effects include anemia, rhinitis/anosmia, pulmonary emphysema, proteinuria and lung cancer. The primary target organs for chronic disease are the kidneys (noncarcinogenic) and the lungs (carcinogenic).

(2) Sampling.

(a) Apparatus.

(i) Filter cassette unit for air sampling: A 37-mm diameter mixed cellulose ester membrane filter with a pore size of 0.8 μm contained in a 37-mm polystyrene two- or three-piece cassette filter holder (part no. MAWP 037 A0, Millipore Corp., Bedford, MA). The filter is supported with a cellulose backup pad. The cassette is sealed prior to use with a shrinkable gel band.

(ii) A calibrated personal sampling pump whose flow is determined to an accuracy of $\pm 5\%$ at the recommended flow rate with the filter cassette unit in line.

(b) Procedure

(i) Attach the prepared cassette to the calibrated sampling pump (the backup pad should face the pump) using flexible tubing. Place the sampling device on the employee such that air is sampled from the breathing zone.

(ii) Collect air samples at a flow rate of 2.0 L/min. If the filter does not become overloaded, a full-shift (at least seven hours) sample is strongly recommended for TWA and action level TWA measurements with a maximum air volume of 960 L. If overloading occurs, collect consecutive air samples for shorter sampling periods to cover the full workshift.

(iii) Replace the end plugs into the filter cassettes immediately after sampling. Record the sampling conditions.

(iv) Securely wrap each sample filter cassette end-to-end with a sample seal.

(v) Submit at least one blank sample. With each set of air samples. The blank sample should be handled the same as the other samples except that no air is drawn through it.

(vi) Ship the samples to the laboratory for analysis as soon as possible in a suitable container designed to prevent damage in transit.

(3) Analysis.

(a) Safety precautions.

(i) Wear safety glasses, protective clothing and gloves at all times.

(ii) Handle acid solutions with care. Handle all cadmium samples and solutions with extra care (see subsection (1)(g) of this section). Avoid their direct contact with work area surfaces, eyes, skin and clothes. Flush acid solutions which contact the skin or eyes with copious amounts of water.

(iii) Perform all acid digestions and acid dilutions in an exhaust hood while wearing a face shield. To avoid exposure to acid vapors, do not remove beakers containing concentrated acid solutions from the exhaust hood until they have returned to room temperature and have been diluted or emptied.

(iv) Exercise care when using laboratory glassware. Do not use chipped pipets, volumetric flasks, beakers or any glassware with sharp edges exposed in order to avoid the possibility of cuts or abrasions.

(v) Never pipet by mouth.

(vi) Refer to the instrument instruction manuals and SOPs (subsection (5)(h) and (i) of this section) for proper and safe operation of the atomic absorption spectrophotometer, graphite furnace atomizer and associated equipment.

(vii) Because metallic elements and other toxic substances are vaporized during AAS flame or graphite furnace atomizer operation, it is imperative that an exhaust vent be used. Always ensure that the exhaust system is operating properly during instrument use.

(b) Apparatus for sample and standard preparation.

(i) Hot plate, capable of reaching 150°C, installed in an exhaust hood.

(ii) Phillips beakers, 125 mL.

(iii) Bottles, narrow-mouth, polyethylene or glass with leakproof caps: used for storage of standards and matrix modifier.

(iv) Volumetric flasks, volumetric pipets, beakers and other associated general laboratory glassware.

(v) Forceps and other associated general laboratory equipment.

(c) Apparatus for flame AAS analysis.

(i) Atomic absorption spectrophotometer consisting of a(an):

Nebulizer and burner head; pressure regulating devices capable of maintaining constant oxidant and fuel pressures; optical system capable of isolating the desired wavelength of radiation (228.8 nm); adjustable slit; light measuring and amplifying device; display, strip chart, or computer interface for indicating the amount of absorbed radiation; cadmium hollow cathode lamp or electrodeless discharge lamp (EDL) and power supply.

(ii) Oxidant: Compressed air, filtered to remove water, oil and other foreign substances.

(iii) Fuel: Standard commercially available tanks of acetylene dissolved in acetone; tanks should be equipped with flash arresters.

Caution: Do not use grades of acetylene containing solvents other than acetone because they may damage the PVC tubing used in some instruments.

(iv) Pressure-reducing valves: Two gauge, two-stage pressure regulators to maintain fuel and oxidant pressures somewhat higher than the controlled operating pressures of the instrument.

(v) Exhaust vent installed directly above the spectrophotometer burner head.

(d) Apparatus for AAS-HGA analysis.

(i) Atomic absorption spectrophotometer consisting of a(an):

Heated graphite furnace atomizer (HGA) with argon purge system pressure-regulating devices capable of maintaining constant argon purge pressure; optical system capable of isolating the desired wavelength of radiation (228.8 nm); adjustable slit; light measuring and amplifying device; display, strip chart, or computer interface for indicating the amount of absorbed radiation (as integrated absorbance, peak area); background corrector: Zeeman or deuterium arc. The Zeeman background corrector is recommended; cadmium hollow cathode lamp or electrodeless discharge lamp (EDL) and power supply; autosampler capable of accurately injecting 5 to 20 μ L sample aliquots onto the L'vov Platform in a graphite tube.

(ii) Pyrolytically coated graphite tubes containing solid, pyrolytic L'vov platforms.

(iii) Polyethylene sample cups, 2.0 to 2.5 mL, for use with the autosampler.

(iv) Inert purge gas for graphite furnace atomizer: Compressed gas cylinder of purified argon.

(v) Two gauge, two-stage pressure regulator for the argon gas cylinder.

(vi) Cooling water supply for graphite furnace atomizer.

(vii) Exhaust vent installed directly above the graphite furnace atomizer.

(e) Reagents. All reagents should be ACS analytical reagent grade or better.

(i) Deionized water with a specific conductance of less than 10 μ S.

(ii) Concentrated nitric acid, HNO₃.

(iii) Concentrated hydrochloric acid, HCl.

(iv) Ammonium phosphate, monobasic, NH₄H₂PO₄.

(v) Magnesium nitrate, Mg(NO₃)₂ • 6H₂O.

(vi) Diluting solution (4% HNO₃, 0.4% HCl): Add 40 mL HNO₃ and 4 mL HCl carefully to approximately 500 mL deionized water and dilute to 1 L with deionized water.

(vii) Cadmium standard stock solution, 1,000 μ g/mL: Use a commercially available certified 1,000 μ g/mL cadmium standard or, alternatively, dissolve 1.0000 g of cadmium metal in a minimum volume of 1:1 HCl and dilute to 1 L with 4% HNO₃. Observe expiration dates of commercial standards. Properly dispose of commercial standards with no expiration dates or prepared standards one year after their receipt or preparation date.

(viii) Matrix modifier for AAS-HGA analysis: Dissolve 1.0 g NH₄H₂PO₄ and 0.15 g Mg(NO₃)₂ • 6H₂O in approximately 200 mL deionized water. Add 1 mL HNO₃ and dilute to 500 mL with deionized water.

(ix) Nitric Acid, 1:1 HNO₃/DI H₂O mixture: Carefully add a measured volume of concentrated HNO₃ to an equal volume of DI H₂O.

(x) Nitric acid, 10% v/v: Carefully add 100 mL of concentrated HNO₃ to 500 mL of DI H₂O and dilute to 1 L.

(f) Glassware preparation.

(i) Clean Phillips beakers by refluxing with 1:1 nitric acid on a hot plate in a fume hood. Thoroughly rinse with deionized water and invert the beakers to allow them to drain dry.

(ii) Rinse volumetric flasks and all other glassware with 10% nitric acid and deionized water prior to use.

(g) Standard preparation for flame AAS analysis.

(i) Dilute stock solutions: Prepare 1, 5, 10 and 100 μ g/mL cadmium standard stock solutions by making appropriate serial dilutions of 1,000 μ g/mL cadmium standard stock solution with the diluting solution described in (e)(vi) of this subsection.

(ii) Working standards: Prepare cadmium working standards in the range of 0.02 to 2.0 μ g/mL by making appropriate serial dilutions of the dilute stock solutions with the same diluting solution. A suggested method of preparation of the working standards is given below.

Working standard (μ g/mL)	Std solution (μ g/mL)	Aliquot (mL)	Final vol. (mL)
0.02	1	10	500
0.05	5	5	500
0.1	10	5	500
0.2	10	10	500
0.5	10	25	500
1	100	5	500
2	100	10	500

Store the working standards in 500-mL, narrow-mouth polyethylene or glass bottles with leak proof caps. Prepare every twelve months.

(h) Standard preparation for AAS-HGA analysis.

(i) Dilute stock solutions: Prepare 10, 100 and 1,000 ng/mL cadmium standard stock solutions by making appropriate ten-fold serial dilutions of the 1,000 μ g/mL cadmium standard stock solution with the diluting solution described in (e)(vi) of this subsection.

(ii) Working standards: Prepare cadmium working standards in the range of 0.2 to 20 ng/mL by making appropriate serial dilutions of the dilute stock solutions with the same diluting solution. A suggested method of preparation of the working standards is given below.

Working standard (ng/mL)	Std solution (ng/mL)	Aliquot (mL)	Final vol. (mL)
0.2	10	2	100
0.5	10	5	100
1	10	10	100
2	100	2	100
5	100	5	100
10	100	10	100
20	1,000	2	100

Store the working standards in narrow-mouth polyethylene or glass bottles with leakproof caps. Prepare monthly.

(i) Sample preparation.

(i) Carefully transfer each sample filter with forceps from its filter cassette unit to a clean, separate 125-mL Phillips beaker along with any loose dust found in the cassette. Label each Phillips beaker with the appropriate sample number.

(ii) Digest the sample by adding 5 mL of concentrated nitric acid (HNO₃) to each Phillips beaker containing an air filter sample. Place the Phillips beakers on a hot plate in an exhaust hood and heat the samples until approximately 0.5 mL remains. The sample solution in each Phillips beaker should become clear. If it is not clear, digest the sample with another portion of concentrated nitric acid.

(iii) After completing the HNO₃ digestion and cooling the samples, add 40 µL (2 drops) of concentrated HCl to each air sample solution and then swirl the contents. Carefully add about 5 mL of deionized water by pouring it down the inside of each beaker.

(iv) Quantitatively transfer each cooled air sample solution from each Phillips beaker to a clean 10-mL volumetric flask. Dilute each flask to volume with deionized water and mix well.

(j) Flame AAS analysis.

Analyze all of the air samples for their cadmium content by flame atomic absorption spectroscopy (AAS) according to the instructions given below.

(i) Set up the atomic absorption spectrophotometer for the air/acetylene flame analysis of cadmium according to the SOP (subsection (5)(h) of this section) or the manufacturer's operational instructions. For the source lamp, use the cadmium hollow cathode or electrodeless discharge lamp operated at the manufacturer's recommended rating for continuous operation. Allow the lamp to warm up ten to twenty minutes or until the energy output stabilizes. Optimize conditions such as lamp position, burner head alignment, fuel and oxidant flow rates, etc. See the SOP or specific instrument manuals for details. Instrumental parameters for the Perkin-Elmer Model 603 used in the validation of this method are given in subsection (6) of this section.

(ii) Aspirate and measure the absorbance of a standard solution of cadmium. The standard concentration should be within the linear range. For the instrumentation used in the validation of this method a 2 µg/mL cadmium standard gives a net absorbance reading of about 0.350 abs. units (see subsection (1)(e)(v) of this section) when the instrument and the source lamp are performing to manufacturer specifications.

(iii) To increase instrument response, scale expand the absorbance reading of the aspirated 2 µg/mL working standard approximately four times. Increase the integration time to at least three seconds to reduce signal noise.

(iv) Autozero the instrument while aspirating a deionized water blank. Monitor the variation in the baseline absorbance reading (baseline noise) for a few minutes to insure that the instrument, source lamp and associated equipment are in good operating condition.

(v) Aspirate the working standards and samples directly into the flame and record their absorbance readings. Aspirate the deionized water blank immediately after every standard or sample to correct for and monitor any baseline drift and noise. Record the baseline absorbance reading of each deionized water blank. Label each standard and sample reading and its accompanying baseline reading.

(vi) It is recommended that the entire series of working standards be analyzed at the beginning and end of the analysis of a set of samples to establish a concentration-response curve, ensure that the standard readings agree with each other and are reproducible. Also, analyze a working standard after every five or six samples to monitor the performance of the spectrophotometer. Standard readings should agree within ±10 to 15% of the readings obtained at the beginning of the analysis.

(vii) Bracket the sample readings with standards during the analysis. If the absorbance reading of a sample is above the absorbance reading of the highest working standard, dilute the sample with diluting solution and reanalyze. Use the appropriate dilution factor in the calculations.

(viii) Repeat the analysis of approximately ten percent of the samples for a check of precision.

(ix) If possible, analyze quality control samples from an independent source as a check on analytical recovery and precision.

(x) Record the final instrument settings at the end of the analysis. Date and label the output.

(k) AAS-HGA analysis.

Initially analyze all of the air samples for their cadmium content by flame atomic absorption spectroscopy (AAS) according to the instructions given in (j) of this subsection. If the concentration of cadmium in a sample solution is less than three times the quantitative detection limit (0.04 µg/mL (40 ng/mL) for the instrumentation used in the validation) and the sample results are to be averaged with other samples for TWA calculations, proceed with the AAS-HGA analysis of the sample as described below.

(i) Set up the atomic absorption spectrophotometer and HGA for flameless atomic absorption analysis of cadmium according to the SOP (subsection (5)(i) of this section) or the manufacturer's operational instructions and allow the instrument to stabilize. The graphite furnace atomizer is equipped with a pyrolytically coated graphite tube containing a pyro-

lytic platform. For the source lamp, use a cadmium hollow cathode or electrodeless discharge lamp operated at the manufacturer's recommended setting for graphite furnace operation. The Zeeman background corrector and EDL are recommended for use with the L'vov platform. Instrumental parameters for the Perkin-Elmer Model 5100 spectrophotometer and Zeeman HGA-600 graphite furnace used in the validation of this method are given in subsection (7) of this section.

(ii) Optimize the energy reading of the spectrophotometer at 228.8 nm by adjusting the lamp position and the wavelength according to the manufacturer's instructions.

(iii) Set up the autosampler to inject a 5- μ L aliquot of the working standard, sample or reagent blank solution onto the L'vov platform along with a 10- μ L overlay of the matrix modifier.

(iv) Analyze the reagent blank (diluting solution, (e)(vi) of this subsection) and then autozero the instrument before starting the analysis of a set of samples. It is recommended that the reagent blank be analyzed several times during the analysis to assure the integrated absorbance (peak area) reading remains at or near zero.

(v) Analyze a working standard approximately midway in the linear portion of the working standard range two or three times to check for reproducibility and sensitivity (see subsection (1)(e)(v) and (vi) of this section) before starting the analysis of samples. Calculate the experimental characteristic mass value from the average integrated absorbance reading and injection volume of the analyzed working standard. Compare this value to the manufacturer's suggested value as a check of proper instrument operation.

(vi) Analyze the reagent blank, working standard, and sample solutions. Record and label the peak area (abs-sec) readings and the peak and background peak profiles on the printer/plotter.

(vii) It is recommended the entire series of working standards be analyzed at the beginning and end of the analysis of a set of samples. Establish a concentration-response curve and ensure standard readings agree with each other and are reproducible. Also, analyze a working standard after every five or six samples to monitor the performance of the system. Standard readings should agree within $\pm 15\%$ of the readings obtained at the beginning of the analysis.

(viii) Bracket the sample readings with standards during the analysis. If the peak area reading of a sample is above the peak area reading of the highest working standard, dilute the sample with the diluting solution and reanalyze. Use the appropriate dilution factor in the calculations.

(ix) Repeat the analysis of approximately ten percent of the samples for a check of precision.

(x) If possible, analyze quality control samples from an independent source as a check of analytical recovery and precision.

(xi) Record the final instrument settings at the end of the analysis. Date and label the output.

(l) Calculations.

Note: Standards used for HGA analysis are in ng/mL. Total amounts of cadmium from calculations will be in ng (not μ g) unless a prior conversion is made.

(i) Correct for baseline drift and noise in flame AAS analysis by subtracting each baseline absorbance reading from its corresponding working standard or sample absorbance reading to obtain the net absorbance reading for each standard and sample.

(ii) Use a least squares regression program to plot a concentration-response curve of net absorbance reading (or peak area for HGA analysis) versus concentration (μ g/mL or ng/mL) of cadmium in each working standard.

(iii) Determine the concentration (μ g/mL or ng/mL) of cadmium in each sample from the resulting concentration-response curve. If the concentration of cadmium in a sample solution is less than three times the quantitative detection limit (0.04 μ g/mL (40 ng/mL) for the instrumentation used in the validation of the method) and if consecutive samples were taken on one employee and the sample results are to be averaged with other samples to determine a single TWA, reanalyze the sample by AAS-HGA as described in (k) of this subsection and report the AAS-HGA analytical results.

(iv) Calculate the total amount (μ g or ng) of cadmium in each sample from the sample solution volume (mL):

$$W = (C)(\text{sample vol, mL})(DF)$$

Where: W = Total cadmium in sample

C = Calculated concentration of cadmium

DF = Dilution Factor (if applicable)

(v) Make a blank correction for each air sample by subtracting the total amount of cadmium in the corresponding blank sample from the total amount of cadmium in the sample.

(vi) Calculate the concentration of cadmium in an air sample (mg/m^3 or $\mu\text{g}/\text{m}^3$) by using one of the following equations:

$$\text{mg}/\text{m}^3 = W_{bc}/(\text{Air vol sampled, L})$$

or

$$\mu\text{g}/\text{m}^3 = (W_{bc})(1,000 \text{ ng}/\mu\text{g})/(\text{Air vol sampled, L})$$

Where: W_{bc} = blank corrected total μ g cadmium in the sample. (1 μ g = 1,000 ng)

(4) Backup data.

(a) Introduction.

(i) The purpose of this evaluation is to determine the analytical method recovery, working standard range, and qualitative and quantitative detection limits of the two atomic absorption analytical techniques included in this method. The evaluation consisted of the following experiments:

(A) An analysis of twenty-four samples (six samples each at 0.1, 0.5, 1 and 2 times the TWA-PEL) for the analytical method recovery study of the flame AAS analytical technique.

(B) An analysis of eighteen samples (six samples each at 0.5, 1 and 2 times the action level TWA-PEL) for the analytical method recovery study of the AAS-HGA analytical technique.

(C) Multiple analyses of the reagent blank and a series of standard solutions to determine the working standard range and the qualitative and quantitative detection limits for both atomic absorption analytical techniques.

(ii) The analytical method recovery results at all test levels were calculated from concentration-response curves and statistically examined for outliers at the ninety-nine percent confidence level. Possible outliers were determined using the Treatment of Outliers test (subsection (5)(j) of this section). In addition, the sample results of the two analytical techniques, at 0.5, 1.0 and 2.0 times their target concentrations, were tested for homogeneity of variances also at the ninety-nine percent confidence level. Homogeneity of the coefficients of variation was determined using the Bartlett's test (subsection (5)(k) of this section). The overall analytical error (OAE) at the ninety-five percent confidence level was calculated using the equation (subsection (5)(l) of this section):

$$\text{OAE} = \pm [|\text{Bias}| + (1.96)(\text{CV}_1(\text{pooled}))](100\%)$$

(iii) A derivation of the International Union of Pure and Applied Chemistry (IUPAC) detection limit equation (subsection (5)(m) of this section) was used to determine the qualitative and quantitative detection limits for both atomic absorption analytical techniques:

$$C_{\text{ld}} = k(\text{sd})/m \quad (\text{Equation 1})$$

Where: C_{ld} = the smallest reliable detectable concentration an analytical instrument can determine at a given confidence level.
 $k = 3$ for the Qualitative Detection Limit at the 99.86% Confidence Level = 10 for the Quantitative Detection Limit at the 99.99% Confidence Level.
 sd = standard deviation of the reagent blank (Rbl) readings.
 m = analytical sensitivity or slope as calculated by linear regression.

(iv) Collection efficiencies of metallic fume and dust atmospheres on 0.8- μm mixed cellulose ester membrane filters are well documented and have been shown to be excellent (subsection (5)(k) of this section). Since elemental cadmium and the cadmium component of cadmium compounds are nonvolatile, stability studies of cadmium spiked MCEF samples were not performed.

(b) Equipment.

(i) A Perkin-Elmer (PE) Model 603 spectrophotometer equipped with a manual gas control system, a stainless steel nebulizer, a burner mixing chamber, a flow spoiler and a 10 cm (one-slot) burner head was used in the experimental validation of the flame AAS analytical technique. A PE cadmium hollow cathode lamp, operated at the manufacturer's recommended current setting for continuous operation (4 mA), was used as the source lamp. Instrument parameters are listed in subsection (6) of this section.

(ii) A PE Model 5100 spectrophotometer, Zeeman HGA-600 graphite furnace atomizer and AS-60 HGA autosampler were used in the experimental validation of the AAS-HGA analytical technique. The spectrophotometer was equipped with a PE Series 7700 professional computer and Model PR-310 printer. A PE System 2 cadmium electrodeless discharge lamp, operated at the manufacturer's recommended current setting for modulated operation (170 mA), was used as the source lamp. Instrument parameters are listed in subsection (7) of this section.

(c) Reagents.

(i) J.T. Baker Chem. Co. (Analyzed grade) concentrated nitric acid, 69.0-71.0%, and concentrated hydrochloric acid, 36.5-38.0%, were used to prepare the samples and standards.

(ii) Ammonium phosphate, monobasic, $\text{NH}_4\text{H}_2\text{PO}_4$ and magnesium nitrate hexahydrate, $\text{Mg}(\text{NO}_3)_2 \cdot 6 \text{H}_2\text{O}$ both manufactured by the Mallinckrodt Chem. Co., were used to prepare the matrix modifier for AAS-HGA analysis.

(d) Standard preparation for flame AAS analysis.

(i) Dilute stock solutions: Prepared 0.01, 0.1, 1, 10 and 100 $\mu\text{g}/\text{mL}$ cadmium standard stock solutions by making appropriate serial dilutions of a commercially available 1,000 $\mu\text{g}/\text{mL}$ cadmium standard stock solution (RICCA Chemical Co., Lot# A102) with the diluting solution (4% HNO_3 , 0.4% HCl).

(ii) Analyzed standards: Prepared cadmium standards in the range of 0.001 to 2.0 $\mu\text{g}/\text{mL}$ by pipetting 2 to 10 mL of the appropriate dilute cadmium stock solution into a 100-mL volumetric flask and diluting to volume with the diluting solution. (See subsection (3)(g)(ii) of this section).

(e) Standard preparation for AAS-HGA analysis.

(i) Dilute stock solutions: Prepared 1, 10, 100 and 1,000 ng/mL cadmium standard stock solutions by making appropriate serial dilutions of a commercially available 1,000 $\mu\text{g}/\text{mL}$ cadmium standard stock solution (J.T. Baker Chemical Co., Intra-analyzed, Lot# D22642) with the diluting solution (4% HNO_3 , 0.4% HCl).

(ii) Analyzed standards: Prepared cadmium standards in the range of 0.1 to 40 ng/mL by pipetting 2 to 10 mL of the appropriate dilute cadmium stock solution into a 100-mL volumetric flask and diluting to volume with the diluting solution. (See subsection (3)(h)(ii) of this section).

(f) Detection limits and standard working range for flame AAS analysis.

(i) Analyzed the reagent blank solution and the entire series of cadmium standards in the range of 0.001 to 2.0 $\mu\text{g}/\text{mL}$ three to six times according to the instructions given in subsection (3)(j) of this section. The diluting solution (4% HNO_3 , 0.4% HCl) was used as the reagent blank. The integration time on the PE 603 spectrophotometer was set to 3.0 seconds and a four-fold expansion of the absorbance reading of the 2.0 $\mu\text{g}/\text{mL}$ cadmium standard was made prior to analysis. The 2.0 $\mu\text{g}/\text{mL}$ standard gave a net absorbance reading of 0.350 abs. units prior to expansion in agreement with the manufacturer's specifications (subsection (5)(f) of this section).

(ii) The net absorbance readings of the reagent blank and the low concentration Cd standards from 0.001 to 0.1 $\mu\text{g}/\text{mL}$ and the statistical analysis of the results are shown in Table 1. The standard deviation, sd , of the six net absorbance readings of the reagent blank is 1.05 abs. units. The slope, m , as calculated by a linear regression plot of the net absorbance readings (shown in Table 2) of the 0.02 to 1.0 $\mu\text{g}/\text{mL}$ cadmium standards versus their concentration is 772.7 abs. units/ $(\mu\text{g}/\text{mL})$.

(iii) If these values for sd and the slope, m , are used in Eqn. 1 ((a)(ii) of this subsection), the qualitative and quantitative detection limits as determined by the IUPAC Method are:

$$C_{\text{ld}} = (3)(1.05 \text{ abs. units}) / (772.7 \text{ abs. units}/(\mu\text{g}/\text{mL})) = 0.0041 \mu\text{g}/\text{mL} \text{ for the qualitative detection limit.}$$

$$C_{id} = (10)(1.05 \text{ abs. units}) / (772.7 \text{ abs. units}/\mu\text{g/mL}) = 0.014 \mu\text{g/mL}$$

for the quantitative detection limit.

The qualitative and quantitative detection limits for the flame AAS analytical technique are 0.041 μg and 0.14 μg cadmium, respectively, for a 10 mL solution volume. These correspond, respectively, to 0.2 $\mu\text{g}/\text{m}^3$ and 0.70 $\mu\text{g}/\text{m}^3$ for a 200 L air volume.

(iv) The recommended Cd standard working range for flame AAS analysis is 0.02 to 2.0 $\mu\text{g}/\text{mL}$. The net absorbance readings of the reagent blank and the recommended working range standards and the statistical analysis of the results are shown in Table 2. The standard of lowest concentration in the working range, 0.02 $\mu\text{g}/\text{mL}$, is slightly greater than the calculated quantitative detection limit, 0.014 $\mu\text{g}/\text{mL}$. The standard of highest concentration in the working range, 2.0 $\mu\text{g}/\text{mL}$, is at the upper end of the linear working range suggested by the manufacturer (subsection (5)(f) of this section). Although the standard net absorbance readings are not strictly linear at concentrations above 0.5 $\mu\text{g}/\text{mL}$, the deviation from linearity is only about ten percent at the upper end of the recommended standard working range. The deviation from linearity is probably caused by the four-fold expansion of the signal suggested in the method. As shown in Table 2, the precision of the standard net absorbance readings are excellent throughout the recommended working range; the relative standard deviations of the readings range from 0.009 to 0.064.

(g) Detection limits and standard working range for AAS-HGA analysis.

(i) Analyzed the reagent blank solution and the entire series of cadmium standards in the range of 0.1 to 40 ng/mL according to the instructions given in subsection (3)(k) of this section. The diluting solution (4% HNO_3 , 0.4% HCl) was used as the reagent blank. A fresh aliquot of the reagent blank and of each standard was used for every analysis. The experimental characteristic mass value was 0.41 pg, calculated from the average peak area (abs-sec) reading of the 5 ng/mL standard which is approximately midway in the linear portion of the working standard range. This agreed within twenty percent with the characteristic mass value, 0.35 pg, listed by the manufacturer of the instrument (subsection (5)(b) of this section).

(ii) The peak area (abs-sec) readings of the reagent blank and the low concentration Cd standards from 0.1 to 2.0 ng/mL and statistical analysis of the results are shown in Table 3. Five of the reagent blank peak area readings were zero and the sixth reading was 1 and was an outlier. The near lack of a blank signal does not satisfy a strict interpretation of the IUPAC method for determining the detection limits. Therefore, the standard deviation of the six peak area readings of the 0.2 ng/mL cadmium standard, 0.75 abs-sec, was used to calculate the detection limits by the IUPAC method. The slope, m , as calculated by a linear regression plot of the peak area (abs-sec) readings (shown in Table 4) of the 0.2 to 10 ng/mL cadmium standards versus their concentration is 51.5 abs-sec/(ng/mL).

(iii) If 0.75 abs-sec (sd) and 51.5 abs-sec/(ng/mL) (m) are used in Eqn. 1 ((a)(iii) of this subsection), the qualitative and quantitative detection limits as determined by the IUPAC method are:

$$C_{id} = (3)(0.75 \text{ abs-sec}) / (51.5 \text{ abs-sec}/(\text{ng/mL})) = 0.044 \text{ ng/mL}$$

for the qualitative detection limit.

$$C_{id} = (10)(0.75 \text{ abs-sec}) / (51.5 \text{ abs-sec}/(\text{ng/mL})) = 0.15 \text{ ng/mL}$$

for the quantitative detection limit. The qualitative and quantitative detection limits for the AAS-HGA analytical technique are 0.44 ng and 1.5 ng cadmium, respectively, for a 10 mL solution volume. These correspond, respectively, to 0.007 $\mu\text{g}/\text{m}^3$ and 0.025 $\mu\text{g}/\text{m}^3$ for a 60 L air volume.

(iv) The peak area (abs-sec) readings of the Cd standards from 0.2 to 40 ng/mL and the statistical analysis of the results are given in Table 4. The recommended standard working range for AAS-HGA analysis is 0.2 to 20 ng/mL. The standard of lowest concentration in the recommended working range is slightly greater than the calculated quantitative detection limit, 0.15 ng/mL. The deviation from linearity of the peak area readings of the 20 ng/mL standard, the highest concentration standard in the recommended working range, is approximately ten percent. The deviations from linearity of the peak area readings of the thirty and forty ng/mL standards are significantly greater than ten percent. As shown in Table 4, the precision of the peak area readings are satisfactory throughout the recommended working range; the relative standard deviations of the readings range from 0.025 to 0.083.

(h) Analytical method recovery for flame AAS analysis.

(i) Four sets of spiked MCEF samples were prepared by injecting 20 μL of 10, 50, 100 and 200 $\mu\text{g}/\text{mL}$ dilute cadmium stock solutions on 37 mm diameter filters (part No. AAWP 037 00, Millipore Corp., Bedford, MA) with a calibrated micropipet. The dilute stock solutions were prepared by making appropriate serial dilutions of a commercially available 1,000 $\mu\text{g}/\text{mL}$ cadmium standard stock solution (RICCA Chemical Co., Lot # A102) with the diluting solution (4% HNO_3 , 0.4% HCl). Each set contained six samples and a sample blank. The amount of cadmium in the prepared sets were equivalent to 0.1, 0.5, 1.0 and 2.0 times the TWA PEL target concentration of 5 $\mu\text{g}/\text{m}^3$ for a 400 L air volume.

(ii) The air-dried spiked filters were digested and analyzed for their cadmium content by flame atomic absorption spectroscopy (AAS) following the procedure described in subsection (3) of this section. The 0.02 to 2.0 $\mu\text{g}/\text{mL}$ cadmium standards (the suggested working range) were used in the analysis of the spiked filters.

(iii) The results of the analysis are given in Table 5. One result at 0.5 times the TWA PEL target concentration was an outlier and was excluded from statistical analysis. Experimental justification for rejecting it is that the outlier value was probably due to a spiking error. The coefficients of variation for the three test levels at 0.5 to 2.0 times the TWA PEL target concentration passed the Bartlett's test and were pooled.

(iv) The average recovery of the six spiked filter samples at 0.1 times the TWA PEL target concentration was 118.2% with a coefficient of variation (CV1) of 0.128. The average recovery of the spiked filter samples in the range of 0.5 to 2.0 times the TWA target concentration was 104.0% with a pooled coefficient of variation (CV1) of 0.010. Consequently, the analytical bias found in these spiked sample results over the tested concentration range was +4.0% and the OAE was $\pm 6.0\%$.

(i) Analytical method recovery for AAS-HGA analysis.

(i) Three sets of spiked MCEF samples were prepared by injecting 15 µL of 5, 10 and 20 µg/mL dilute cadmium stock solutions on 37 mm diameter filters (part no. AAWP 037 00, Millipore Corp., Bedford, MA) with a calibrated micropipet. The dilute stock solutions were prepared by making appropriate serial dilutions of a commercially available certified 1,000 µg/mL cadmium standard stock solution (Fisher Chemical Co., Lot# 913438-24) with the diluting solution (4% HNO₃, 0.4% HCl). Each set contained six samples and a sample blank. The amount of cadmium in the prepared sets were equivalent to 0.5, 1 and 2 times the action level TWA target concentration of 2.5 µg/m³ for a 60 L air volume.

(ii) The air-dried spiked filters were digested and analyzed for their cadmium content by flameless atomic absorption spectroscopy using a heated graphite furnace atomizer following the procedure described in subsection (3) of this section. A five-fold dilution of the spiked filter samples at 2 times the action level TWA was made prior to their analysis. The 0.05 to 20 ng/mL cadmium standards were used in the analysis of the spiked filters.

(iii) The results of the analysis are given in Table 6. There were no outliers. The coefficients of variation for the three test levels at 0.5 to 2.0 times the action level TWA PEL passed the Bartlett's test and were pooled. The average recovery of the spiked filter samples was 94.2% with a pooled coefficient of variation (CV1) of 0.043. Consequently, the analytical bias was -5.8% and the OAE was ±14.2%.

(j) Conclusions.

The experiments performed in this evaluation show the two atomic absorption analytical techniques included in this method to be precise and accurate and have sufficient sensitivity to measure airborne cadmium over a broad range of exposure levels and sampling periods.

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Table 1—Cd Detection Limit Study

[Flame AAS Analysis]		
STD (µg/mL)	Absorbance reading at 228.8 nm	Statistical analysis
Reagent blank	5 2	n=6.
	4 3	mean=3.50.
	4 3	std dev=1.05. CV=0.30.
0.001	6 6	n=6.
	2 4	mean=5.00.
	6 6	std dev=1.67. CV=0.335.
0.002	5 7	n=6.
	7 3	mean=5.50.
	7 4	std dev=1.76. CV=0.320.
0.005	7 7	n=6.
	8 8	mean=7.33.
	8 6	std dev=0.817. CV=0.111.
0.010	10 9	n=6.
	10 13	mean=10.3.
	10 10	std dev=1.37. CV=0.133.

STD ($\mu\text{g/mL}$)	Absorbance reading at 228.8 nm	Statistical analysis
0.020	20 23	n=6.
	20 22	mean=20.8.
	20 20	std dev=1.33. CV=0.064.
0.050	42 42	n=6.
	42 42	mean=42.5.
	42 45	std dev=1.22. CV=0.029.
0.10	84	n=3.
	80	mean=82.3.
	83	std dev=2.08. CV=0.025.

Table 2—Cd Standard Working Range Study

STD($\mu\text{g/mL}$)	[Flame AAS Analysis]		
	Absorbance reading at 228.8 nm	Statistical analysis	
Reagent blank	5 2 4 3 4 3	n=6. mean=3.50. std dev=1.05. CV=0.30.	
0.020	20 23 20 22 20 20	n=6. mean=20.8. std dev=1.33.	
	0.050	42 42 42 42 42 45	n=6. mean=42.5. std dev=1.22. CV=0.029.
		0.10	84 80 83
0.20			161 161 158
	0.50		391 389 393
		1.00	760 748 752
2.00			1416 1426 1401

Table 3—Cd Detection Limit Study

STD (ng/mL)	[AAS-HGA Analysis]		
	Peak area readings $\times 10^3$ at 228.8 nm	Statistical analysis	
Reagent blank	0 0 0 1 0 0	n=6. mean=0.167. std dev=0.41. CV=2.45.	
0.1	8 6 5 7 13 7	n=6. mean=7.7. std dev=2.8. CV=0.366.	
	0.2	11 13 11 12 12 12	n=6. mean=11.8. std dev=0.75. CV=0.064.
		0.5	28 33 26 28 28 30	n=6. mean=28.8. std dev=2.4. CV=0.083.
1.0			52 55 56 58 54 54	n=6. mean=54.8. std dev=2.0. CV=0.037.
	2.0		101 112 110 110 110 110

Table 4—Cd Standard Working Range Study

STD (ng/mL)	[AAS-HGA Analysis]		
	Peak area readings $\times 10^3$ at 228.8 nm	Statistical analysis	
0.2	11 13 11 12 12 12	n=6. mean=11.8. std dev=0.75. CV=0.064.	
	0.5	28 33 26 28 28 30	n=6. mean=28.8. std dev=2.4. CV=0.083.
		1.0	52 55 56 58 54 54
2.0			101 112 110 110 110 110
	5.0		247 265 268 275 259 279
		10.0	495 520

STD (ng/mL)	Peak area readings x 10 ³ at 228.8 nm	Statistical analysis
	523 513 516 533	mean=516.7 std dev=12.7 CV=0.025.
20.0	950 953 951 958 949 890	n=6. mean=941.8 std dev=25.6 CV=0.027.
30.0	1269 1291 1303 1307 1295 1290	n=6. mean=1293. std dev=13.3. CV=0.010.
40.0	1505 1567 1535 1567 1566 1572	n=6. mean=1552. std dev=26.6. CV=0.017.

Table 5—Analytical Method Recovery
[Flame AAS Analysis]

Test level	0.5x			1.0x			2.0x		
µg taken	µg found	Percent rec.	µg taken	µg found	Percent rec.	µg taken	µg found	Percent rec.	
1.00	1.0715	107.2	2.00	2.0688	103.4	4.00	4.1504	103.8	
1.00	1.0842	108.4	2.00	2.0174	100.9	4.00	4.1108	102.8	
1.00	1.0842	108.4	2.00	2.0431	102.2	4.00	4.0581	101.5	
1.00	*1.0081	*100.8	2.00	2.0431	102.2	4.00	4.0844	102.1	
1.00	1.0715	107.2	2.00	2.0174	100.9	4.00	4.1504	103.8	
1.00	1.0842	108.4	2.00	2.0045	100.2	4.00	4.1899	104.7	
n=	5			6			6		
mean=	107.9			101.6			103.1		
std dev=	0.657			1.174			1.199		
CV ₁ =	0.006			0.011			0.012		
CV ₁ (pooled)=	0.010								

*Rejected as an outlier—this value did not pass the outlier T-test at the 99% confidence level.

Test level 0.1x	µg found	µg rec.	Percent
taken			
0.200	0.2509	125.5	
0.200	0.2509	125.5	
0.200	0.2761	138.1	
0.200	0.2258	112.9	
0.200	0.2258	112.9	
0.200	0.1881	94.1	
n =	6		
mean =	118.2		
std dev =	15.1		
CV ₁ =	0.128		

Table 6—Analytical Method Recovery
[AAS-HGA analysis]

Test level	0.5x			1.0x			2.0x		
	ng taken	ng found	Percent rec.	ng taken	ng found	Percent rec.	ng taken	ng found	Percent rec.
75	71.23	95.0	150	138.00	92.0	300	258.43	86.1	
75	71.47	95.3	150	138.29	92.2	300	258.46	86.2	
75	70.02	93.4	150	136.30	90.9	300	280.55	93.5	
75	77.34	103.1	150	146.62	97.7	300	288.34	96.1	
75	78.32	104.4	150	145.17	96.8	300	261.74	87.2	
75	71.96	95.9	150	144.88	96.6	300	277.22	92.4	
n =	6			6			6		
mean =	97.9			94.4			90.3		
std dev =	4.66			2.98			4.30		
CV ₁ =	0.048			0.032			0.048		
CV ₁ (pooled) =	0.043								

(6) Instrumental Parameters for Flame AAS Analysis
Atomic Absorption Spectrophotometer
(Perkin-Elmer Model 603)

Flame: Air/Acetylene—lean, blue
Oxidant Flow: 55
Fuel Flow: 32
Wavelength: 228.8 nm
Slit: 4 (0.7 nm)
Range: UV
Signal: Concentration (4 exp)
Integration Time: 3 sec

(7) Instrumental Parameters for HGA Analysis
Atomic Absorption Spectrophotometer
(Perkin-Elmer Model 5100)

Signal Type: Zeeman AA
Slitwidth: 0.7 nm
Wavelength: 228.8 nm
Measurement: Peak Area
Integration Time: 6.0 sec
BOC Time: 5 sec BOC=Background Offset
Correction: Zeeman Graphite Furnace
(Perkin-Elmer Model HGA-600)

Step	Ramp time (sec)	Hold time (sec)	Temp. (°C)	Argon flow (mL/min)	Read (sec)
1) Predry	5	10	90	300	
2) Dry	30	10	140	300	
3) Char	10	20	900	300	
4) Cool Down	1	8	30	300	
5) Atomize	0	5	1600	0	-1
6) Burnout	1	8	2500	300	

[Statutory Authority: Chapter 49.17 RCW. 93-21-075 (Order 93-06), § 296-62-07449, filed 10/20/93, effective 12/1/93; 93-07-044 (Order 93-01), § 296-62-07449, filed 3/13/93, effective 4/27/93.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 296-62-07451 A short description of Appendix F to 29 CFR 1910.1027—Nonmandatory protocol for biological monitoring. Appendix F is not included in this standard due to limited employer/employee application. The fol-

lowing is a brief synopsis of the content of Appendix F to 29 CFR 1910.1027, Cadmium.

(1) The medical monitoring program for cadmium requires that blood and urine samples must be collected at defined intervals from workers by physicians responsible for medical monitoring. These samples are sent to commercial laboratories that perform the required analyses and report results of these analyses to the responsible physicians. To ensure the accuracy and reliability of these laboratory analyses, the laboratories to which samples are submitted should participate in an ongoing and efficacious proficiency testing program.

(2) This nonmandatory protocol is intended to provide guidelines and recommendations for physicians and laboratories to improve the accuracy and reliability of the procedures used to analyze the biological samples collected as part of the medical monitoring program for cadmium. This protocol provides procedures for characterizing and maintaining the quality of analytic results derived from the analyses of cadmium in blood (CDB), cadmium in urine (CDU), and beta-2-microglobulin in urine (B2MU) by commercial laboratories. Laboratories conforming to the provisions of this nonmandatory protocol shall be known as "participating laboratories."

(3) This protocol describes procedures that may be used by the responsible physicians to identify laboratories most likely to be proficient in the analysis of samples used in the biological monitoring of cadmium. It also provides procedures for record keeping and reporting by laboratories participating in proficiency testing programs, and recommendations to assist these physicians in interpreting analytical results determined by participating laboratories.

(4) For those needing Appendix F, 29 CFR 1910.1027, in its entirety, a copy may be obtained by request to:

Department of Labor and Industries
Division of Industrial Safety and Health
Standards and Information
Post Office Box 44620
Olympia, Washington 98504-4620
or telephone (360) 956-5527

[Statutory Authority: Chapter 49.17 RCW. 93-07-044 (Order 93-01), § 296-62-07451, filed 3/13/93, effective 4/27/93.]

WAC 296-62-07460 Butadiene. (1) Scope and application.

(a) This section applies to all occupational exposures to 1,3-Butadiene (BD), Chemical Abstracts Service Registry No. 106-99-0, except as provided in (b) of this subsection.

(b)(i) Except for the recordkeeping provisions in subsection (13)(a) of this section, this section does not apply to the processing, use, or handling of products containing BD or to other work operations and streams in which BD is present where objective data are reasonably relied upon that demonstrate the work operation or the product or the group of products or operations to which it belongs may not reasonably be foreseen to release BD in airborne concentrations at or above the action level or in excess of the STEL under the expected conditions of processing, use, or handling that will cause the greatest possible release or in any plausible accident.

(ii) This section also does not apply to work operations, products or streams where the only exposure to BD is from

liquid mixtures containing 0.1% or less of BD by volume or the vapors released from such liquids, unless objective data become available that show that airborne concentrations generated by such mixtures can exceed the action level or STEL under reasonably predictable conditions of processing, use or handling that will cause the greatest possible release.

(iii) Except for labeling requirements and requirements for emergency response, this section does not apply to the storage, transportation, distribution or sale of BD or liquid mixtures in intact containers or in transportation pipelines sealed in such a manner as to fully contain BD vapors or liquids.

(c) Where products or processes containing BD are exempted under (b) of this subsection, the employer shall maintain records of the objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in subsection (13)(a) of this section.

(2) Definitions: For the purpose of this section, the following definitions shall apply:

"Action level" means a concentration of airborne BD of 0.5 ppm calculated as an 8-hour time-weighted average.

"Director" means the director of the department of labor and industries, or authorized representatives.

"Authorized person" means any person specifically designated by the employer, whose duties require entrance into a regulated area, or a person entering such an area as a designated representative of employees to exercise the right to observe monitoring and measuring procedures under subsection (4)(h) of this section, or a person designated under the WISH Act or regulations issued under the WISH Act to enter a regulated area.

"1,3-Butadiene" means an organic compound with chemical formula $\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$ that has a molecular weight of approximately 54.15 gm/mole.

"Business day" means any Monday through Friday, except those days designated as federal, state, local or company specific holidays.

"Complete blood count (CBC)" means laboratory tests performed on whole blood specimens and includes the following: White blood cell count (WBC), hematocrit (Hct), red blood cell count (RBC), hemoglobin (Hgb), differential count of white blood cells, red blood cell morphology, red blood cell indices, and platelet count.

"Day" means any part of a calendar day.

"Emergency situation" means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment that may or does result in an uncontrolled significant release of BD.

"Employee exposure" means exposure of a worker to airborne concentrations of BD which would occur if the employee were not using respiratory protective equipment.

"Objective data" means monitoring data, or mathematical modelling or calculations based on composition, chemical and physical properties of a material, stream or product.

"Permissible exposure limits (PELs)" means either the 8-hour time-weighted average (8-hr TWA) exposure or the short-term exposure limit (STEL).

"Physician or other licensed health care professional" is an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to

independently provide or be delegated the responsibility to provide one or more of the specific health care services required by (k) of this subsection.

"Regulated area" means any area where airborne concentrations of BD exceed or can reasonably be expected to exceed the 8-hour time-weighted average (8-hr TWA) exposure of 1 ppm or the short-term exposure limit (STEL) of 5 ppm for 15 minutes.

"This section" means this 1,3-butadiene standard.

(3) Permissible exposure limits (PELs).

(a) Time-weighted average (TWA) limit. The employer shall ensure that no employee is exposed to an airborne concentration of BD in excess of one part BD per million parts of air (ppm) measured as an eight (8)-hour time-weighted average.

(b) Short-term exposure limit (STEL). The employer shall ensure that no employee is exposed to an airborne concentration of BD in excess of five parts of BD per million parts of air (5 ppm) as determined over a sampling period of fifteen minutes.

(4) Exposure monitoring.

(a) General.

(i) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the 8-hour TWA and 15-minute short-term exposures of each employee.

(ii) Representative 8-hour TWA employee exposure shall be determined on the basis of one or more samples representing full-shift exposure for each shift and for each job classification in each work area.

(iii) Representative 15-minute short-term employee exposures shall be determined on the basis of one or more samples representing 15-minute exposures associated with operations that are most likely to produce exposures above the STEL for each shift and for each job classification in each work area.

(iv) Except for the initial monitoring required under (b) of this subsection, where the employer can document that exposure levels are equivalent for similar operations on different work shifts, the employer need only determine representative employee exposure for that operation from the shift during which the highest exposure is expected.

(b) Initial monitoring.

(i) Each employer who has a workplace or work operation covered by this section, shall perform initial monitoring to determine accurately the airborne concentrations of BD to which employees may be exposed, or shall rely on objective data pursuant to subsection (1)(b)(i) of this section to fulfill this requirement.

(ii) Where the employer has monitored within two years prior to the effective date of this section and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of (b)(i) of this subsection, provided that the conditions under which the initial monitoring was conducted have not changed in a manner that may result in new or additional exposures.

(c) Periodic monitoring and its frequency.

(i) If the initial monitoring required by (b) of this subsection reveals employee exposure to be at or above the action

level but at or below both the 8-hour TWA limit and the STEL, the employer shall repeat the representative monitoring required by (a) of this subsection every twelve months.

(ii) If the initial monitoring required by (b) of this subsection reveals employee exposure to be above the 8-hour TWA limit, the employer shall repeat the representative monitoring required by (a)(ii) of this subsection at least every three months until the employer has collected two samples per quarter (each at least 7 days apart) within a two-year period, after which such monitoring must occur at least every six months.

(iii) If the initial monitoring required by (b) of this subsection reveals employee exposure to be above the STEL, the employer shall repeat the representative monitoring required by (a)(iii) of this subsection at least every three months until the employer has collected two samples per quarter (each at least 7 days apart) within a two-year period, after which such monitoring must occur at least every six months.

(iv) The employer may alter the monitoring schedule from every six months to annually for any required representative monitoring for which two consecutive measurements taken at least 7 days apart indicate that employee exposure has decreased to or below the 8-hour TWA, but is at or above the action level.

(d) Termination of monitoring.

(i) If the initial monitoring required by (b) of this subsection reveals employee exposure to be below the action level and at or below the STEL, the employer may discontinue the monitoring for employees whose exposures are represented by the initial monitoring.

(ii) If the periodic monitoring required by (c) of this subsection reveals that employee exposures, as indicated by at least two consecutive measurements taken at least 7 days apart, are below the action level and at or below the STEL, the employer may discontinue the monitoring for those employees who are represented by such monitoring.

(e) Additional monitoring.

(i) The employer shall institute the exposure monitoring required under subsection (4) of this section whenever there has been a change in the production, process, control equipment, personnel or work practices that may result in new or additional exposures to BD or when the employer has any reason to suspect that a change may result in new or additional exposures.

(ii) Whenever spills, leaks, ruptures or other breakdowns occur that may lead to employee exposure above the 8-hr TWA limit or above the STEL, the employer shall monitor (using leak source, such as direct reading instruments, area or personal monitoring), after the cleanup of the spill or repair of the leak, rupture or other breakdown, to ensure that exposures have returned to the level that existed prior to the incident.

(f) Accuracy of monitoring.

Monitoring shall be accurate, at a confidence level of 95 percent, to within plus or minus 25 percent for airborne concentrations of BD at or above the 1 ppm TWA limit and to within plus or minus 35 percent for airborne concentrations of BD at or above the action level of 0.5 ppm and below the 1 ppm TWA limit.

(g) Employee notification of monitoring results.

(i) The employer shall, within 5 business days after the receipt of the results of any monitoring performed under this section, notify the affected employees of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) The employer shall, within 15 business days after receipt of any monitoring performed under this section indicating the 8-hour TWA or STEL has been exceeded, provide the affected employees, in writing, with information on the corrective action being taken by the employer to reduce employee exposure to or below the 8-hour TWA or STEL and the schedule for completion of this action.

(h) Observation of monitoring.

(i) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to BD conducted in accordance with this section.

(ii) Observation procedures. When observation of the monitoring of employee exposure to BD requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer at no cost with protective clothing and equipment, and shall ensure that the observer uses this equipment and complies with all other applicable safety and health procedures.

(5) Regulated areas.

(a) The employer shall establish a regulated area whenever occupational exposures to airborne concentrations of BD exceed or can reasonably be expected to exceed the permissible exposure limits, either the 8-hr TWA or the STEL.

(b) Access to regulated areas shall be limited to authorized persons.

(c) Regulated areas shall be demarcated from the rest of the workplace in any manner that minimizes the number of employees exposed to BD within the regulated area.

(d) An employer at a multi-employer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to other employers with work operations at that worksite whose employees may have access to these areas.

(6) Methods of compliance.

(a) Engineering controls and work practices.

(i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the PELs, except to the extent that the employer can establish that these controls are not feasible or where subsection (8)(a)(i) of this section applies.

(ii) Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the 8-hour TWA or STEL, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of subsection (8) of this section.

(b) Compliance plan.

(i) Where any exposures are over the PELs, the employer shall establish and implement a written plan to reduce employee exposure to or below the PELs primarily by means of engineering and work practice controls, as required by (a) of this subsection, and by the use of respiratory protection

where required or permitted under this section. No compliance plan is required if all exposures are under the PELs.

(ii) The written compliance plan shall include a schedule for the development and implementation of the engineering controls and work practice controls including periodic leak detection surveys.

(iii) Copies of the compliance plan required in (b) of this subsection shall be furnished upon request for examination and copying to the director, affected employees and designated employee representatives. Such plans shall be reviewed at least every 12 months, and shall be updated as necessary to reflect significant changes in the status of the employer's compliance program.

(iv) The employer shall not implement a schedule of employee rotation as a means of compliance with the PELs.

(7) Exposure goal program.

(a) For those operations and job classifications where employee exposures are greater than the action level, in addition to compliance with the PELs, the employer shall have an exposure goal program that is intended to limit employee exposures to below the action level during normal operations.

(b) Written plans for the exposure goal program shall be furnished upon request for examination and copying to the director, affected employees and designated employee representatives.

(c) Such plans shall be updated as necessary to reflect significant changes in the status of the exposure goal program.

(d) Respirator use is not required in the exposure goal program.

(e) The exposure goal program shall include the following items unless the employer can demonstrate that the item is not feasible, will have no significant effect in reducing employee exposures, or is not necessary to achieve exposures below the action level:

(i) A leak prevention, detection, and repair program.

(ii) A program for maintaining the effectiveness of local exhaust ventilation systems.

(iii) The use of pump exposure control technology such as, but not limited to, mechanical double-sealed or seal-less pumps.

(iv) Gauging devices designed to limit employee exposure, such as magnetic gauges on rail cars.

(v) Unloading devices designed to limit employee exposure, such as a vapor return system.

(vi) A program to maintain BD concentration below the action level in control rooms by use of engineering controls.

(8) Respiratory protection.

(a) General. The employer shall provide respirators that comply with the requirements of this subsection, at no cost to each affected employee, and ensure that each affected employee uses such respirator where required by this section. Respirators shall be used in the following circumstances:

(i) During the time interval necessary to install or implement feasible engineering and work practice controls;

(ii) In nonroutine work operations which are performed infrequently and in which exposures are limited in duration;

(iii) In work situations where feasible engineering controls and work practice controls are not yet sufficient to reduce exposures to or below the PELs; or

(iv) In emergencies.

(b) Respirator selection.

(i) Where respirators are required, the employer shall select and provide the appropriate respirator as specified in Table 1 of this section, and ensure its use.

(ii) The employer shall select respirators from among those approved by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 42 CFR Part 84, "Respiratory Protective Devices." Air purifying respirators shall have filter element(s) approved by NIOSH for organic vapors or BD.

(iii) If an employee whose job requires the use of a respirator cannot use a negative pressure respirator, the employee must be provided with a respirator having less breathing resistance, such as a powered air-purifying respirator or supplied air respirator, if the employee is able to use it and if it will provide adequate protection.

(c) Respirator program. Where respiratory protection is required, the employer shall institute a respirator program in accordance with WAC 296-62-071.

(d) Respirator use.

(i) Where air-purifying respirators are used, the employer shall replace the air-purifying filter element(s) according to the replacement life interval set for the class of respirator listed in Table 1 in (e) of this subsection and at the beginning of each work shift.

(ii) In lieu of the replacement intervals listed in Table 1, the employer may replace cartridges or canisters at 90% of the expiration of service life, provided the employer can demonstrate that employees will be adequately protected. BD breakthrough data relied upon by the employer must derive from tests conducted under worst case conditions of humidity, temperature, and air flow rate through the filter element. The employer shall describe the data supporting the

cartridge/canister change schedule and the basis for reliance on the data in the employer's respirator program.

(iii) A label shall be attached to the filter element(s) to indicate the date and time it is first installed on the respirator. If an employee detects the odor of BD, the employer shall replace the air-purifying element(s) immediately.

(iv) If a NIOSH-approved end of service life indicator (ESLI) for BD becomes available for an air-purifying filter element, the element may be used until such time as the indicator shows no further useful service life or until replaced at the beginning of the next work shift, whichever comes first. If an employee detects the odor of BD, the employer shall replace the air-purifying element(s) immediately.

(v) The employer shall permit employees who wear respirators to leave the regulated area to wash their faces and respirator facepieces as necessary in order to prevent skin irritation associated with respirator use or to change the filter elements of air-purifying respirators whenever they detect a change in breathing resistance or whenever the odor of BD is detected.

(e) Respirator fit testing.

(i) The employer shall perform either qualitative fit testing (QLFT) or quantitative fit testing (QNFT), as required in Appendix E to this section, at the time of initial fitting and at least annually thereafter for employees who wear tight-fitting negative pressure respirators. Fit testing shall be used to select a respirator facepiece which exhibits minimum leakage and provides the required protection as prescribed in Table 1 of this section.

(ii) For each employee wearing a tight-fitting full facepiece negative pressure respirator who is exposed to airborne concentrations of BD that exceed 10 times the TWA PEL (10 ppm), the employer shall perform quantitative fit testing as required in Appendix E to this section, at the time of initial fitting and at least annually thereafter.

Table 1. - Minimum Requirements for Respiratory Protection for Airborne BD

Concentration of Airborne BD (ppm) or condition of use	Minimum required respirator
Less than or equal to 5 ppm(5 times PEL)	(a) Air-purifying half mask or full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 4 hours.
Less than or equal to 10 ppm(10 times PEL)	(a) Air-purifying half mask or full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 3 hours.
Less than or equal to 25 ppm(25 times PEL)	(a) Air-purifying full facepiece respirator equipped with approved BD or organic vapor cartridges or canisters. Cartridges or canisters shall be replaced every 2 hours. (b) Any powered air-purifying respirator equipped with approved BD or organic vapor cartridges. PAPR cartridges shall be replaced every 2 hours. (c) Continuous flow supplied air respirator equipped with a hood or helmet.
Less than or equal to 50 ppm(50 times PEL)	(a) Air-purifying full facepiece respirator equipped with approved BD or organic vapor cartridges or

Concentration of Airborne BD (ppm) or condition of use	Minimum required respirator
Less than or equal to 1,000 ppm (1,000 times PEL)	canisters. Cartridges or canisters shall be replaced every 1 hour.
Greater than 1,000 ppm	<p>(b) Powered air purifying respirator equipped with a tight-fitting facepiece and an approved BD or organic vapor cartridges. PAPR cartridges shall be replaced every 1 hour.</p> <p>(a) Supplied air respirator equipped with a half mask or full facepiece and operated in a pressure demand or other positive pressure mode.</p> <p>(a) Self-contained breathing unknown concentration, or apparatus equipped with a fire fighting full facepiece and operated in a pressure demand or other positive pressure mode.</p> <p>(b) Any supplied air respirator equipped with a full facepiece and operated in a pressure demand or other positive pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure demand or other positive pressure mode.</p> <p>(a) Any positive pressure self-contained breathing apparatus with an appropriate service life.</p> <p>(b) Any air-purifying full facepiece respirator equipped with a front or back mounted BD or organic vapor canister.</p>
Escape from IDLH Conditions	regardless of when the employee is transferred, whose work histories suggest exposure to BD:
<p>Notes: Respirators approved for use in higher concentrations are permitted to be used in lower concentrations. Full facepiece is required when eye irritation is anticipated.</p>	(A) At or above the PELs on 30 or more days a year for 10 or more years;
(iii) The employer shall ensure that employees wearing tight-fitting respirators perform a facepiece seal fit check to ensure that a proper facepiece seal is obtained prior to entry into a BD atmosphere. The recommended positive or negative pressure fit check procedures listed in Appendix E to this section or the respirator manufacturer's recommended fit check procedure shall be used.	(B) At or above the action level on 60 or more days a year for 10 or more years; or
(9) Protective clothing and equipment. Where appropriate to prevent eye contact and limit dermal exposure to BD, the employer shall provide protective clothing and equipment at no cost to the employee and shall ensure its use. Eye and face protection shall meet the requirements of WAC 296-24-078.	(C) Above 10 ppm on 30 or more days in any past year; and
(10) Emergency situations. Written plan. A written plan for emergency situations shall be developed, or an existing plan shall be modified, to contain the applicable elements specified in WAC 296-24-567, Employee emergency plans and fire prevention plans, and in WAC 296-62-3112, hazardous waste operations and emergency responses, for each workplace where there is a possibility of an emergency.	(iii) Each employee exposed to BD following an emergency situation.
(11) Medical screening and surveillance.	(b) Program administration.
(a) Employees covered. The employer shall institute a medical screening and surveillance program as specified in this subsection for:	(i) The employer shall ensure that the health questionnaire, physical examination and medical procedures are provided without cost to the employee, without loss of pay, and at a reasonable time and place.
(i) Each employee with exposure to BD at concentrations at or above the action level on 30 or more days or for employees who have or may have exposure to BD at or above the PELs on 10 or more days a year;	(ii) Physical examinations, health questionnaires, and medical procedures shall be performed or administered by a physician or other licensed health care professional.
(ii) Employers (including successor owners) shall continue to provide medical screening and surveillance for employees, even after transfer to a non-BD exposed job and	(iii) Laboratory tests shall be conducted by an accredited laboratory.
(1999 Ed.)	(c) Frequency of medical screening activities. The employer shall make medical screening available on the following schedule:
	(i) For each employee covered under (a)(i) and (ii) of this subsection, a health questionnaire and complete blood count (CBC) with differential and platelet count every year, and a physical examination as specified below:
	(A) An initial physical examination that meets the requirements of this rule, if twelve months or more have elapsed since the last physical examination conducted as part of a medical screening program for BD exposure;
	(B) Before assumption of duties by the employee in a job with BD exposure;
	(C) Every 3 years after the initial physical examination;

(D) At the discretion of the physician or other licensed health care professional reviewing the annual health questionnaire and CBC;

(E) At the time of employee reassignment to an area where exposure to BD is below the action level, if the employee's past exposure history does not meet the criteria of (a)(ii) of this subsection for continued coverage in the screening and surveillance program, and if twelve months or more have elapsed since the last physical examination; and

(F) At termination of employment if twelve months or more have elapsed since the last physical examination.

(ii) Following an emergency situation, medical screening shall be conducted as quickly as possible, but not later than 48 hours after the exposure.

(iii) For each employee who must wear a respirator, physical ability to perform the work and use the respirator must be determined as required by WAC 296-62-071.

(d) Content of medical screening.

(i) Medical screening for employees covered by (a)(i) and (ii) of this subsection shall include:

(A) A baseline health questionnaire that includes a comprehensive occupational and health history and is updated annually. Particular emphasis shall be placed on the hematopoietic and reticuloendothelial systems, including exposure to chemicals, in addition to BD, that may have an adverse effect on these systems, the presence of signs and symptoms that might be related to disorders of these systems, and any other information determined by the examining physician or other licensed health care professional to be necessary to evaluate whether the employee is at increased risk of material impairment of health from BD exposure. Health questionnaires shall consist of the sample forms in Appendix C to this section, or be equivalent to those samples;

(B) A complete physical examination, with special emphasis on the liver, spleen, lymph nodes, and skin;

(C) A CBC; and

(D) Any other test which the examining physician or other licensed health care professional deems necessary to evaluate whether the employee may be at increased risk from exposure to BD.

(ii) Medical screening for employees exposed to BD in an emergency situation shall focus on the acute effects of BD exposure and at a minimum include: A CBC within 48 hours of the exposure and then monthly for three months; and a physical examination if the employee reports irritation of the eyes, nose, throat, lungs, or skin, blurred vision, coughing, drowsiness, nausea, or headache. Continued employee participation in the medical screening and surveillance program, beyond these minimum requirements, shall be at the discretion of the physician or other licensed health care professional.

(e) Additional medical evaluations and referrals.

(i) Where the results of medical screening indicate abnormalities of the hematopoietic or reticuloendothelial systems, for which a nonoccupational cause is not readily apparent, the examining physician or other licensed health care professional shall refer the employee to an appropriate specialist for further evaluation and shall make available to the specialist the results of the medical screening.

(ii) The specialist to whom the employee is referred under this subsection shall determine the appropriate content for the medical evaluation, e.g., examinations, diagnostic tests and procedures, etc.

(f) Information provided to the physician or other licensed health care professional. The employer shall provide the following information to the examining physician or other licensed health care professional involved in the evaluation:

(i) A copy of this section including its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's BD exposure;

(iii) The employee's actual or representative BD exposure level during employment tenure, including exposure incurred in an emergency situation;

(iv) A description of pertinent personal protective equipment used or to be used; and

(v) Information, when available, from previous employment-related medical evaluations of the affected employee which is not otherwise available to the physician or other licensed health care professional or the specialist.

(g) The written medical opinion.

(i) For each medical evaluation required by this section, the employer shall ensure that the physician or other licensed health care professional produces a written opinion and provides a copy to the employer and the employee within 15 business days of the evaluation. The written opinion shall be limited to the following information:

(A) The occupationally pertinent results of the medical evaluation;

(B) A medical opinion concerning whether the employee has any detected medical conditions which would place the employee's health at increased risk of material impairment from exposure to BD;

(C) Any recommended limitations upon the employee's exposure to BD; and

(D) A statement that the employee has been informed of the results of the medical evaluation and any medical conditions resulting from BD exposure that require further explanation or treatment.

(ii) The written medical opinion provided to the employer shall not reveal specific records, findings, and diagnoses that have no bearing on the employee's ability to work with BD.

Note: This provision does not negate the ethical obligation of the physician or other licensed health care professional to transmit any other adverse findings directly to the employee.

(h) Medical surveillance.

(i) The employer shall ensure that information obtained from the medical screening program activities is aggregated (with all personal identifiers removed) and periodically reviewed, to ascertain whether the health of the employee population of that employer is adversely affected by exposure to BD.

(ii) Information learned from medical surveillance activities must be disseminated to covered employees, as defined in (a) of this subsection, in a manner that ensures the confidentiality of individual medical information.

(12) Communication of BD hazards to employees.

(a) Hazard communication. The employer shall communicate the hazards associated with BD exposure in accordance with the requirements of the hazard communication standard, WAC 296-62-054.

(b) Employee information and training.

(i) The employer shall provide all employees exposed to BD with information and training in accordance with the requirements of the hazard communication standard, WAC 296-62-054.

(ii) The employer shall institute a training program for all employees who are potentially exposed to BD at or above the action level or the STEL, ensure employee participation in the program and maintain a record of the contents of such program.

(iii) Training shall be provided prior to or at the time of initial assignment to a job potentially involving exposure to BD at or above the action level or STEL and at least annually thereafter.

(iv) The training program shall be conducted in a manner that the employee is able to understand. The employer shall ensure that each employee exposed to BD over the action level or STEL is informed of the following:

(A) The health hazards associated with BD exposure, and the purpose and a description of the medical screening and surveillance program required by this section;

(B) The quantity, location, manner of use, release, and storage of BD and the specific operations that could result in exposure to BD, especially exposures above the PEL or STEL;

(C) The engineering controls and work practices associated with the employee's job assignment, and emergency procedures and personal protective equipment;

(D) The measures employees can take to protect themselves from exposure to BD;

(E) The contents of this standard and its appendices; and

(F) The right of each employee exposed to BD at or above the action level or STEL to obtain:

(I) Medical examinations as required by subsection (10) of this section at no cost to the employee;

(II) The employee's medical records required to be maintained by subsection (13)(d) of this section; and

(III) All air monitoring results representing the employee's exposure to BD and required to be kept by subsection (13)(b) of this section.

(c) Access to information and training materials.

(i) The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees and their designated representatives and shall provide a copy if requested.

(ii) The employer shall provide to the director, or the designated employee representatives, upon request, all materials relating to the employee information and the training program.

(13) Recordkeeping.

(a) Objective data for exemption from initial monitoring.

(i) Where the processing, use, or handling of products or streams made from or containing BD are exempted from other requirements of this section under subsection (1)(b) of this section, or where objective data have been relied on in lieu of initial monitoring under subsection (4)(b)(ii) of this

section, the employer shall establish and maintain a record of the objective data reasonably relied upon in support of the exemption.

(ii) This record shall include at least the following information:

(A) The product or activity qualifying for exemption;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and analysis of the material for the release of BD;

(D) A description of the operation exempted and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(b) Exposure measurements.

(i) The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to BD as prescribed in subsection (4) of this section.

(ii) The record shall include at least the following information:

(A) The date of measurement;

(B) The operation involving exposure to BD which is being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy;

(D) Number, duration, and results of samples taken;

(E) Type of protective devices worn, if any;

(F) Name, Social Security number and exposure of the employees whose exposures are represented; and

(G) The written corrective action and the schedule for completion of this action required by subsection (4)(g)(ii) of this section.

(iii) The employer shall maintain this record for at least 30 years in accordance with WAC 296-62-052.

(c) Respirator fit test.

(i) The employer shall establish a record of the fit tests administered to an employee including:

(A) The name of the employee;

(B) Type of respirator;

(C) Brand and size of respirator;

(D) Date of test; and

(E) Where QNFT is used, the fit factor, strip chart recording or other recording of the results of the test.

(ii) Fit test records shall be maintained for respirator users until the next fit test is administered.

(d) Medical screening and surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical screening and surveillance under this section.

(ii) The record shall include at least the following information:

(A) The name and Social Security number of the employee;

(B) Physician's or other licensed health care professional's written opinions as described in subsection (11)(f) of this section;

(C) A copy of the information provided to the physician or other licensed health care professional as required by subsections (11)(f) of this section.

(iii) Medical screening and surveillance records shall be maintained for each employee for the duration of employment plus 30 years, in accordance with WAC 296-62-052.

(e) Availability.

(i) The employer, upon written request, shall make all records required to be maintained by this section available for examination and copying to the director.

(ii) Access to records required to be maintained by (a) through (c) of this subsection shall be granted in accordance with WAC 296-62-05209.

(f) Transfer of records.

(i) Whenever the employer ceases to do business, the employer shall transfer records required by this section to the successor employer. The successor employer shall receive and maintain these records. If there is no successor employer, the employer shall notify the director, at least three months prior to disposal, and transmit them to the director if requested by the director within that period.

(ii) The employer shall transfer medical and exposure records as set forth in WAC 296-62-05215.

(14) Dates.

(a) Effective date. This section shall become effective (day, month), 1997.

(b) Start-up dates.

(i) The initial monitoring required under subsection (4)(b) of this section shall be completed immediately or within sixty days of the introduction of BD into the workplace.

(ii) The requirements of subsections (3) through (13) of this section, including feasible work practice controls but not including engineering controls specified in subsection (6)(a) of this section, shall be complied with immediately.

(iii) Engineering controls specified by subsection (6)(a) of this section shall be implemented by February 4, 1999, and the exposure goal program specified in subsection (7) of this section shall be implemented by February 4, 2000.

(15) Appendices.

(a) Appendix E to this section is mandatory.

(b) Appendices A, B, C, D, and F to this section are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

Appendix A. Substance Safety Data Sheet For 1,3-Butadiene (Non-Mandatory)

(1) Substance Identification.

(a) Substance: 1,3-Butadiene ($\text{CH}_2=\text{CH}-\text{CH}=\text{CH}_2$).

(b) Synonyms: 1,3-Butadiene (BD); butadiene; biethylene; bi-vinyl; divinyl; butadiene-1,3; buta-1,3-diene; erythrene; NCI-C50602; CAS-106-99-0.

(c) BD can be found as a gas or liquid.

(d) BD is used in production of styrene-butadiene rubber and polybutadiene rubber for the tire industry. Other uses include copolymer latexes for carpet backing and paper coating, as well as resins and polymers for pipes and automobile and appliance parts. It is also used as an intermediate in the production of such chemicals as fungicides.

(e) Appearance and odor: BD is a colorless, non-corrosive, flammable gas with a mild aromatic odor at standard ambient temperature and pressure.

(f) Permissible exposure: Exposure may not exceed 1 part BD per million parts of air averaged over the 8-hour workday, nor may short-term exposure exceed 5 parts of BD per million parts of air averaged over any 15-minute period in the 8-hour workday.

(2) Health Hazard Data.

(a) BD can affect the body if the gas is inhaled or if the liquid form, which is very cold (cryogenic), comes in contact with the eyes or skin.

(b) Effects of overexposure: Breathing very high levels of BD for a short time can cause central nervous system effects, blurred vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. There are no recorded cases of accidental exposures at high levels that have caused death in humans, but this could occur. Breathing lower levels of BD may cause irritation of the eyes, nose, and throat. Skin contact with liquefied BD can cause irritation and frostbite.

(c) Long-term (chronic) exposure: BD has been found to be a potent carcinogen in rodents, inducing neoplastic lesions at multiple target sites in mice and rats. A recent study of BD-exposed workers showed that exposed workers have an increased risk of developing leukemia. The risk of leukemia increases with increased exposure to BD. OSHA has concluded that there is strong evidence that workplace exposure to BD poses an increased risk of death from cancers of the lymphohematopoietic system.

(d) Reporting signs and symptoms: You should inform your supervisor if you develop any of these signs or symptoms and suspect that they are caused by exposure to BD.

(3) Emergency First Aid Procedures.

In the event of an emergency, follow the emergency plan and procedures designated for your work area. If you have been trained in first aid procedures, provide the necessary first aid measures. If necessary, call for additional assistance from co-workers and emergency medical personnel.

(a) Eye and Skin Exposures: If there is a potential that liquefied BD can come in contact with eye or skin, face shields and skin protective equipment must be provided and used. If liquefied BD comes in contact with the eye, immediately flush the eyes with large amounts of water, occasionally lifting the lower and the upper lids. Flush repeatedly. Get medical attention immediately. Contact lenses should not be worn when working with this chemical. In the event of skin contact, which can cause frostbite, remove any contaminated clothing and flush the affected area repeatedly with large amounts of tepid water.

(b) Breathing: If a person breathes in large amounts of BD, move the exposed person to fresh air at once. If breathing has stopped, begin cardiopulmonary resuscitation (CPR) if you have been trained in this procedure. Keep the affected person warm and at rest. Get medical attention immediately.

(c) Rescue: Move the affected person from the hazardous exposure. If the exposed person has been overcome, call for help and begin emergency rescue procedures. Use extreme caution so that you do not become a casualty. Understand the plant's emergency rescue procedures and know the locations of rescue equipment before the need arises.

(4) Respirators and Protective Clothing.

(a) Respirators: Good industrial hygiene practices recommend that engineering and work practice controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when these controls fail and need to be supplemented or during brief, non-routine, intermittent exposure. Respirators may also be used in situations involving non-routine work operations which are performed infrequently and in which exposures are limited in duration, and in emergency situations. In some instances cartridge respirator use is allowed, but only with strict time constraints. For example, at exposure below 5 ppm BD, a cartridge (or canister) respirator, either full or half face, may be used, but the cartridge must be replaced at least every 4 hours, and it must be replaced every 3 hours when the exposure is between 5 and 10 ppm.

If the use of respirators is necessary, the only respirators permitted are those that have been approved by the National Institute for Occupational Safety and Health (NIOSH). In addition to respirator selection, a complete respiratory protection program must be instituted which includes regular training, maintenance, fit testing, inspection, cleaning, and evaluation of respirators. If you can smell BD while wearing a respirator, proceed immediately to fresh air, and change cartridge (or canister) before re-entering an area where there is BD exposure. If you experience difficulty in breathing while wearing a respirator, tell your supervisor.

(b) Protective Clothing: Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent the skin from becoming frozen by contact with liquefied BD (or a vessel containing liquid BD).

Employees should be provided with and required to use splash-proof safety goggles where liquefied BD may contact the eyes.

(5) Precautions for Safe Use, Handling, and Storage.

(a) Fire and Explosion Hazards: BD is a flammable gas and can easily form explosive mixtures in air. It has a lower explosive limit of 2%, and an upper explosive limit of 11.5%. It has an autoignition temperature of 420 deg. C (788 deg. F). Its vapor is heavier than air (vapor density, 1.9) and may travel a considerable distance to a source of ignition and flash back. Usually it contains inhibitors to prevent self-polymerization (which is accompanied by evolution of heat) and to prevent formation of explosive peroxides. At elevated temperatures, such as in fire conditions, polymerization may take place. If the polymerization takes place in a container, there is a possibility of violent rupture of the container.

(b) Hazard: Slightly toxic. Slight respiratory irritant. Direct contact of liquefied BD on skin may cause freeze burns and frostbite.

(c) Storage: Protect against physical damage to BD containers. Outside or detached storage of BD containers is preferred. Inside storage should be in a cool, dry, well-ventilated, noncombustible location, away from all possible

sources of ignition. Store cylinders vertically and do not stack. Do not store with oxidizing material.

(d) Usual Shipping Containers: Liquefied BD is contained in steel pressure apparatus.

(e) Electrical Equipment: Electrical installations in Class I hazardous locations, as defined in Article 500 of the National Electrical Code, should be in accordance with Article 501 of the Code. If explosion-proof electrical equipment is necessary, it shall be suitable for use in Group B. Group D equipment may be used if such equipment is isolated in accordance with Section 501-5(a) by sealing all conduit 1/2-inch size or larger. See Venting of Deflagrations (NFPA No. 68, 1994), National Electrical Code (NFPA No. 70, 1996), Static Electricity (NFPA No. 77, 1993), Lightning Protection Systems (NFPA No. 780, 1995), and Fire Hazard Properties of Flammable Liquids, Gases and Volatile Solids (NFPA No. 325, 1994).

(f) Fire Fighting: Stop flow of gas. Use water to keep fire-exposed containers cool. Fire extinguishers and quick drenching facilities must be readily available, and you should know where they are and how to operate them.

(g) Spill and Leak: Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until clean-up has been completed. If BD is spilled or leaked, the following steps should be taken:

(i) Eliminate all ignition sources.

(ii) Ventilate area of spill or leak.

(iii) If in liquid form, for small quantities, allow to evaporate in a safe manner.

(iv) Stop or control the leak if this can be done without risk. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place and repair the leak or allow the cylinder to empty.

(h) Disposal: This substance, when discarded or disposed of, is a hazardous waste according to Federal regulations (40 CFR part 261). It is listed as hazardous waste number D001 due to its ignitability. The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with 40 CFR parts 262, 263, 264, 268 and 270. Disposal can occur only in properly permitted facilities. Check state and local regulation of any additional requirements as these may be more restrictive than federal laws and regulation.

(i) You should not keep food, beverages, or smoking materials in areas where there is BD exposure, nor should you eat or drink in such areas.

(j) Ask your supervisor where BD is used in your work area and ask for any additional plant safety and health rules.

(6) Medical Requirements.

Your employer is required to offer you the opportunity to participate in a medical screening and surveillance program if you are exposed to BD at concentrations exceeding the action level (0.5 ppm BD as an 8-hour TWA) on 30 days or more a year, or at or above the 8-hr TWA (1 ppm) or STEL (5 ppm for 15 minutes) on 10 days or more a year. Exposure for any part of a day counts. If you have had exposure to BD in the past, but have been transferred to another job, you may still be eligible to participate in the medical screening and surveillance program.

The WISHA rule specifies the past exposures that would qualify you for participation in the program. These past exposure are work histories that suggest the following:

- (a) That you have been exposed at or above the PELs on 30 days a year for 10 or more years;
- (b) That you have been exposed at or above the action level on 60 days a year for 10 or more years; or
- (c) That you have been exposed above 10 ppm on 30 days in any past year.

Additionally, if you are exposed to BD in an emergency situation, you are eligible for a medical examination within 48 hours. The basic medical screening program includes a health questionnaire, physical examination, and blood test. These medical evaluations must be offered to you at a reasonable time and place, and without cost or loss of pay.

(7) Observation of Monitoring.

Your employer is required to perform measurements that are representative of your exposure to BD and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear, the protective clothing and equipment.

(8) Access to Information.

(a) Each year, your employer is required to inform you of the information contained in this appendix. In addition, your employer must instruct you in the proper work practices for using BD, emergency procedures, and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to BD. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits and of the schedule to implement these actions.

(c) Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least thirty (30) years.

(d) Your employer is required to release your exposure and medical records to you or your representative upon your request.

Appendix B. Substance Technical Guidelines for 1,3-Butadiene (Non-Mandatory)

(1) Physical and Chemical Data.

(a) Substance identification:

(i) Synonyms: 1,3-Butadiene (BD); butadiene; biethylenic; bivinyl; divinyl; butadiene-1,3; buta-1,3-diene; erythrene; NCI-C50620; CAS-106-99-0.

(ii) Formula: $(CH_2)=CH-CH=CH_2$.

(iii) Molecular weight: 54.1.

(b) Physical data:

(i) Boiling point (760 mm Hg): -4.7 deg. C (23.5 deg. F).

(ii) Specific gravity (water=1): 0.62 at 20 deg. C (68 deg. F).

- (iii) Vapor density (air=1 at boiling point of BD): 1.87.
- (iv) Vapor pressure at 20 deg. C (68 deg. F): 910 mm Hg.
- (v) Solubility in water, g/100 g water at 20 deg. C (68 deg. F): 0.05.

(vi) Appearance and odor: Colorless, flammable gas with a mildly aromatic odor. Liquefied BD is a colorless liquid with a mildly aromatic odor.

(2) Fire, Explosion, and Reactivity Hazard Data.

(a) Fire:

(i) Flash point: -76 deg. C (-105 deg. F) for take out; liquefied BD; Not applicable to BD gas.

(ii) Stability: A stabilizer is added to the monomer to inhibit formation of polymer during storage. Forms explosive peroxides in air in absence of inhibitor.

(iii) Flammable limits in air, percent by volume: Lower: 2.0; Upper: 11.5.

(iv) Extinguishing media: Carbon dioxide for small fires, polymer or alcohol foams for large fires.

(v) Special fire fighting procedures: Fight fire from protected location or maximum possible distance. Stop flow of gas before extinguishing fire. Use water spray to keep fire-exposed cylinders cool.

(vi) Unusual fire and explosion hazards: BD vapors are heavier than air and may travel to a source of ignition and flash back. Closed containers may rupture violently when heated.

(vii) For purposes of compliance with the requirements of WAC 296-24-330, BD is classified as a flammable gas. For example, 7,500 ppm, approximately one-fourth of the lower flammable limit, would be considered to pose a potential fire and explosion hazard.

(viii) For purposes of compliance with WAC 296-24-585, BD is classified as a Class B fire hazard.

(ix) For purposes of compliance with WAC 296-24-956, locations classified as hazardous due to the presence of BD shall be Class I.

(b) Reactivity:

(i) Conditions contributing to instability: Heat. Peroxides are formed when inhibitor concentration is not maintained at proper level. At elevated temperatures, such as in fire conditions, polymerization may take place.

(ii) Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions. The contacting of crude BD (not BD monomer) with copper and copper alloys may cause formations of explosive copper compounds.

(iii) Hazardous decomposition products: Toxic gases (such as carbon monoxide) may be released in a fire involving BD.

(iv) Special precautions: BD will attack some forms of plastics, rubber, and coatings. BD in storage should be checked for proper inhibitor content, for self-polymerization, and for formation of peroxides when in contact with air and iron. Piping carrying BD may become plugged by formation of rubbery polymer.

(c) Warning Properties:

(i) Odor Threshold: An odor threshold of 0.45 ppm has been reported in The American Industrial Hygiene Association (AIHA) Report, Odor Thresholds for Chemicals with Established Occupational Health Standards. (Ex. 32-28C).

(ii) Eye Irritation Level: Workers exposed to vapors of BD (concentration or purity unspecified) have complained of irritation of eyes, nasal passages, throat, and lungs. Dogs and rabbits exposed experimentally to as much as 6700 ppm for 7 1/2 hours a day for 8 months have developed no histologically demonstrable abnormality of the eyes.

(iii) Evaluation of Warning Properties: Since the mean odor threshold is about half of the 1 ppm PEL, and more than 10-fold below the 5 ppm STEL, most wearers of air purifying respirators should still be able to detect breakthrough before a significant overexposure to BD occurs.

(3) Spill, Leak, and Disposal Procedures.

(a) Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed. If BD is spilled or leaked, the following steps should be taken:

(i) Eliminate all ignition sources.

(ii) Ventilate areas of spill or leak.

(iii) If in liquid form, for small quantities, allow to evaporate in a safe manner.

(iv) Stop or control the leak if this can be done without risk. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place and repair the leak or allow the cylinder to empty.

(b) Disposal: This substance, when discarded or disposed of, is a hazardous waste according to Federal regula-

tions (40 CFR part 261). It is listed by the EPA as hazardous waste number D001 due to its ignitability. The transportation, storage, treatment, and disposal of this waste material must be conducted in compliance with 40 CFR parts 262, 263, 264, 268 and 270. Disposal can occur only in properly permitted facilities. Check state and local regulations for any additional requirements because these may be more restrictive than federal laws and regulations.

(4) Monitoring and Measurement Procedures.

(a) Exposure above the Permissible Exposure Limit (8-hr TWA) or Short-Term Exposure Limit (STEL):

(i) 8-hr TWA exposure evaluation: Measurements taken for the purpose of determining employee exposure under this standard are best taken with consecutive samples covering the full shift. Air samples must be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

(ii) STEL exposure evaluation: Measurements must represent 15 minute exposures associated with operations most likely to exceed the STEL in each job and on each shift.

(iii) Monitoring frequencies: Table 1 gives various exposure scenarios and their required monitoring frequencies, as required by the final standard for occupational exposure to butadiene.

Table 1. — Five Exposure Scenarios and Their Associated Monitoring Frequencies

Action Level	8-hr TWA	STEL	Required Monitoring Activity
—*	—	—	No 8-hr TWA or STEL monitoring required.
+*	—	—	No STEL monitoring required. Monitor 8-hr TWA annually.
+	—	—	No STEL monitoring required. Periodic monitoring 8-hr TWA, in accordance with (4)(c)(iii).**
+	+	+	Periodic monitoring 8-hr TWA, in accordance with (4)(c)(iii)**. Periodic monitoring STEL in accordance with (4)(c)(iii).
+	—	+	Periodic monitoring STEL, in accordance with (4)(c)(iii). Monitor 8-hr TWA annually.

Footnote (*) Exposure Scenario, Limit Exceeded: + = Yes, - = No.

Footnote (**) The employer may decrease the frequency of exposure monitoring to annually when at least 2 consecutive measurements taken at least 7 days apart show exposures to be below the 8-hr TWA, but at or above the action level.

(iv) Monitoring techniques: Appendix D describes the validated method of sampling and analysis which has been tested by OSHA for use with BD. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his or her unique field conditions. The standard requires that the method of monitoring must be accurate, to a 95 percent confidence level, to plus or minus 25 percent for concentrations of BD at or above 1 ppm, and to plus or minus 35 percent for concentrations below 1 ppm.

(5) Personal Protective Equipment.

(a) Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to

prevent the skin from becoming frozen from contact with liquid BD.

(b) Any clothing which becomes wet with liquid BD should be removed immediately and not re-worn until the butadiene has evaporated.

(c) Employees should be provided with and required to use splash proof safety goggles where liquid BD may contact the eyes.

(6) Housekeeping and Hygiene Facilities.

For purposes of complying with WAC 296-24-120 (Part B-1 Sanitation), the following items should be emphasized:

(a) The workplace should be kept clean, orderly, and in a sanitary condition.

(b) Adequate washing facilities with hot and cold water are to be provided and maintained in a sanitary condition.

(7) Additional Precautions.

(a) Store BD in tightly closed containers in a cool, well-ventilated area and take all necessary precautions to avoid any explosion hazard.

(b) Non-sparking tools must be used to open and close metal containers. These containers must be effectively grounded.

(c) Do not incinerate BD cartridges, tanks or other containers.

(d) Employers must advise employees of all areas and operations where exposure to BD might occur.

Appendix C. Medical Screening and Surveillance for 1,3-Butadiene (Non-Mandatory)

(1) Basis for Medical Screening and Surveillance Requirements.

(a) Route of Entry Inhalation.

(b) Toxicology.

Inhalation of BD has been linked to an increased risk of cancer, damage to the reproductive organs, and fetotoxicity. Butadiene can be converted via oxidation to epoxybutene and diepoxybutane, two genotoxic metabolites that may play a role in the expression of BD's toxic effects. BD has been tested for carcinogenicity in mice and rats. Both species responded to BD exposure by developing cancer at multiple primary organ sites. Early deaths in mice were caused by malignant lymphomas, primarily lymphocytic type, originating in the thymus.

Mice exposed to BD have developed ovarian or testicular atrophy. Sperm head morphology tests also revealed abnormal sperm in mice exposed to BD; lethal mutations were found in a dominant lethal test. In light of these results in animals, the possibility that BD may adversely affect the reproductive systems of male and female workers must be considered.

Additionally, anemia has been observed in animals exposed to butadiene. In some cases, this anemia appeared to be a primary response to exposure; in other cases, it may have been secondary to a neoplastic response.

(c) Epidemiology.

Epidemiologic evidence demonstrates that BD exposure poses an increased risk of leukemia. Mild alterations of hematologic parameters have also been observed in synthetic rubber workers exposed to BD.

(2) Potential Adverse Health Effects.

(a) Acute.

Skin contact with liquid BD causes characteristic burns or frostbite. BD in gaseous form can irritate the eyes, nasal passages, throat, and lungs. Blurred vision, coughing, and drowsiness may also occur. Effects are mild at 2,000 ppm and pronounced at 8,000 ppm for exposures occurring over the full workshift.

At very high concentrations in air, BD is an anesthetic, causing narcosis, respiratory paralysis, unconsciousness, and death. Such concentrations are unlikely, however, except in an extreme emergency because BD poses an explosion hazard at these levels.

(b) Chronic.

The principal adverse health effects of concern are BD-induced lymphoma, leukemia and potential reproductive toxicity. Anemia and other changes in the peripheral blood cells may be indicators of excessive exposure to BD.

(c) Reproductive.

Workers may be concerned about the possibility that their BD exposure may be affecting their ability to procreate a healthy child. For workers with high exposures to BD, especially those who have experienced difficulties in conceiving, miscarriages, or stillbirths, appropriate medical and laboratory evaluation of fertility may be necessary to determine if BD is having any adverse effect on the reproductive system or on the health of the fetus.

(3) Medical Screening Components At-A-Glance.

(a) Health Questionnaire.

The most important goal of the health questionnaire is to elicit information from the worker regarding potential signs or symptoms generally related to leukemia or other blood abnormalities. Therefore, physicians or other licensed health care professionals should be aware of the presenting symptoms and signs of lymphohematopoietic disorders and cancers, as well as the procedures necessary to confirm or exclude such diagnoses. Additionally, the health questionnaire will assist with the identification of workers at greatest risk of developing leukemia or adverse reproductive effects from their exposures to BD.

Workers with a history of reproductive difficulties or a personal or family history of immune deficiency syndromes, blood dyscrasias, lymphoma, or leukemia, and those who are or have been exposed to medicinal drugs or chemicals known to affect the hematopoietic or lymphatic systems may be at higher risk from their exposure to BD. After the initial administration, the health questionnaire must be updated annually.

(b) Complete Blood Count (CBC).

The medical screening and surveillance program requires an annual CBC, with differential and platelet count, to be provided for each employee with BD exposure. This test is to be performed on a blood sample obtained by phlebotomy of the venous system or, if technically feasible, from a fingerstick sample of capillary blood. The sample is to be analyzed by an accredited laboratory.

Abnormalities in a CBC may be due to a number of different etiologies. The concern for workers exposed to BD includes, but is not limited to, timely identification of lymphohematopoietic cancers, such as leukemia and non-Hodgkin's lymphoma. Abnormalities of portions of the CBC are identified by comparing an individual's results to those of an established range of normal values for males and females. A substantial change in any individual employee's CBC may also be viewed as "abnormal" for that individual even if all measurements fall within the population-based range of normal values. It is suggested that a flowsheet for laboratory values be included in each employee's medical record so that comparisons and trends in annual CBCs can be easily made.

A determination of the clinical significance of an abnormal CBC shall be the responsibility of the examining physician, other licensed health care professional, or medical specialist to whom the employee is referred. Ideally, an abnormal CBC should be compared to previous CBC measure-

ments for the same employee, when available. Clinical common sense may dictate that a CBC value that is very slightly outside the normal range does not warrant medical concern. A CBC abnormality may also be the result of a temporary physical stressor, such as a transient viral illness, blood donation, or menorrhagia, or laboratory error. In these cases, the CBC should be repeated in a timely fashion, i.e., within 6 weeks, to verify that return to the normal range has occurred. A clinically significant abnormal CBC should result in removal of the employee from further exposure to BD. Transfer of the employee to other work duties in a BD-free environment would be the preferred recommendation.

(c) Physical Examination.

The medical screening and surveillance program requires an initial physical examination for workers exposed to BD; this examination is repeated once every three years. The initial physical examination should assess each worker's baseline general health and rule out clinical signs of medical conditions that may be caused by or aggravated by occupational BD exposure. The physical examination should be directed at identification of signs of lymphohematopoietic disorders, including lymph node enlargement, splenomegaly, and hepatomegaly.

Repeated physical examinations should update objective clinical findings that could be indicative of interim development of a lymphohematopoietic disorder, such as lymphoma, leukemia, or other blood abnormality. Physical examinations may also be provided on an as needed basis in order to follow up on a positive answer on the health questionnaire, or in response to an abnormal CBC. Physical examination of workers who will no longer be working in jobs with BD exposure are intended to rule out lymphohematopoietic disorders.

The need for physical examinations for workers concerned about adverse reproductive effects from their exposure to BD should be identified by the physician or other licensed health care professional and provided accordingly. For these workers, such consultations and examinations may relate to developmental toxicity and reproductive capacity.

Physical examination of workers acutely exposed to significant levels of BD should be especially directed at the respiratory system, eyes, sinuses, skin, nervous system, and any region associated with particular complaints. If the worker has received a severe acute exposure, hospitalization may be required to assure proper medical management. Since this type of exposure may place workers at greater risk of blood abnormalities, a CBC must be obtained within 48 hours and repeated at one, two, and three months.

Appendix D: Sampling and Analytical Method for 1,3-Butadiene (Non-Mandatory)

OSHA Method No.: 56.

Matrix: Air.

Target concentration: 1 ppm (2.21 mg/m³).

Procedure: Air samples are collected by drawing known volumes of air through sampling tubes containing charcoal adsorbent which has been coated with 4-tert-butylcatechol. The samples are desorbed with carbon disulfide and then analyzed by gas chromatography using a flame ionization detector.

Recommended sampling rate and air volume: 0.05 L/min and 3 L.

Detection limit of the overall procedure: 90 ppb (200 ug/m³) (based on 3 L air volume).

Reliable quantitation limit: 155 ppb (343 ug/m³) (based on 3 L air volume).

Standard error of estimate at the target concentration: 6.5%.

Special requirements: The sampling tubes must be coated with 4-tert-butylcatechol. Collected samples should be stored in a freezer.

Status of method: A sampling and analytical method has been subjected to the established evaluation procedures of the Organic Methods Evaluation Branch, OSHA Analytical Laboratory, Salt Lake City, Utah 84165.

(1) Background.

This work was undertaken to develop a sampling and analytical procedure for BD at 1 ppm. The current method recommended by OSHA for collecting BD uses activated coconut shell charcoal as the sampling medium (Ref. 5.2). This method was found to be inadequate for use at low BD levels because of sample instability.

The stability of samples has been significantly improved through the use of a specially cleaned charcoal which is coated with 4-tert-butylcatechol (TBC). TBC is a polymerization inhibitor for BD (Ref. 5.3).

(a) Toxic effects.

Symptoms of human exposure to BD include irritation of the eyes, nose and throat. It can also cause coughing, drowsiness and fatigue. Dermatitis and frostbite can result from skin exposure to liquid BD. (Ref. 5.1)

NIOSH recommends that BD be handled in the workplace as a potential occupational carcinogen. This recommendation is based on two inhalation studies that resulted in cancers at multiple sites in rats and in mice. BD has also demonstrated mutagenic activity in the presence of a liver microsomal activating system. It has also been reported to have adverse reproductive effects. (Ref. 5.1)

(b) Potential workplace exposure.

About 90% of the annual production of BD is used to manufacture styrene-butadiene rubber and Polybutadiene rubber. Other uses include: Polychloroprene rubber, acrylonitrile butadiene-styrene resins, nylon intermediates, styrene-butadiene latexes, butadiene polymers, thermoplastic elastomers, nitrile resins, methyl methacrylate-butadiene styrene resins and chemical intermediates. (Ref. 5.1)

(c) Physical properties (Ref. 5.1).

CAS No.: 106-99-0

Molecular weight: 54.1

Appearance: Colorless gas

Boiling point: -4.41 deg. C (760 mm Hg)

Freezing point: -108.9 deg. C

Vapor pressure: 2 atm (a) 15.3 deg. C; 5 atm (a) 47 deg.

C

Explosive limits: 2 to 11.5% (by volume in air)

Odor threshold: 0.45 ppm

Structural formula: H(2)C:CHCH:CH(2)

Synonyms: BD; biethylene; divinyl; butadiene; divinyl; buta-1,3-diene; alpha-gamma-butadiene; erythrene; NCI-C50602; pyrrolylene; vinylethylene.

(d) Limit defining parameters.

The analyte air concentrations listed throughout this method are based on an air volume of 3 L and a desorption volume of 1 mL. Air concentrations listed in ppm are referenced to 25 deg. C and 760 mm Hg.

(e) Detection limit of the analytical procedure.

The detection limit of the analytical procedure was 304 pg per injection. This was the amount of BD which gave a response relative to the interferences present in a standard.

(f) Detection limit of the overall procedure.

The detection limit of the overall procedure was 0.60 ug per sample (90 ppb or 200 ug/m(3)). This amount was determined graphically. It was the amount of analyte which, when spiked on the sampling device, would allow recovery approximately equal to the detection limit of the analytical procedure.

(g) Reliable quantitation limit.

The reliable quantitation limit was 1.03 ug per sample (155 ppb or 343 ug/m(3)). This was the smallest amount of analyte which could be quantitated within the limits of a recovery of at least 75% and a precision (+/- 1.96 SD) of +/- 25% or better.

(h) Sensitivity.(1)

Footnote (1) The reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an analyte is exceptionally higher than these limits, they may not be attainable at the routine operation parameters.

The sensitivity of the analytical procedure over a concentration range representing 0.6 to 2 times the target concentration, based on the recommended air volume, was 387 area units per ug/mL. This value was determined from the slope of the calibration curve. The sensitivity may vary with the particular instrument used in the analysis.

(i) Recovery.

The recovery of BD from samples used in storage tests remained above 77% when the samples were stored at ambient temperature and above 94% when the samples were stored at refrigerated temperature. These values were determined from regression lines which were calculated from the storage data. The recovery of the analyte from the collection device must be at least 75% following storage.

(j) Precision (analytical method only).

The pooled coefficient of variation obtained from replicate determinations of analytical standards over the range of 0.6 to 2 times the target concentration was 0.011.

(k) Precision (overall procedure).

The precision at the 95% confidence level for the refrigerated temperature storage test was +/- 12.7%. This value includes an additional +/- 5% for sampling error. The overall procedure must provide results at the target concentrations that are +/- 25% at the 95% confidence level.

(l) Reproducibility.

Samples collected from a controlled test atmosphere and a draft copy of this procedure were given to a chemist unassociated with this evaluation. The average recovery was 97.2% and the standard deviation was 6.2%.

(2) Sampling procedure.

(a) Apparatus. Samples are collected by use of a personal sampling pump that can be calibrated to within +/- 5% of the

recommended 0.05 L/min sampling rate with the sampling tube in line.

(b) Samples are collected with laboratory prepared sampling tubes. The sampling tube is constructed of silane-treated glass and is about 5-cm long. The ID is 4 mm and the OD is 6 mm. One end of the tube is tapered so that a glass wool end plug will hold the contents of the tube in place during sampling. The opening in the tapered end of the sampling tube is at least one-half the ID of the tube (2 mm). The other end of the sampling tube is open to its full 4-mm ID to facilitate packing of the tube. Both ends of the tube are fire-polished for safety. The tube is packed with 2 sections of pre-treated charcoal which has been coated with TBC. The tube is packed with a 50-mg backup section, located nearest the tapered end, and with a 100-mg sampling section of charcoal. The two sections of coated adsorbent are separated and retained with small plugs of silanized glass wool. Following packing, the sampling tubes are sealed with two 7/32 inch OD plastic end caps. Instructions for the pretreatment and coating of the charcoal are presented in Section 4.1 of this method.

(c) Reagents.

None required.

(d) Technique.

(i) Properly label the sampling tube before sampling and then remove the plastic end caps.

(ii) Attach the sampling tube to the pump using a section of flexible plastic tubing such that the larger front section of the sampling tube is exposed directly to the atmosphere. Do not place any tubing ahead of the sampling tube. The sampling tube should be attached in the worker's breathing zone in a vertical manner such that it does not impede work performance.

(iii) After sampling for the appropriate time, remove the sampling tube from the pump and then seal the tube with plastic end caps. Wrap the tube lengthwise.

(iv) Include at least one blank for each sampling set. The blank should be handled in the same manner as the samples with the exception that air is not drawn through it.

(v) List any potential interferences on the sample data sheet.

(vi) The samples require no special shipping precautions under normal conditions. The samples should be refrigerated if they are to be exposed to higher than normal ambient temperatures. If the samples are to be stored before they are shipped to the laboratory, they should be kept in a freezer. The samples should be placed in a freezer upon receipt at the laboratory.

(e) Breakthrough.

(Breakthrough was defined as the relative amount of analyte found on the backup section of the tube in relation to the total amount of analyte collected on the sampling tube. Five-percent breakthrough occurred after sampling a test atmosphere containing 2.0 ppm BD for 90 min. at 0.05 L/min. At the end of this time 4.5 L of air had been sampled and 20.1 ug of the analyte was collected. The relative humidity of the sampled air was 80% at 23 deg. C.)

Breakthrough studies have shown that the recommended sampling procedure can be used at air concentrations higher than the target concentration. The sampling time, however,

should be reduced to 45 min. if both the expected BD level and the relative humidity of the sampled air are high.

(f) Desorption efficiency.

The average desorption efficiency for BD from TBC coated charcoal over the range from 0.6 to 2 times the target concentration was 96.4%. The efficiency was essentially constant over the range studied.

(g) Recommended air volume and sampling rate.

(h) The recommended air volume is 3 L.

(i) The recommended sampling rate is 0.05 L/min. for 1 hour.

(j) Interferences.

There are no known interferences to the sampling method.

(k) Safety precautions.

(i) Attach the sampling equipment to the worker in such a manner that it will not interfere with work performance or safety.

(ii) Follow all safety practices that apply to the work area being sampled.

(3) Analytical procedure.

(a) Apparatus.

(i) A gas chromatograph (GC), equipped with a flame ionization detector (FID).(2)

Footnote (2) A Hewlett-Packard Model 5840A GC was used for this evaluation. Injections were performed using a Hewlett-Packard Model 7671A automatic sampler.

(ii) A GC column capable of resolving the analytes from any interference.(3)

Footnote (3) A 20-ft x 1/8-inch OD stainless steel GC column containing 20% FFAP on 80/100 mesh Chromabsorb W-AW-DMCS was used for this evaluation.

(iii) Vials, glass 2-mL with Teflon-lined caps.

(iv) Disposable Pasteur-type pipets, volumetric flasks, pipets and syringes for preparing samples and standards, making dilutions and performing injections.

(b) Reagents.

(i) Carbon disulfide.(4)

Footnote (4) Fisher Scientific Company A.C.S. Reagent Grade solvent was used in this evaluation.

The benzene contaminant that was present in the carbon disulfide was used as an internal standard (ISTD) in this evaluation.

(ii) Nitrogen, hydrogen and air, GC grade.

(iii) BD of known high purity.(5)

Footnote (5) Matheson Gas Products, CP Grade 1,3-butadiene was used in this study.

(c) Standard preparation.

(i) Prepare standards by diluting known volumes of BD gas with carbon disulfide. This can be accomplished by injecting the appropriate volume of BD into the headspace above the 1-mL of carbon disulfide contained in sealed 2-mL vial. Shake the vial after the needle is removed from the septum.(6)

Footnote (6) A standard containing 7.71 ug/mL (at ambient temperature and pressure) was prepared by diluting 4 uL of the gas with 1-mL of carbon disulfide.

(ii) The mass of BD gas used to prepare standards can be determined by use of the following equations:

$$MV = (760/BP)(273+T)/(273)(22.41)$$

Where:

MV = ambient molar volume

BP = ambient barometric pressure

T = ambient temperature

$$\text{ug/uL} = 54.09/MV$$

$\text{ug/standard} = (\text{ug/uL})(\text{uL})$ BD used to prepare the standard

(d) Sample preparation.

(i) Transfer the 100-mg section of the sampling tube to a 2-mL vial. Place the 50-mg section in a separate vial. If the glass wool plugs contain a significant amount of charcoal, place them with the appropriate sampling tube section.

(ii) Add 1-mL of carbon disulfide to each vial.

(iii) Seal the vials with Teflon-lined caps and then allow them to desorb for one hour. Shake the vials by hand vigorously several times during the desorption period.

(iv) If it is not possible to analyze the samples within 4 hours, separate the carbon disulfide from the charcoal, using a disposable Pasteur-type pipet, following the one hour. This separation will improve the stability of desorbed samples.

(v) Save the used sampling tubes to be cleaned and repacked with fresh adsorbent.

(e) Analysis.

(i) GC Conditions.

Column temperature: 95 deg. C

Injector temperature: 180 deg. C

Detector temperature: 275 deg. C

Carrier gas flow rate: 30 mL/min.

Injection volume: 0.80 uL

GC column: 20-ft x 1/8-in OD stainless steel GC column containing 20%

FFAP on 80/100 Chromabsorb W-AW-DMCS.

(ii) Chromatogram. See Section 4.2.

(iii) Use a suitable method, such as electronic or peak heights, to measure detector response.

(iv) Prepare a calibration curve using several standard solutions of different concentrations. Prepare the calibration curve daily. Program the integrator to report the results in ug/mL.

(v) Bracket sample concentrations with standards.

(f) Interferences (analytical).

(i) Any compound with the same general retention time as the analyte and which also gives a detector response is a potential interference. Possible interferences should be reported by the industrial hygienist to the laboratory with submitted samples.

(ii) GC parameters (temperature, column, etc.) may be changed to circumvent interferences.

(iii) A useful means of structure designation is GC/MS. It is recommended that this procedure be used to confirm samples whenever possible.

(g) Calculations.

(i) Results are obtained by use of calibration curves. Calibration curves are prepared by plotting detector response against concentration for each standard. The best line through the data points is determined by curve fitting.

(ii) The concentration, in ug/mL, for a particular sample is determined by comparing its detector response to the calibration curve. If any analyte is found on the backup section, this amount is added to the amount found on the front section. Blank corrections should be performed before adding the results together.

(iii) The BD air concentration can be expressed using the following equation:

$$\text{mg/m(3)} = (A)(B)/(C)(D)$$

Where:

A = ug/mL from Section 3.7.2 B = volume C = L of air sampled D = efficiency

(iv) The following equation can be used to convert results in mg/m(3) to ppm:

$$\text{ppm} = (\text{mg/m(3)})(24.46)/54.09$$

Where:

mg/m(3) = result from Section 3.7.3. 24.46 = molar volume of an ideal gas at 760 mm Hg and 25 deg. C.

(h) Safety precautions (analytical).

(i) Avoid skin contact and inhalation of all chemicals.

(ii) Restrict the use of all chemicals to a fume hood whenever possible.

(iii) Wear safety glasses and a lab coat in all laboratory areas.

(4) Additional Information.

(a) A procedure to prepare specially cleaned charcoal coated with TBC.

(i) Apparatus.

(A) Magnetic stirrer and stir bar.

(B) Tube furnace capable of maintaining a temperature of 700 deg. C and equipped with a quartz tube that can hold 30 g of charcoal.(8)

Footnote (8) A Lindberg Type 55035 Tube furnace was used in this evaluation.

(C) A means to purge nitrogen gas through the charcoal inside the quartz tube.

(D) Water bath capable of maintaining a temperature of 60 deg. C.

(E) Miscellaneous laboratory equipment: One-liter vacuum flask, 1-L Erlenmeyer flask, 350-M1 Buchner funnel with a coarse fitted disc, 4-oz brown bottle, rubber stopper, Teflon tape etc.

(ii) Reagents.

(A) Phosphoric acid, 10% by weight, in water.(9)

Footnote (9) Baker Analyzed Reagent grade was diluted with water for use in this evaluation.

(B) 4-tert-Butylcatechol (TBC).(10)

Footnote (10) The Aldrich Chemical Company 99% grade was used in this evaluation.

(C) Specially cleaned coconut shell charcoal, 20/40 mesh.(11)

Footnote (11) Specially cleaned charcoal was obtained from Supelco, Inc. for use in this evaluation. The cleaning process used by Supelco is proprietary.

(D) Nitrogen gas, GC grade.

(iii) Procedure.

Weigh 30g of charcoal into a 500-mL Erlenmeyer flask. Add about 250 mL of 10% phosphoric acid to the flask and then swirl the mixture. Stir the mixture for 1 hour using a magnetic stirrer. Filter the mixture using a fitted Buchner

funnel. Wash the charcoal several times with 250-mL portions of deionized water to remove all traces of the acid. Transfer the washed charcoal to the tube furnace quartz tube. Place the quartz tube in the furnace and then connect the nitrogen gas purge to the tube. Fire the charcoal to 700 deg. C. Maintain that temperature for at least 1 hour. After the charcoal has cooled to room temperature, transfer it to a tared beaker. Determine the weight of the charcoal and then add an amount of TBC which is 10% of the charcoal, by weight.

CAUTION-TBC is toxic and should only be handled in a fume hood while wearing gloves.

Carefully mix the contents of the beaker and then transfer the mixture to a 4-oz bottle. Stopper the bottle with a clean rubber stopper which has been wrapped with Teflon tape. Clamp the bottle in a water bath so that the water level is above the charcoal level. Gently heat the bath to 60 deg. C and then maintain that temperature for 1 hour. Cool the charcoal to room temperature and then transfer the coated charcoal to a suitable container.

The coated charcoal is now ready to be packed into sampling tubes. The sampling tubes should be stored in a sealed container to prevent contamination. Sampling tubes should be stored in the dark at room temperature. The sampling tubes should be segregated by coated adsorbent lot number.

(b) Chromatograms.

The chromatograms were obtained using the recommended analytical method. The chart speed was set at 1 cm/min. for the first three min. and then at 0.2 cm/min. for the time remaining in the analysis.

The peak which elutes just before BD is a reaction product between an impurity on the charcoal and TBC. This peak is always present, but it is easily resolved from the analyte. The peak which elutes immediately before benzene is an oxidation product of TBC.

(5) References.

(a) "Current Intelligence Bulletin 41, 1,3-Butadiene", U.S. Dept. of Health and Human Services, Public Health Service, Center for Disease Control, NIOSH.

(b) "NIOSH Manual of Analytical Methods", 2nd ed.; U.S. Dept. of Health Education and Welfare, National Institute for Occupational Safety and Health: Cincinnati, OH. 1977, Vol. 2, Method No. S91 DHEW (NIOSH) Publ. (U.S.), No. 77-157-B.

(c) Hawley, G.C., Ed. "The Condensed Chemical Dictionary", 8th ed.; Van Nostrand Reinhold Company: New York, 1971; 139.5.4. Chem. Eng. News (June 10, 1985), (63), 22-66.

Appendix E: Respirator Fit Testing Procedures (Mandatory)

A. The Employer Shall Conduct Fit Testing Using the Following Procedures.

These provisions apply to both QLFT and QNFT.

1. The test subject shall be allowed to pick the most comfortable respirator from a selection of respirators of various sizes and models.

2. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a comfortable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the respirator. This

instruction may not constitute the subject's formal training on respirator use, because it is only a review.

3. The test subject shall be informed that he/she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

4. The test subject shall be instructed to hold each chosen facepiece up to the face and eliminate those which obviously do not give a comfortable fit.

5. The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in item 6 below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

6. Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- (a) Position of the mask on the nose.
- (b) Room for eye protection.
- (c) Room to talk.
- (d) Position of mask on face and cheeks.

7. The following criteria shall be used to help determine the adequacy of the respirator fit:

- (a) Chin properly placed;
- (b) Adequate strap tension, not overly tightened;
- (c) Fit across nose bridge;
- (d) Respirator of proper size to span distance from nose to chin;
- (e) Tendency of respirator to slip;
- (f) Self-observation in mirror to evaluate fit and respirator position.

8. The test subject shall conduct the negative and positive pressure fit checks using procedures in Appendix A or those recommended by the respirator manufacturer. Before conducting the negative or positive pressure fit checks, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the fit check tests.

9. The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, or sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

10. If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician to determine whether the test subject can wear a respirator while performing her or his duties.

11. If the employee finds the fit of the respirator unacceptable, the test subject shall be given the opportunity to select a different respirator and to be retested.

12. Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a descrip-

tion of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least 5 minutes before the start of the fit test.

13. Test Exercises. The test subject shall perform exercises, in the test environment, while wearing any applicable safety equipment that may be worn during actual respirator use which could interfere with fit, in the manner described below:

(a) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(b) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as to not hyperventilate.

(c) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(d) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(e) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song.

Rainbow Passage

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(f) Grimace. The test subject shall grimace by smiling or frowning. (Only for QNFT testing, not performed for QLFT)

(g) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(h) Normal breathing. Same as exercise (a). Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for 15 seconds.

The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

B. Qualitative Fit Test (QLFT) Protocols

1. General

(a) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator qualitative fit test program.

(b) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and assure that test equipment is in proper working order.

(c) The employer shall assure that QLFT equipment is kept clean and well maintained so as to operate within the parameters for which it was designed.

2. Isoamyl Acetate Protocol

(a) Odor threshold screening.

The odor threshold screening test, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate.

(1) Three 1 liter glass jars with metal lids are required.

(2) Odor free water (e.g. distilled or spring water) at approximately 25 degrees C shall be used for the solutions.

(3) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a 1 liter jar and shaking for 30 seconds. A new solution shall be prepared at least weekly.

(4) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated to prevent the odor of IAA from becoming evident in the general room air where testing takes place.

(5) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. The solution shall be shaken for 30 seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(6) A test blank shall be prepared in a third jar by adding 500 cc of odor free water.

(7) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. Labels shall be placed on the lids so they can be periodically peeled off and switched to maintain the integrity of the test.

(8) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(9) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(10) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(11) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(b) Isoamyl acetate fit test

(1) The fit test chamber shall be similar to a clear 55-gallon drum liner suspended inverted over a 2-foot diameter frame so that the top of the chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(2) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors.

(3) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(4) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(5) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

(6) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the test exercises; or to demonstrate some of the exercises.

(7) If at any time during the test, the subject detects the banana like odor of IAA, the test is failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(8) If the test is failed, the subject shall return to the selection room and remove the respirator. The test subject shall repeat the odor sensitivity test, select and put on another respirator, return to the test area and again begin the fit test procedure described in (1) through (7) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(9) When the subject wearing the respirator passes the test, its efficiency shall be demonstrated for the subject by having the subject break the face seal and take a breath before exiting the chamber.

(10) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test, so there is no significant IAA concentration buildup in the chamber during subsequent tests. The used towels shall be kept in a self-sealing bag to keep the test area from being contaminated.

3. Saccharin Solution Aerosol Protocol

The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(1) During threshold screening as well as during fit testing, subjects shall wear an enclosure about the head and shoulders that is approximately 12 inches in diameter by 14 inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An

enclosure substantially similar to the 3M hood assembly, parts # FT 14 and # FT 15 combined, is adequate.

(2) The test enclosure shall have a 3/4-inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(3) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her slightly open mouth with tongue extended.

(4) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(5) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 ml of warm water. It can be prepared by putting 1 ml of the fit test solution (see (b)(5) below) in 100 ml of distilled water.

(6) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(7) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(8) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(9) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(10) The test conductor will take note of the number of squeezes required to solicit a taste response.

(11) If the saccharin is not tasted after 30 squeezes (step 10), the test subject may not perform the saccharin fit test.

(12) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(13) Correct use of the nebulizer means that approximately 1 ml of liquid is used at a time in the nebulizer body.

(14) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(b) Saccharin solution aerosol fit test procedure

(1) The test subject may not eat, drink (except plain water), smoke, or chew gum for 15 minutes before the test.

(2) The fit test uses the same enclosure described in (a) above.

(3) The test subject shall don the enclosure while wearing the respirator selected in section (a) above. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(4) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(5) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 ml of warm water.

(6) As before, the test subject shall breathe through the slightly open mouth with tongue extended.

(7) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same number of squeezes required to

elicit a taste response in the screening test. A minimum of 10 squeezes is required.

(8) After generating the aerosol the test subject shall be instructed to perform the exercises in section A. 13 above.

(9) Every 30 seconds the aerosol concentration shall be replenished using one half the number of squeezes as initially.

(10) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(11) If the taste of saccharin is detected, the fit is deemed unsatisfactory and a different respirator shall be tried.

4. Irritant Fume Protocol

(a) The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) filters.

(b) No form of test enclosure or hood for the test subject shall be used.

(c) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its irritating properties.

(d) Break both ends of a ventilation smoke tube containing stannic chloride. Attach one end of the smoke tube to an aspirator squeeze bulb and cover the other end with a short piece of tubing to prevent potential injury from the jagged end of the smoke tube.

(d) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

(e) The test conductor shall direct the stream of irritant smoke from the smoke tube towards the face seal area of the test subject. He/She shall begin at least 12 inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(f) The exercises identified in section A. 13 above shall be performed by the test subject while the respirator seal is being challenged by the smoke.

(g) Each test subject passing the smoke test without evidence of a response (involuntary cough) shall be given a sensitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to evoke a response shall void the fit test.

(h) The fit test shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agent.

C. Quantitative Fit Test (QNFT) Protocols

The following quantitative fit testing procedures have been demonstrated to be acceptable.

(1) Quantitative fit testing using a non-hazardous challenge aerosol (such as corn oil or sodium chloride) generated in a test chamber, and employing instrumentation to quantify the fit of the respirator.

(2) Quantitative fit testing using ambient aerosol as the challenge agent and appropriate instrumentation (condensation nuclei counter) to quantify the respirator fit.

(3) Quantitative fit testing using controlled negative pressure and appropriate instrumentation to measure the volumetric leak rate of a facepiece to quantify the respirator fit.

1. General

(a) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator quantitative fit test program.

(b) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and assure that test equipment is in proper working order.

(c) The employer shall assure that QNFT equipment is kept clean, maintained and calibrated according to the manufacturer's instructions so as to operate at the parameters for which it was designed.

2. Generated aerosol quantitative fit testing protocol Apparatus

(a) Instrumentation. Aerosol generation, dilution, and measurement systems using particulates (corn oil or sodium chloride) or gases or vapors as test aerosols shall be used for quantitative fit testing.

(b) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(c) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate air (HEPA) filter supplied by the same manufacturer in the case of particulate QNFT aerosols or a sorbent offering contaminant penetration protection equivalent to high-efficiency filters where the QNFT test agent is a gas or vapor.

(d) The sampling instrument shall be selected so that a computer record or strip chart record may be made of the test showing the rise and fall of the challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000. Integrators or computers which integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(e) The combination of substitute air-purifying elements, challenge agent and challenge agent concentration shall be such that the test subject is not exposed in excess of an established exposure limit for the challenge agent at any time during the testing process based upon the length of the exposure and the exposure limit duration.

(f) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g. where the respirator is probed), a free air flow is allowed into the sampling line at all times and so that there is no interference with the fit or performance of the respirator. The in-mask sampling device (probe) shall be designed and used so that the air sample is drawn from the breathing zone of the test subject, midway between the nose and mouth and with the probe extending into the facepiece cavity at least 1/4 inch.

(g) The test set up shall permit the person administering the test to observe the test subject inside the chamber during the test.

(h) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant to within a 10 percent variation for the duration of the test.

(i) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event and its being recorded.

(j) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(k) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release.

(l) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(m) The limitations of instrument detection shall be taken into account when determining the fit factor.

(n) Test respirators shall be maintained in proper working order and inspected for deficiencies such as cracks, missing valves and gaskets, etc.

3. Procedural Requirements

(a) When performing the initial positive or negative pressure fit check the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these fit checks.

(b) The use of an abbreviated screening QLFT test is optional and may be utilized in order to quickly identify poor fitting respirators which passed the positive and/or negative pressure test and thus reduce the amount of QNFT time. The use of the CNC QNFT instrument in the count mode is another optional method to use to obtain a quick estimate of fit and eliminate poor fitting respirators before going on to perform a full QNFT.

(c) A reasonably stable challenge agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain type of test units the determination of the challenge agent stability may be established after the test subject has entered the test environment.

(d) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half mask or 1 percent for a full facepiece respirator.

(e) A stable challenge concentration shall be obtained prior to the actual start of testing.

(f) Respirator restraining straps shall not be over tightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonably comfortable fit typical of normal use.

(g) The test shall be terminated whenever any single peak penetration exceeds 5 percent for half masks and 1 percent for full facepiece respirators. The test subject shall be refitted and retested.

(h) Calculation of fit factors.

(1) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration measured inside the respirator for each test exercise except the grimace exercise.

(2) The average test chamber concentration shall be calculated as the arithmetic average of the concentration measured before and after each test (i.e. 8 exercises) or the arithmetic average of the concentration measured before and after each exercise or the true average measured continuously during the respirator sample.

(3) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(i) Average peak penetration method means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers which calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(ii) Maximum peak penetration method means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(iii) Integration by calculation of the area under the individual peak for each exercise except the grimace exercise. This includes computerized integration.

(iv) The calculation of the overall fit factor using individual exercise fit factors involves first converting the exercise fit factors to penetration values, determining the average, and then converting that result back to a fit factor. This procedure is described in the following equation:

$$\text{Overall Fit Factor} = \frac{\text{Number of exercises}}{1/ff(1)+1/ff(2)+1/ff(3)+1/ff(4)+1/ff(5)+1/ff(7)+1/ff(8)}$$

where ff(1), ff(2), ff(3), etc. are the fit factors for exercise 1,2,3, etc. (Results of the grimace exercise (7) are not used in this calculation.)

(j) The test subject shall not be permitted to wear a half mask or quarter facepiece respirator unless a minimum fit factor of 100 is obtained, or a full facepiece respirator unless a minimum fit factor of 500 is obtained.

(k) Filters used for quantitative fit testing shall be replaced whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced if there is any indication of breakthrough by a test agent.

4. Ambient aerosol condensation nuclei counter (CNC) quantitative fit testing protocol

The ambient aerosol condensation nuclei counter (CNC) quantitative fit testing (Portacount(TM)) protocol quantitatively fit tests respirators with the use of a probe. The probed respirator is only used for quantitative fit tests. A probed respirator has a special sampling device, installed on the respirator, that allows the probe to sample the air from inside the mask. A probed respirator is required for each make, model, and size in which your company requires and can be obtained from the respirator manufacturer or distributor. The CNC instrument manufacturer Dynatech Nevada also provides

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probe attachments (TSI sampling adapters) that permits fit testing in an employee's own respirator. A fit factor pass level of 100 is necessary for a half-mask respirator and a fit factor of at least 10 times greater than the assigned protection factor for any other negative pressure respirator. The Agency does not recommend the use of homemade sampling adapters. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(a) Portacount Fit Test Requirements.

(1) Check the respirator to make sure the respirator is fitted with a high efficiency filter and that the sampling probe and line are properly attached to the facepiece.

(2) Instruct the person to be tested to don the respirator several minutes before the fit test starts. This purges the particles inside the respirator and permits the wearer to make certain the respirator is comfortable. This individual should have already been trained on how to wear the respirator properly.

(3) Check the following conditions for the adequacy of the respirator fit: Chin properly placed; Adequate strap tension, not overly tightened; Fit across nose bridge; Respirator of proper size to span distance from nose to chin; Tendencies for the respirator to slip; Self-observation in a mirror to evaluate fit and respirator position.

(4) Have the person wearing the respirator do a fit check. If leakage is detected, determine the cause. If leakage is from a poorly fitting facepiece, try another size of the same type of respirator.

(5) Follow the instructions for operating the Portacount and proceed with the test.

(b) Portacount Test Exercises.

(1) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally for 1 minute.

(2) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply for 1 minute, taking caution so as not to hyperventilate.

(3) Turning head side to side. Standing in place, the subject shall slowly turn his or her head from side to side between the extreme positions on each side for 1 minute. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(4) Moving head up and down. Standing in place, the subject shall slowly move his or her head up and down for 1 minute. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(5) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from 100, or recite a memorized poem or song for 1 minute.

(6) Grimace. The test subject shall grimace by smiling or frowning for 15 seconds.

(7) Bending Over. The test subject shall bend at the waist as if he or she were to touch his or her toes for 1 minute. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(8) Normal Breathing. Remove and re-don the respirator within a one-minute period. Then, in a normal standing posi-

tion, without talking, the subject shall breathe normally for 1 minute.

After the test exercises, the test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

(c) Portacount Test Instrument.

(1) The Portacount will automatically stop and calculate the overall fit factor for the entire set of exercises. The overall fit factor is what counts. The Pass or Fail message will indicate whether or not the test was successful. If the test was a Pass, the fit test is over.

(2) A record of the test needs to be kept on file assuming the fit test was successful. The record must contain the test subject's name; overall fit factor; make, model and size of respirator used, and date tested.

APPENDIX F, MEDICAL QUESTIONNAIRES, (Non-mandatory)

1,3-Butadiene (BD) Initial Health Questionnaire

DIRECTIONS:

You have been asked to answer the questions on this form because you work with BD (butadiene). These questions are about your work, medical history, and health concerns. Please do your best to answer all of the questions. If you need help, please tell the doctor or health care professional who reviews this form.

This form is a confidential medical record. Only information directly related to your health and safety on the job may be given to your employer. Personal health information will not be given to anyone without your consent.

Date: _____
Name: _____ Last First MI SSN ___/___/___

Job Title: _____
Company's Name: _____
Supervisor's Name: _____
Supervisor's Phone No.: () ___-___

Work History

1. Please list all jobs you have had in the past, starting with the job you have now and moving back in time to your first job. (For more space, write on the back of this page.)

Main Job Duty
Year
Company Name
City, State

Chemicals

- 1.
2.
3.
4.
5.
6.

- 7.
8.

2. Please describe what you do during a typical work day. Be sure to tell about your work with BD.

3. Please check any of these chemicals that you work with now or have worked with in the past:

- benzene
glues
toluene
inks, dyes
other solvents, grease cutters
insecticides (like DDT, lindane, etc.)
paints, varnishes, thinners, strippers
dusts
carbon tetrachloride ("carbon tet")
arsine
carbon disulfide
lead
cement
petroleum products
nitrites

4. Please check the protective clothing or equipment you use at the job you have now:

- gloves
coveralls
respirator
dust mask
safety glasses, goggles

Please circle your answer.

5. Does your protective clothing or equipment fit you properly? yes no

6. Have you ever made changes in your protective clothing or equipment to make it fit better? yes no

7. Have you been exposed to BD when you were not wearing protective clothing or equipment? yes no

8. Where do you eat, drink and/or smoke when you are at work? (Please check all that apply.)

- Cafeteria/restaurant/snack bar
Break room/employee lounge
Smoking lounge
At my work station

Please circle your answer.

9. Have you been exposed to radiation (like x-rays or nuclear material) at the job you have now or at past jobs? yes no

10. Do you have any hobbies that expose you to dusts or chemicals (including paints, glues, etc.)? yes no

11. Do you have any second or side jobs? yes no

If yes, what are your duties there?

12. Were you in the military? yes no

If yes, what did you do in the military? _____

Family Health History

1. In the FAMILY MEMBER column, across from the disease name, write which family member, if any, had the disease.

DISEASE	FAMILY MEMBER
Cancer	
Lymphoma	
Sickle Cell Disease or Trait	
Immune Disease	
Leukemia	
Anemia	

2. Please fill in the following information about family health

- Relative
- Alive?
- Age at Death?
- Cause of Death?
- Father
- Mother
- Brother/Sister
- Brother/Sister
- Brother/Sister

Personal Health History

Birth Date ___/___/___ Age ___ Sex ___ Height ___

Weight ___

Please circle your answer.

1. Do you smoke any tobacco products? yes no

2. Have you ever had any kind of surgery or operation? yes no

If yes, what type of surgery: _____

3. Have you ever been in the hospital for any other reasons? yes no

If yes, please describe the reason _____

4. Do you have any on-going or current medical problems or conditions? yes no

If yes, please describe: _____

5. Do you now have or have you ever had any of the following? Please check all that apply to you.

- unexplained fever _____
- anemia ("low blood") _____
- HIV/AIDS _____
- weakness _____
- sickle cell _____
- miscarriage _____
- skin rash _____
- bloody stools _____
- leukemia/lymphoma _____
- neck mass/swelling _____
- wheezing _____
- yellowing of skin _____
- bruising easily _____
- lupus _____
- weight loss _____
- kidney problems _____
- enlarged lymph nodes _____
- liver disease _____
- cancer _____
- infertility _____
- drinking problems _____
- thyroid problems _____
- night sweats _____
- chest pain _____
- still birth _____
- eye redness _____
- lumps you can feel _____
- child with birth defect _____
- autoimmune disease _____
- overly tired _____
- lung problems _____
- rheumatoid arthritis _____
- mononucleosis ("mono") _____
- nagging cough _____

Please circle your answer.

6. Do you have any symptoms or health problems that you think may be related to your work with BD? yes no

If yes, please describe: _____

7. Have any of your co-workers had similar symptoms or problems? yes no don't know

If yes, please describe: _____

8. Do you notice any irritation of your eyes, nose, throat, lungs, or skin when working with BD? yes no

9. Do you notice any blurred vision, coughing, drowsiness, nausea, or headache when working with BD? yes no

10. Do you take any medications (including birth control or over-the-counter)? yes no

If yes, please list: _____

11. Are you allergic to any medication, food, or chemicals? yes no

If yes, please list: _____

12. Do you have any health conditions not covered by this questionnaire that you think are affected by your work with BD? yes no

If yes, please explain: _____

13. Did you understand all the questions? yes no

Signature _____

1,3-Butadiene (BD) Health Update Questionnaire

DIRECTIONS:

You have been asked to answer the questions on this form because you work with BD (butadiene). These questions are about your work, medical history, and health concerns. Please do your best to answer all of the questions. If you need help, please tell the doctor or health care professional who reviews this form.

This form is a confidential medical record. Only information directly related to your health and safety on the job may be given to your employer. Personal health information will not be given to anyone without your consent.

Date: _____

Name: _____ SSN ___/___/___
Last First MI

Job Title: _____

Company's Name: _____

Supervisor's Name: _____

Supervisor's Phone No.: () _____ - _____

1. Please describe any NEW duties that you have at your job. _____

2. Please describe any additional job duties you have:

Please circle your answer.

3. Are you exposed to any other chemicals in your work since the last time you were evaluated for exposure to BD? yes no

If yes, please list what they are: _____

4. Does your personal protective equipment and clothing fit you properly? yes no

5. Have you made changes in this equipment or clothing to make it fit better? yes no

6. Have you been exposed to BD when you were not wearing protective clothing or equipment? yes no

7. Are you exposed to any NEW chemicals at home or while working on hobbies? yes no

If yes, please list what they are: _____

8. Since your last BD health evaluation, have you started working any new second or side jobs? yes no

If yes, what are your duties there? _____

Personal Health History

1. What is your current weight? ___pounds

2. Have you been diagnosed with any new medical conditions or illness since your last evaluation? yesno

If yes, please tell what they are: _____

3. Since your last evaluation, have you been in the hospital for any illnesses, injuries, or surgery? yes no

If yes, please describe: _____

4. Do you have any of the following? Please place a check for all that apply to you.

- unexplained fever —
- anemia ("low blood") —
- HIV/AIDS —
- weakness —
- sickle cell —
- miscarriage —
- skin rash —
- bloody stools —
- leukemia/lymphoma —
- neck mass/swelling —
- wheezing —
- yellowing of skin —
- bruising easily —
- lupus —
- weight loss —
- kidney problems —
- enlarged lymph nodes —
- liver disease —
- cancer —
- infertility —
- drinking problems —
- thyroid problems —
- night sweats —
- chest pain —
- still birth —
- eye redness —

lumps you can feel _____
 child with birth defect _____
 autoimmune disease _____
 overly tired _____
 lung problems _____
 rheumatoid arthritis _____
 mononucleosis ("mono") _____
 nagging cough _____

Please circle your answer.

5. Do you have any symptoms or health problems that you think may be related to your work with BD? yes no

If yes, please describe: _____

6. Have any of your co-workers had similar symptoms or problems? yes no don't know

If yes, please describe: _____

7. Do you notice any irritation of your eyes, nose, throat, lungs, or skin when working with BD? yes no

8. Do you notice any blurred vision, coughing, drowsiness, nausea, or headache when working with BD? yes no

9. Have you been taking any NEW medications (including birth control or over-the-counter)? yes no

If yes, please list:

10. Have you developed any new allergies to medications, foods, or chemicals? yes no

If yes, please list:

11. Do you have any health conditions not covered by this questionnaire that you think are affected by your work with BD? yes no

If yes, please explain: _____

12. Do you understand all the questions? yes no

Signature _____

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07460, filed 9/5/97, effective 11/5/97.]

WAC 296-62-07470 Methylene chloride. This occupational health standard establishes requirements for employers to control occupational exposure to methylene chloride (MC). Employees exposed to MC are at increased risk of developing cancer, adverse effects on the heart, central nervous system and liver, and skin or eye irritation. Exposure may occur through inhalation, by absorption through the skin, or through contact with the skin. MC is a solvent which is used in many different types of work activities, such as paint stripping, polyurethane foam manufacturing, and cleaning and degreasing. Under the requirements of subsection (4)

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of this section, each covered employer must make an initial determination of each employee's exposure to MC. If the employer determines that employees are exposed below the action level, the only other provisions of this section that apply are that a record must be made of the determination, the employees must receive information and training under subsection (12) of this section and, where appropriate, employees must be protected from contact with liquid MC under subsection (8) of this section.

The provisions of the MC standard are as follows:

(1) **Scope and application.** This section applies to all occupational exposures to methylene chloride (MC), Chemical Abstracts Service Registry Number 75-09-2, in general industry, construction and shipyard employment.

(2) **Definitions.** For the purposes of this section, the following definitions shall apply:

"Action level" means a concentration of airborne MC of 12.5 parts per million (ppm) calculated as an eight (8)-hour time-weighted average (TWA).

"Authorized person" means any person specifically authorized by the employer and required by work duties to be present in regulated areas, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under subsection (4) of this section, or any other person authorized by the WISH Act or regulations issued under the act.

"Director" means the director of the department of labor and industries, or designee.

"Emergency" means any occurrence, such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment, which results, or is likely to result in an uncontrolled release of MC. If an incidental release of MC can be controlled by employees such as maintenance personnel at the time of release and in accordance with the leak/spill provisions required by subsection (6) of this section, it is not considered an emergency as defined by this standard.

"Employee exposure" means exposure to airborne MC which occurs or would occur if the employee were not using respiratory protection.

"Methylene chloride (MC)" means an organic compound with chemical formula, CH₂Cl₂. Its Chemical Abstracts Service Registry Number is 75-09-2. Its molecular weight is 84.9 g/mole.

"Physician or other licensed health care professional" is an individual whose legally permitted scope of practice (i.e., license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the health care services required by subsection (10) of this section.

"Regulated area" means an area, demarcated by the employer, where an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed either the 8-hour TWA PEL or the STEL.

"Symptom" means central nervous system effects such as headaches, disorientation, dizziness, fatigue, and decreased attention span; skin effects such as chapping, erythema, cracked skin, or skin burns; and cardiac effects such as chest pain or shortness of breath.

"This section" means this methylene chloride standard.

(3) Permissible exposure limits (PELs).

(a) Eight-hour time-weighted average (TWA) PEL. The employer shall ensure that no employee is exposed to an airborne concentration of MC in excess of twenty-five parts of MC per million parts of air (25 ppm) as an 8-hour TWA.

(b) Short-term exposure limit (STEL). The employer shall ensure that no employee is exposed to an airborne concentration of MC in excess of one hundred and twenty-five parts of MC per million parts of air (125 ppm) as determined over a sampling period of fifteen minutes.

(4) Exposure monitoring.

(a) Characterization of employee exposure.

(i) Where MC is present in the workplace, the employer shall determine each employee's exposure by either:

(A) Taking a personal breathing zone air sample of each employee's exposure; or

(B) Taking personal breathing zone air samples that are representative of each employee's exposure.

(ii) Representative samples. The employer may consider personal breathing zone air samples to be representative of employee exposures when they are taken as follows:

(A) 8-hour TWA PEL. The employer has taken one or more personal breathing zone air samples for at least one employee in each job classification in a work area during every work shift, and the employee sampled is expected to have the highest MC exposure.

(B) Short-term exposure limits. The employer has taken one or more personal breathing zone air samples which indicate the highest likely 15-minute exposures during such operations for at least one employee in each job classification in the work area during every work shift, and the employee sampled is expected to have the highest MC exposure.

(C) Exception. Personal breathing zone air samples taken during one work shift may be used to represent employee exposures on other work shifts where the employer can document that the tasks performed and conditions in the workplace are similar across shifts.

(iii) Accuracy of monitoring. The employer shall ensure that the methods used to perform exposure monitoring produce results that are accurate to a confidence level of 95 percent, and are:

(A) Within plus or minus 25 percent for airborne concentrations of MC above the 8-hour TWA PEL or the STEL; or

(B) Within plus or minus 35 percent for airborne concentrations of MC at or above the action level but at or below the 8-hour TWA PEL.

(b) Initial determination. Each employer whose employees are exposed to MC shall perform initial exposure monitoring to determine each affected employee's exposure, except under the following conditions:

(i) Where objective data demonstrate that MC cannot be released in the workplace in airborne concentrations at or above the action level or above the STEL. The objective data shall represent the highest MC exposures likely to occur under reasonably foreseeable conditions of processing, use, or handling. The employer shall document the objective data exemption as specified in subsection (13) of this section;

(ii) Where the employer has performed exposure monitoring within 12 months prior to December 1, and that exposure monitoring meets all other requirements of this section,

and was conducted under conditions substantially equivalent to existing conditions; or

(iii) Where employees are exposed to MC on fewer than 30 days per year (e.g., on a construction site), and the employer has measurements by direct reading instruments which give immediate results (such as a detector tube) and which provide sufficient information regarding employee exposures to determine what control measures are necessary to reduce exposures to acceptable levels.

(c) Periodic monitoring. Where the initial determination shows employee exposures at or above the action level or above the STEL, the employer shall establish an exposure monitoring program for periodic monitoring of employee exposure to MC in accordance with Table 1:

Table 1
Six Initial Determination Exposure Scenarios and Their Associated Monitoring Frequencies

Exposure scenario	Required monitoring activity
Below the action level and at or below the STEL.	No 8-hour TWA or STEL monitoring required.
Below the action level and above the STEL.	No 8-hour TWA monitoring required; monitor STEL exposures every three months.
At or above the action level, at or below the TWA, and at or below the STEL.	Monitor 8-hour TWA exposures every six months.
At or above the action level, at or below the TWA, and above the STEL.	Monitor 8-hour TWA exposures every six months and monitor STEL exposures every three months.
Above the TWA and at or below the STEL.	Monitor 8-hour TWA exposures every three months.
Above the TWA and above the STEL.	Monitor both 8-hour TWA exposures and STEL exposures every three months.

(Note to subsection (3)(c) of this section: The employer may decrease the frequency of exposure monitoring to every six months when at least 2 consecutive measurements taken at least 7 days apart show exposures to be at or below the 8-hour TWA PEL. The employer may discontinue the periodic 8-hour TWA monitoring for employees where at least two consecutive measurements taken at least 7 days apart are below the action level. The employer may discontinue the periodic STEL monitoring for employees where at least two consecutive measurements taken at least 7 days apart are at or below the STEL.)

(d) Additional monitoring.

(i) The employer shall perform exposure monitoring when a change in workplace conditions indicates that employee exposure may have increased. Examples of situations that may require additional monitoring include changes in production, process, control equipment, or work practices, or a leak, rupture, or other breakdown.

(ii) Where exposure monitoring is performed due to a spill, leak, rupture or equipment breakdown, the employer

shall clean up the MC and perform the appropriate repairs before monitoring.

(e) Employee notification of monitoring results.

(i) The employer shall, within 15 working days after the receipt of the results of any monitoring performed under this section, notify each affected employee of these results in writing, either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) Whenever monitoring results indicate that employee exposure is above the 8-hour TWA PEL or the STEL, the employer shall describe in the written notification the corrective action being taken to reduce employee exposure to or below the 8-hour TWA PEL or STEL and the schedule for completion of this action.

(f) Observation of monitoring.

(i) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to MC conducted in accordance with this section.

(ii) Observation procedures. When observation of the monitoring of employee exposure to MC requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide, at no cost to the observer(s), and the observer(s) shall be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

(5) Regulated areas.

(a) The employer shall establish a regulated area whenever an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed either the 8-hour TWA PEL or the STEL.

(b) The employer shall limit access to regulated areas to authorized persons.

(c) The employer shall supply a respirator, selected in accordance with subsection (7)(c) of this section, to each person who enters a regulated area and shall require each affected employee to use that respirator whenever MC exposures are likely to exceed the 8-hour TWA PEL or STEL.

(Note to subsection (5)(c) of this section: An employer who has implemented all feasible engineering, work practice and administrative controls (as required in subsection (6) of this section), and who has established a regulated area (as required by subsection (5)(a) of this section) where MC exposure can be reliably predicted to exceed the 8-hour TWA PEL or the STEL only on certain days (for example, because of work or process schedule) would need to have affected employees use respirators in that regulated area only on those days.)

(d) The employer shall ensure that, within a regulated area, employees do not engage in nonwork activities which may increase dermal or oral MC exposure.

(e) The employer shall ensure that while employees are wearing respirators, they do not engage in activities (such as taking medication or chewing gum or tobacco) which interfere with respirator seal or performance.

(f) The employer shall demarcate regulated areas from the rest of the workplace in any manner that adequately establishes and alerts employees to the boundaries of the area and minimizes the number of authorized employees exposed to MC within the regulated area.

(g) An employer at a multi-employer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to all other employers with work operations at that worksite.

(6) Methods of compliance.

(a) Engineering and work practice controls. The employer shall institute and maintain the effectiveness of engineering controls and work practices to reduce employee exposure to or below the PELs except to the extent that the employer can demonstrate that such controls are not feasible.

(b) Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the 8-TWA PEL or STEL, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of subsection (7) of this section.

(c) Prohibition of rotation. The employer shall not implement a schedule of employee rotation as a means of compliance with the PELs.

(d) Leak and spill detection.

(i) The employer shall implement procedures to detect leaks of MC in the workplace. In work areas where spills may occur, the employer shall make provisions to contain any spills and to safely dispose of any MC-contaminated waste materials.

(ii) The employer shall ensure that all incidental leaks are repaired and that incidental spills are cleaned promptly by employees who use the appropriate personal protective equipment and are trained in proper methods of cleanup.

(Note to subsection (6)(d)(ii) of this section: See Appendix A of this section for examples of procedures that satisfy this requirement. Employers covered by this standard may also be subject to the hazardous waste and emergency response provisions contained in WAC 296-62-3112.)

(7) Respiratory protection.

(a) General requirements. The employer shall provide a respirator which complies with the requirement of this subsection, at no cost to each affected employee, and ensure that each affected employee uses such respirator where appropriate. Respirators shall be used in the following circumstances:

(i) Whenever an employee's exposure to MC exceeds or can reasonably be expected to exceed the 8-hour TWA PEL or the STEL (such as where an employee is using MC in a regulated area);

(ii) During the time interval necessary to install or implement feasible engineering and work practice controls;

(iii) In a few work operations, such as some maintenance operations and repair activities, for which the employer demonstrates that engineering and work practice controls are infeasible;

(iv) Where feasible engineering and work practice controls are not sufficient to reduce exposures to or below the PELs; or

(v) In emergencies.

(b) Medical evaluation. Before having any employee use a supplied-air respirator in the negative pressure mode, or a gas mask with organic vapor canister for emergency escape, the employer shall have a physician or other licensed health care professional ascertain each affected employee's ability

to use such respiratory protection. The physician or other licensed health care professional shall provide his or her findings to the affected employee and the employer in a written opinion.

(Note to subsection (7)(b) of this section: See also WAC 296-62-07109(3) - Respiratory Protection for medical evaluation requirements for employees using respirators for purposes other than emergency escape.)

(c) Respirator selection. The appropriate atmosphere-supplying respirators, as specified in Table 2, shall be selected from those approved by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 42 CFR Part 84, "Respiratory Protective Devices." When employers elect to provide gas masks with organic vapor canisters for use in emergency escape, the organic vapor canisters shall bear the approval of NIOSH.

Table 2.—Minimum Requirements for Respiratory Protection for Airborne Methylene Chloride

Methylene chloride airborne concentration (ppm) or condition of use	Minimum respirator required ¹
Up to 625 ppm (25 X PEL)	(1) Continuous flow supplied-air respirator, hood or helmet.
Up to 1250 ppm (50 X 8 hr TWA PEL)	(1) Full facepiece supplied-air respirator operated in negative pressure (demand) mode. (2) Full facepiece self-contained breathing apparatus (SCBA) operated in negative pressure (demand) mode.
Up to 5000 ppm (200 X 8-TWA PEL)	(1) Continuous flow supplied-air respirator, full facepiece. (2) Pressure demand supplied-air respirator, full facepiece. (3) Positive pressure full facepiece SCBA.
Unknown concentration, or above 5000 ppm (Greater than 200 X 8-TWA PEL)	(1) Positive pressure full facepiece SCBA. (2) Full facepiece pressure demand supplied-air respirator with an auxiliary self-contained air supply.
Fire fighting	Positive pressure full facepiece SCBA.
Emergency escape	(1) Any continuous flow or pressure demand SCBA. (2) Gas mask with organic vapor canister.

¹ Respirators assigned for higher airborne concentrations may be used at lower concentrations.

(d) Respirator program. Where respiratory protection is required by this section, the employer shall institute a respirator program in accordance with WAC 296-62-071.

(e) Permission to leave area. The employer shall permit employees who wear respirators to leave the regulated area to

readjust the facepieces to their faces to achieve a proper fit, and to wash their faces and respirator facepieces as necessary in order to prevent skin irritation associated with respirator use.

(f) Filter respirators. Employers who provide gas masks with organic vapor canisters for the purpose of emergency escape shall replace those canisters after any emergency use before those gas masks are returned to service.

(g) Respirator fit testing.

(i) The employer shall ensure that each respirator issued to the employee is properly fitted and exhibits the least possible facepiece leakage from among the facepieces tested.

(ii) The employer shall perform qualitative or quantitative fit tests at the time of initial fitting and at least annually thereafter for each employee wearing a negative pressure respirator, including those employees for whom emergency escape respirators are provided.

(Note to subsection (7)(g)(ii) of this section: The only supplied-air respirators to which this provision would apply are SCBA in negative pressure mode and full facepiece supplied-air respirators operated in negative pressure mode. The small business compliance guides will contain examples of protocols for qualitative and quantitative fit testing.)

(8) Protective work clothing and equipment.

(a) Where needed to prevent MC- induced skin or eye irritation, the employer shall provide clean protective clothing and equipment which is resistant to MC, at no cost to the employee, and shall ensure that each affected employee uses it. Eye and face protection shall meet the requirements of WAC 296-24-078, as applicable.

(b) The employer shall clean, launder, repair and replace all protective clothing and equipment required by this subsection as needed to maintain their effectiveness.

(c) The employer shall be responsible for the safe disposal of such clothing and equipment.

(Note to subsection (8)(c) of this section: See Appendix A for examples of disposal procedures that will satisfy this requirement.)

(9) Hygiene facilities.

(a) If it is reasonably foreseeable that employees' skin may contact solutions containing 0.1 percent or greater MC (for example, through splashes, spills or improper work practices), the employer shall provide conveniently located washing facilities capable of removing the MC, and shall ensure that affected employees use these facilities as needed.

(b) If it is reasonably foreseeable that an employee's eyes may contact solutions containing 0.1 percent or greater MC (for example through splashes, spills or improper work practices), the employer shall provide appropriate eyewash facilities within the immediate work area for emergency use, and shall ensure that affected employees use those facilities when necessary.

(10) Medical surveillance.

(a) Affected employees. The employer shall make medical surveillance available for employees who are or may be exposed to MC as follows:

(i) At or above the action level on 30 or more days per year, or above the 8-hour TWA PEL or the STEL on 10 or more days per year;

(ii) Above the 8-TWA PEL or STEL for any time period where an employee has been identified by a physician or other licensed health care professional as being at risk from cardiac disease or from some other serious MC-related health condition and such employee requests inclusion in the medical surveillance program;

(iii) During an emergency.

(b) Costs. The employer shall provide all required medical surveillance at no cost to affected employees, without loss of pay and at a reasonable time and place.

(c) Medical personnel. The employer shall ensure that all medical surveillance procedures are performed by a physician or other licensed health care professional, as defined in subsection (2) of this section.

(d) Frequency of medical surveillance. The employer shall make medical surveillance available to each affected employee as follows:

(i) Initial surveillance. The employer shall provide initial medical surveillance under the schedule provided by subsection (14)(b)(iii) of this section, or before the time of initial assignment of the employee, whichever is later. The employer need not provide the initial surveillance if medical records show that an affected employee has been provided with medical surveillance that complies with this section within 12 months before December 1.

(ii) Periodic medical surveillance. The employer shall update the medical and work history for each affected employee annually. The employer shall provide periodic physical examinations, including appropriate laboratory surveillance, as follows:

(A) For employees 45 years of age or older, within 12 months of the initial surveillance or any subsequent medical surveillance; and

(B) For employees younger than 45 years of age, within 36 months of the initial surveillance or any subsequent medical surveillance.

(iii) Termination of employment or reassignment. When an employee leaves the employer's workplace, or is reassigned to an area where exposure to MC is consistently at or below the action level and STEL, medical surveillance shall be made available if six months or more have elapsed since the last medical surveillance.

(iv) Additional surveillance. The employer shall provide additional medical surveillance at frequencies other than those listed above when recommended in the written medical opinion. (For example, the physician or other licensed health care professional may determine an examination is warranted in less than 36 months for employees younger than 45 years of age based upon evaluation of the results of the annual medical and work history.)

(e) Content of medical surveillance.

(i) Medical and work history. The comprehensive medical and work history shall emphasize neurological symptoms, skin conditions, history of hematologic or liver disease, signs or symptoms suggestive of heart disease (angina, coronary artery disease), risk factors for cardiac disease, MC exposures, and work practices and personal protective equipment used during such exposures.

(Note to subsection (10)(e)(i) of this section: See Appendix B of this section for an example of a medical and work history format that would satisfy this requirement.)

(ii) Physical examination. Where physical examinations are provided as required above, the physician or other licensed health care professional shall accord particular attention to the lungs, cardiovascular system (including blood pressure and pulse), liver, nervous system, and skin. The physician or other licensed health care professional shall determine the extent and nature of the physical examination based on the health status of the employee and analysis of the medical and work history.

(iii) Laboratory surveillance. The physician or other licensed health care professional shall determine the extent of any required laboratory surveillance based on the employee's observed health status and the medical and work history.

(Note to subsection (10)(e)(iii) of this section: See Appendix B of this section for information regarding medical tests. Laboratory surveillance may include before-and after-shift carboxyhemoglobin determinations, resting ECG, hematocrit, liver function tests and cholesterol levels.)

(iv) Other information or reports. The medical surveillance shall also include any other information or reports the physician or other licensed health care professional determines are necessary to assess the employee's health in relation to MC exposure.

(f) Content of emergency medical surveillance. The employer shall ensure that medical surveillance made available when an employee has been exposed to MC in emergency situations includes, at a minimum:

(i) Appropriate emergency treatment and decontamination of the exposed employee;

(ii) Comprehensive physical examination with special emphasis on the nervous system, cardiovascular system, lungs, liver and skin, including blood pressure and pulse;

(iii) Updated medical and work history, as appropriate for the medical condition of the employee; and

(iv) Laboratory surveillance, as indicated by the employee's health status.

(Note to subsection (10)(f)(iv) of this section: See Appendix B for examples of tests which may be appropriate.)

(g) Additional examinations and referrals. Where the physician or other licensed health care professional determines it is necessary, the scope of the medical examination shall be expanded and the appropriate additional medical surveillance, such as referrals for consultation or examination, shall be provided.

(h) Information provided to the physician or other licensed health care professional. The employer shall provide the following information to a physician or other licensed health care professional who is involved in the diagnosis of MC-induced health effects:

(i) A copy of this section including its applicable appendices;

(ii) A description of the affected employee's past, current and anticipated future duties as they relate to the employee's MC exposure;

(iii) The employee's former or current exposure levels or, for employees not yet occupationally exposed to MC, the employee's anticipated exposure levels and the frequency and

exposure levels anticipated to be associated with emergencies;

(iv) A description of any personal protective equipment, such as respirators, used or to be used; and

(v) Information from previous employment-related medical surveillance of the affected employee which is not otherwise available to the physician or other licensed health care professional.

(i) Written medical opinions.

(i) For each physical examination required by this section, the employer shall ensure that the physician or other licensed health care professional provides to the employer and to the affected employee a written opinion regarding the results of that examination within 15 days of completion of the evaluation of medical and laboratory findings, but not more than 30 days after the examination. The written medical opinion shall be limited to the following information:

(A) The physician's or other licensed health care professional's opinion concerning whether the employee has any detected medical condition(s) which would place the employee's health at increased risk of material impairment from exposure to MC;

(B) Any recommended limitations upon the employee's exposure to MC or upon the employee's use of protective clothing or equipment and respirators;

(C) A statement that the employee has been informed by the physician or other licensed health care professional that MC is a potential occupational carcinogen, of risk factors for heart disease, and the potential for exacerbation of underlying heart disease by exposure to MC through its metabolism to carbon monoxide; and

(D) A statement that the employee has been informed by the physician or other licensed health care professional of the results of the medical examination and any medical conditions resulting from MC exposure which require further explanation or treatment.

(ii) The employer shall instruct the physician or other licensed health care professional not to reveal to the employer, orally or in the written opinion, any specific records, findings, and diagnoses that have no bearing on occupational exposure to MC.

(Note to subsection (10)(h)(ii) of this section: The written medical opinion may also include information and opinions generated to comply with other OSHA health standards.)

(11) Hazard communication. The employer shall communicate the following hazards associated with MC on labels and in material safety data sheets in accordance with the requirements of the hazard communication standard, WAC 296-62-054: cancer, cardiac effects (including elevation of carboxyhemoglobin), central nervous system effects, liver effects, and skin and eye irritation.

(12) Employee information and training.

(a) The employer shall provide information and training for each affected employee prior to or at the time of initial assignment to a job involving potential exposure to MC.

(b) The employer shall ensure that information and training is presented in a manner that is understandable to the employees.

(c) In addition to the information required under the hazard communication standard at WAC 296-62-054:

(i) The employer shall inform each affected employee of the requirements of this section and information available in its appendices, as well as how to access or obtain a copy of it in the workplace;

(ii) Wherever an employee's exposure to airborne concentrations of MC exceeds or can reasonably be expected to exceed the action level, the employer shall inform each affected employee of the quantity, location, manner of use, release, and storage of MC and the specific operations in the workplace that could result in exposure to MC, particularly noting where exposures may be above the 8-hour TWA PEL or STEL;

(d) The employer shall train each affected employee as required under the hazard communication standard at WAC 296-62-054, as appropriate.

(e) The employer shall re-train each affected employee as necessary to ensure that each employee exposed above the action level or the STEL maintains the requisite understanding of the principles of safe use and handling of MC in the workplace.

(f) Whenever there are workplace changes, such as modifications of tasks or procedures or the institution of new tasks or procedures, which increase employee exposure, and where those exposures exceed or can reasonably be expected to exceed the action level, the employer shall update the training as necessary to ensure that each affected employee has the requisite proficiency.

(g) An employer whose employees are exposed to MC at a multi-employer worksite shall notify the other employers with work operations at that site in accordance with the requirements of the hazard communication standard, WAC 296-62-054, as appropriate.

(h) The employer shall provide to the director, upon request, all available materials relating to employee information and training.

(13) Recordkeeping.

(a) Objective data.

(i) Where an employer seeks to demonstrate that initial monitoring is unnecessary through reasonable reliance on objective data showing that any materials in the workplace containing MC will not release MC at levels which exceed the action level or the STEL under foreseeable conditions of exposure, the employer shall establish and maintain an accurate record of the objective data relied upon in support of the exemption.

(ii) This record shall include at least the following information:

(A) The MC-containing material in question;

(B) The source of the objective data;

(C) The testing protocol, results of testing, and/or analysis of the material for the release of MC;

(D) A description of the operation exempted under subsection (4)(b)(i) of this section and how the data support the exemption; and

(E) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(iii) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(b) Exposure measurements.

(i) The employer shall establish and keep an accurate record of all measurements taken to monitor employee exposure to MC as prescribed in subsection (4) of this section.

(ii) Where the employer has 20 or more employees, this record shall include at least the following information:

- (A) The date of measurement for each sample taken;
- (B) The operation involving exposure to MC which is being monitored;
- (C) Sampling and analytical methods used and evidence of their accuracy;
- (D) Number, duration, and results of samples taken;
- (E) Type of personal protective equipment, such as respiratory protective devices, worn, if any; and
- (F) Name, Social Security number, job classification and exposure of all of the employees represented by monitoring, indicating which employees were actually monitored.

(iii) Where the employer has fewer than 20 employees, the record shall include at least the following information:

- (A) The date of measurement for each sample taken;
- (B) Number, duration, and results of samples taken; and
- (C) Name, Social Security number, job classification and exposure of all of the employees represented by monitoring, indicating which employees were actually monitored.

(iv) The employer shall maintain this record for at least thirty (30) years, in accordance with WAC 296-62-052.

(c) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance under subsection (10) of this section.

(ii) The record shall include at least the following information:

- (A) The name, Social Security number and description of the duties of the employee;
- (B) Written medical opinions; and
- (C) Any employee medical conditions related to exposure to MC.

(iii) The employer shall ensure that this record is maintained for the duration of employment plus thirty (30) years, in accordance with WAC 296-62-052.

(d) Availability.

(i) The employer, upon written request, shall make all records required to be maintained by this section available to the director for examination and copying in accordance with WAC 296-62-052.

(Note to subsection (13)(d)(i) of this section: All records required to be maintained by this section may be kept in the most administratively convenient form (for example, electronic or computer records would satisfy this requirement).)

(ii) The employer, upon request, shall make any employee exposure and objective data records required by this section available for examination and copying by affected employees, former employees, and designated representatives in accordance with WAC 296-62-052.

(iii) The employer, upon request, shall make employee medical records required to be kept by this section available for examination and copying by the subject employee and by anyone having the specific written consent of the subject employee in accordance with WAC 296-62-052.

(e) Transfer of records. The employer shall comply with the requirements concerning transfer of records set forth in WAC 296-62-05215.

(14) Dates.

(a) Effective date. This section shall become effective December 1, 1997.

(b) Start-up dates.

(i) Initial monitoring required by subsection (4)(b) of this section shall be completed according to the following schedule:

(A) For employers with fewer than 20 employees, no later than February 4, 1998.

(B) Immediately for all other employers.

(ii) Engineering controls required under subsection (6)(a) of this section shall be implemented according to the following schedule:

(A) For employers with fewer than 20 employees, no later than April 10, 2000.

(B) For polyurethane foam manufacturers with 20 to 99 employees, no later than April 10, 1999.

(C) For all other employers, no later than April 10, 1998.

(iii) All other requirements of this section shall be complied with according to the following schedule:

(A) For employers with fewer than 20 employees, no later than April 10, 1998.

(B) For polyurethane foam manufacturers with 20 to 99 employees, no later than January 5, 1998.

(C) For all other employers, on the effective date.

(c) Transitional dates. The exposure limits for MC specified in WAC 296-62-07515 Table 1, shall remain in effect until the start-up dates for the exposure limits specified in subsection (14) of this section, or if the exposure limits in this section are stayed or vacated.

(15) Appendices. The information contained in the appendices does not, by itself, create any additional obligations not otherwise imposed or detract from any existing obligation.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 97-18-062, § 296-62-07470, filed 9/2/97, effective 12/1/97.]

WAC 296-62-07473 Appendix A. Substance Safety Data Sheet and Technical Guidelines for Methylene Chloride

I. Substance Identification

A. Substance: Methylene chloride (CH₂Cl₂).

B. Synonyms: MC, Dichloromethane (DCM); Methylene dichloride; Methylene bichloride; Methane dichloride; CAS: 75-09-2; NCI-C50102.

C. Physical data:

1. Molecular weight: 84.9.
2. Boiling point (760 mm Hg): 39.8 deg.C (104 deg.F).
3. Specific gravity (water = 1): 1.3.
4. Vapor density (air = 1 at boiling point): 2.9.
5. Vapor pressure at 20 deg. C (68 deg. F): 350 mm Hg.
6. Solubility in water, g/100 g water at 20 deg. C (68 deg. F) = 1.32.

7. Appearance and odor: colorless liquid with a chloroform-like odor.

D. Uses: MC is used as a solvent, especially where high volatility is required. It is a good solvent for oils, fats, waxes, resins, bitumen, rubber and cellulose acetate and is a useful

paint stripper and degreaser. It is used in paint removers, in propellant mixtures for aerosol containers, as a solvent for plastics, as a degreasing agent, as an extracting agent in the pharmaceutical industry and as a blowing agent in polyurethane foams. Its solvent property is sometimes increased by mixing with methanol, petroleum naphtha or tetrachloroethylene.

E. Appearance and odor: MC is a clear colorless liquid with a chloroform-like odor. It is slightly soluble in water and completely miscible with most organic solvents.

F. Permissible exposure: Exposure may not exceed 25 parts MC per million parts of air (25 ppm) as an eight-hour time-weighted average (8-hour TWA PEL) or 125 parts of MC per million parts of air (125 ppm) averaged over a 15-minute period (STEL).

II. Health Hazard Data

A. MC can affect the body if it is inhaled or if the liquid comes in contact with the eyes or skin. It can also affect the body if it is swallowed.

B. Effects of overexposure:

1. Short-term Exposure: MC is an anesthetic. Inhaling the vapor may cause mental confusion, light-headedness, nausea, vomiting, and headache. Continued exposure may cause increased light-headedness, staggering, unconsciousness, and even death. High vapor concentrations may also cause irritation of the eyes and respiratory tract. Exposure to MC may make the symptoms of angina (chest pains) worse. Skin exposure to liquid MC may cause irritation. If liquid MC remains on the skin, it may cause skin burns. Splashes of the liquid into the eyes may cause irritation.

2. Long-term (chronic) exposure: The best evidence that MC causes cancer is from laboratory studies in which rats, mice and hamsters inhaled MC 6 hours per day, 5 days per week for 2 years. MC exposure produced lung and liver tumors in mice and mammary tumors in rats. No carcinogenic effects of MC were found in hamsters. There are also some human epidemiological studies which show an association between occupational exposure to MC and increases in biliary (bile duct) cancer and a type of brain cancer. Other epidemiological studies have not observed a relationship between MC exposure and cancer. WISHA interprets these results to mean that there is suggestive (but not absolute) evidence that MC is a human carcinogen.

C. Reporting signs and symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to MC.

D. Warning Properties:

1. Odor Threshold: Different authors have reported varying odor thresholds for MC. Kirk-Othmer and Sax both reported 25 to 50 ppm; Summer and May both reported 150 ppm; Spector reports 320 ppm. Patty, however, states that since one can become adapted to the odor, MC should not be considered to have adequate warning properties.

2. Eye Irritation Level: Kirk-Othmer reports that "MC vapor is seriously damaging to the eyes." Sax agrees with Kirk-Othmer's statement. The ACGIH Documentation of TLVs states that irritation of the eyes has been observed in workers exposed to concentrations up to 5000 ppm.

3. Evaluation of Warning Properties: Since a wide range of MC odor thresholds are reported (25-320 ppm), and

human adaptation to the odor occurs, MC is considered to be a material with poor warning properties.

III. Emergency First Aid Procedures

In the event of emergency, institute first aid procedures and send for first aid or medical assistance.

A. Eye and Skin Exposures: If there is a potential for liquid MC to come in contact with eye or skin, face shields and skin protective equipment must be provided and used. If liquid MC comes in contact with the eye, get medical attention. Contact lenses should not be worn when working with this chemical.

B. Breathing: If a person breathes in large amounts of MC, move the exposed person to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

C. Rescue: Move the affected person from the hazardous exposure immediately. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises. Do not become a casualty yourself.

IV. Respirators, Protective Clothing, and Eye Protection

A. Respirators: Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not feasible, when such controls are in the process of being installed, or when these controls fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the National Institute for Occupational Safety and Health (NIOSH). Supplied-air respirators are required because air-purifying respirators do not provide adequate respiratory protection against MC. In addition to respirator selection, a complete written respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation. If you can smell MC while wearing a respirator, proceed immediately to fresh air. If you experience difficulty in breathing while wearing a respirator, tell your employer.

B. Protective Clothing: Employees must be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid MC or contact with vessels containing liquid MC. Any clothing which becomes wet with liquid MC should be removed immediately and not reworn until the employer has ensured that the protective clothing is fit for reuse. Contaminated protective clothing should be placed in a regulated area designated by the employer for removal of MC before the clothing is laundered or disposed of. Clothing and equipment should remain in the regulated area until all of the MC contamination has evaporated; clothing and equipment should then be laundered or disposed of as appropriate.

C. Eye Protection: Employees should be provided with and required to use splash-proof safety goggles where liquid MC may contact the eyes.

V. Housekeeping and Hygiene Facilities

For purposes of complying with WAC 296-24-120, the following items should be emphasized:

A. The workplace should be kept clean, orderly, and in a sanitary condition. The employer should institute a leak and spill detection program for operations involving liquid MC in order to detect sources of fugitive MC emissions.

B. Emergency drench showers and eyewash facilities are recommended. These should be maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of MC from the skin.

C. Because of the hazardous nature of MC, contaminated protective clothing should be placed in a regulated area designated by the employer for removal of MC before the clothing is laundered or disposed of.

VI. Precautions for Safe Use, Handling, and Storage

A. Fire and Explosion Hazards: MC has no flash point in a conventional closed tester, but it forms flammable vapor-air mixtures at approximately 100 deg.C (212 deg.F), or higher. It has a lower explosion limit of 12%, and an upper explosion limit of 19% in air. It has an autoignition temperature of 556.1 deg.C (1033 deg.F), and a boiling point of 39.8 deg.C (104 deg.F). It is heavier than water with a specific gravity of 1.3. It is slightly soluble in water.

B. Reactivity Hazards: Conditions contributing to the instability of MC are heat and moisture. Contact with strong oxidizers, caustics, and chemically active metals such as aluminum or magnesium powder, sodium and potassium may cause fires and explosions. Special precautions: Liquid MC will attack some forms of plastics, rubber, and coatings.

C. Toxicity: Liquid MC is painful and irritating if splashed in the eyes or if confined on the skin by gloves, clothing, or shoes. Vapors in high concentrations may cause narcosis and death. Prolonged exposure to vapors may cause cancer or exacerbate cardiac disease.

D. Storage: Protect against physical damage. Because of its corrosive properties, and its high vapor pressure, MC should be stored in plain, galvanized or lead lined, mild steel containers in a cool, dry, well ventilated area away from direct sunlight, heat source and acute fire hazards.

E. Piping Material: All piping and valves at the loading or unloading station should be of material that is resistant to MC and should be carefully inspected prior to connection to the transport vehicle and periodically during the operation.

F. Usual Shipping Containers: Glass bottles, 5- and 55-gallon steel drums, tank cars, and tank trucks.

Note: This section addresses MC exposure in marine terminal and longshore employment only where leaking or broken packages allow MC exposure that is not addressed through compliance with WAC 296-56.

G. Electrical Equipment: Electrical installations in Class I hazardous locations as defined in Article 500 of the National Electrical Code, should be installed according to Article 501 of the code; and electrical equipment should be suitable for use in atmospheres containing MC vapors. See Flammable and Combustible Liquids Code (NFPA No.

(1999 Ed.)

325M), Chemical Safety Data Sheet SD-86 (Manufacturing Chemists' Association, Inc.).

H. Fire Fighting: When involved in fire, MC emits highly toxic and irritating fumes such as phosgene, hydrogen chloride and carbon monoxide. Wear breathing apparatus and use water spray to keep fire-exposed containers cool. Water spray may be used to flush spills away from exposures. Extinguishing media are dry chemical, carbon dioxide, foam. For purposes of compliance with WAC 296-24-956, locations classified as hazardous due to the presence of MC shall be Class I.

I. Spills and Leaks: Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed. If MC has spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.

J. Methods of Waste Disposal: Small spills should be absorbed onto sand and taken to a safe area for atmospheric evaporation. Incineration is the preferred method for disposal of large quantities by mixing with a combustible solvent and spraying into an incinerator equipped with acid scrubbers to remove hydrogen chloride gases formed. Complete combustion will convert carbon monoxide to carbon dioxide. Care should be taken for the presence of phosgene.

K. You should not keep food, beverage, or smoking materials, or eat or smoke in regulated areas where MC concentrations are above the permissible exposure limits.

L. Portable heating units should not be used in confined areas where MC is used.

M. Ask your supervisor where MC is used in your work area and for any additional plant safety and health rules.

VII. Medical Requirements

Your employer is required to offer you the opportunity to participate in a medical surveillance program if you are exposed to MC at concentrations at or above the action level (12.5 ppm 8-hour TWA) for more than 30 days a year or at concentrations exceeding the PELs (25 ppm 8-hour TWA or 125 ppm 15-minute STEL) for more than 10 days a year. If you are exposed to MC at concentrations over either of the PELs, your employer will also be required to have a physician or other licensed health care professional ensure that you are able to wear the respirator that you are assigned. Your employer must provide all medical examinations relating to your MC exposure at a reasonable time and place and at no cost to you.

VIII. Monitoring and Measurement Procedures

A. Exposure above the Permissible Exposure Limit:

1. Eight-hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken with consecutive samples covering the full shift. Air samples must be taken in the employee's breathing zone.

2. Monitoring techniques: The sampling and analysis under this section may be performed by collection of the MC vapor on two charcoal adsorption tubes in series or other composition adsorption tubes, with subsequent chemical analysis. Sampling and analysis may also be performed by

instruments such as real-time continuous monitoring systems, portable direct reading instruments, or passive dosimeters as long as measurements taken using these methods accurately evaluate the concentration of MC in employees' breathing zones. OSHA method 80 is an example of a validated method of sampling and analysis of MC. Copies of this method are available from OSHA or can be downloaded from the Internet at <http://www.osha.gov>. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his or her unique field conditions. The standard requires that the method of monitoring must be accurate, to a 95 percent confidence level, to plus or minus 25 percent for concentrations of MC at or above 25 ppm, and to plus or minus 35 percent for concentrations at or below 25 ppm. In addition to OSHA method 80, there are numerous other methods available for monitoring for MC in the workplace.

B. Since many of the duties relating to employee exposure are dependent on the results of measurement procedures, employers must assure that the evaluation of employee exposure is performed by a technically qualified person.

IX. Observation of Monitoring

Your employer is required to perform measurements that are representative of your exposure to MC and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and

equipment are required to be worn, you or your representative must also be provided with, and must wear, protective clothing and equipment.

Access To Information

A. Your employer is required to inform you of the information contained in this Appendix. In addition, your employer must instruct you in the proper work practices for using MC, emergency procedures, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to MC. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being over exposed, he or she is required to inform you of the actions which are being taken to reduce your exposure to within permissible exposure limits.

C. Your employer is required to keep records of your exposures and medical examinations. These records must be kept by the employer for at least thirty (30) years.

D. Your employer is required to release your exposure and medical records to you or your representative upon your request.

E. Your employer is required to provide labels and material safety data sheets (MSDS) for all materials, mixtures or solutions composed of greater than 0.1 percent MC. An example of a label that would satisfy these requirements would be:

**Danger Contains Methylene Chloride
Potential Cancer Hazard**

May worsen heart disease because methylene chloride is converted to carbon monoxide in the body.

May cause dizziness, headache, irritation of the throat and lungs, loss of consciousness and death at high concentrations (for example, if used in a poorly ventilated room).

Avoid Skin Contact. Contact with liquid causes skin and eye irritation.

X. Common Operations and Controls

The following list includes some common operations in which exposure to MC may occur and control methods which may be effective in each case:

Operations	Controls
Use as solvent in paint and varnish removers cold cleaning and ultrasonic cleaning, and as a solvent in furniture stripping.	General dilution ventilation; local; manufacture of aerosols; cold cleaning exhaust ventilation; personal protective equipment; substitution.
Use as solvent in vapor degreasing.	Process enclosure; local exhaust ventilation; chilling coils; substitution.
Use as a secondary refrigerant in air scientific testing.	General dilution ventilation; local conditioning and exhaust ventilation; personal protective equipment.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 97-18-062, § 296-62-07473, filed 9/2/97, effective 12/1/97.]

WAC 296-62-07475 Appendix B. Medical Surveillance for Methylene Chloride

I. Primary Route of Entry Inhalation.

II. Toxicology.

Methylene Chloride (MC) is primarily an inhalation hazard. The principal acute hazardous effects are the depressant action on the central nervous system, possible cardiac toxicity and possible liver toxicity. The range of CNS effects are

from decreased eye/hand coordination and decreased performance in vigilance tasks to narcosis and even death of individuals exposed at very high doses. Cardiac toxicity is due to the metabolism of MC to carbon monoxide, and the effects of carbon monoxide on heart tissue. Carbon monoxide displaces oxygen in the blood, decreases the oxygen available to heart tissue, increasing the risk of damage to the heart, which may result in heart attacks in susceptible individuals. Susceptible

individuals include persons with heart disease and those with risk factors for heart disease. Elevated liver enzymes and irritation to the respiratory passages and eyes have also been reported for both humans and experimental animals exposed to MC vapors.

MC is metabolized to carbon monoxide and carbon dioxide via two separate pathways. Through the first pathway, MC is metabolized to carbon monoxide as an end-product via the P-450 mixed function oxidase pathway located in the microsomal fraction of the cell. This biotransformation of MC to carbon monoxide occurs through the process of microsomal oxidative dechlorination which takes place primarily in the liver. The amount of conversion to carbon monoxide is significant as measured by the concentration of carboxyhemoglobin, up to 12% measured in the blood following occupational exposure of up to 610 ppm. Through the second pathway, MC is metabolized to carbon dioxide as an end product (with formaldehyde and formic acid as metabolic intermediates) via the glutathione dependent enzyme found in the cytosolic fraction of the liver cell. Metabolites along this pathway are believed to be associated with the carcinogenic activity of MC.

MC has been tested for carcinogenicity in several laboratory rodents. These rodent studies indicate that there is clear evidence that MC is carcinogenic to male and female mice and female rats. Based on epidemiologic studies, OSHA has concluded that there is suggestive evidence of increased cancer risk in MC-related worker populations. The epidemiological evidence is consistent with the finding of excess cancer in the experimental animal studies. NIOSH regards MC as a potential occupational carcinogen and the International Agency for Research Cancer (IARC) classifies MC as an animal carcinogen. OSHA considers MC as a suspected human carcinogen.

III. Medical Signs and Symptoms of Acute Exposure

Skin exposure to liquid MC may cause irritation or skin burns. Liquid MC can also be irritating to the eyes. MC is also absorbed through the skin and may contribute to the MC exposure by inhalation. At high concentrations in air, MC may cause nausea, vomiting, light-headedness, numbness of the extremities, changes in blood enzyme levels, and breathing problems, leading to bronchitis and pulmonary edema, unconsciousness and even death.

At lower concentrations in air, MC may cause irritation to the skin, eye, and respiratory tract and occasionally headache and nausea. Perhaps the greatest problem from exposure to low concentrations of MC is the CNS effects on coordination and alertness that may cause unsafe operations of machinery and equipment, leading to self-injury or accidents. Low levels and short duration exposures do not seem to produce permanent disability, but chronic exposures to MC have been demonstrated to produce liver toxicity in animals, and therefore, the evidence is suggestive for liver toxicity in humans after chronic exposure. Chronic exposure to MC may also cause cancer.

IV. Surveillance and Preventive Considerations

As discussed above, MC is classified as a suspect or potential human carcinogen. It is a central nervous system (CNS) depressant and a skin, eye and respiratory tract irritant. At extremely high concentrations, MC has caused liver damage

in animals. MC principally affects the CNS, where it acts as a narcotic. The observation of the symptoms characteristic of CNS depression, along with a physical examination, provides the best detection of early neurological disorders. Since exposure to MC also increases the carboxyhemoglobin level in the blood, ambient carbon monoxide levels would have an additive effect on that carboxyhemoglobin level. Based on such information, a periodic post-shift carboxyhemoglobin test as an index of the presence of carbon monoxide in the blood is recommended, but not required, for medical surveillance.

Based on the animal evidence and three epidemiologic studies previously mentioned, OSHA concludes that MC is a suspect human carcinogen. The medical surveillance program is designed to observe exposed workers on a regular basis. While the medical surveillance program cannot detect MC-induced cancer at a preneoplastic stage, OSHA anticipates that, as in the past, early detection and treatments of cancers leading to enhanced survival rates will continue to evolve.

A. Medical and Occupational History:

The medical and occupational work history plays an important role in the initial evaluation of workers exposed to MC. It is therefore extremely important for the examining physician or other licensed health care professional to evaluate the MC-exposed worker carefully and completely and to focus the examination on MC's potentially associated health hazards. The medical evaluation must include an annual detailed work and medical history with special emphasis on cardiac history and neurological symptoms.

An important goal of the medical history is to elicit information from the worker regarding potential signs or symptoms associated with increased levels of carboxyhemoglobin due to the presence of carbon monoxide in the blood. Physicians or other licensed health care professionals should ensure that the smoking history of all MC exposed employees is known. Exposure to MC may cause a significant increase in carboxyhemoglobin level in all exposed persons. However, smokers as well as workers with anemia or heart disease and those concurrently exposed to carbon monoxide are at especially high risk of toxic effects because of an already reduced oxygen carrying capacity of the blood.

A comprehensive or interim medical and work history should also include occurrence of headache, dizziness, fatigue, chest pain, shortness of breath, pain in the limbs, and irritation of the skin and eyes. In addition, it is important for the physician or other licensed health care professional to become familiar with the operating conditions in which exposure to MC is likely to occur. The physician or other licensed health care professional also must become familiar with the signs and symptoms that may indicate that a worker is receiving otherwise unrecognized and exceptionally high exposure levels of MC.

An example of a medical and work history that would satisfy the requirement for a comprehensive or interim work history is represented by the following:

The following is a list of recommended questions and issues for the self-administered questionnaire for methylene chloride exposure.

Questionnaire For Methylene Chloride Exposure**I. Demographic Information**

1. Name _____
2. Social Security Number _____
3. Date _____
4. Date of Birth _____
5. Age _____
6. Present occupation _____
7. Sex _____
8. Race _____

II. Occupational History

1. Have you ever worked with methylene chloride, dichloromethane, methylene dichloride, or CH₂Cl₂ (all are different names for the same chemical)? Please list which on the occupational history form if you have not already.

2. If you have worked in any of the following industries and have not listed them on the occupational history form, please do so.

Furniture stripping _____

Polyurethane foam manufacturing _____

Chemical manufacturing or formulation _____

Pharmaceutical manufacturing _____

Any industry in which you used solvents to clean and degrease equipment or parts _____

Construction, especially painting and refinishing _____

Aerosol manufacturing _____

Any industry in which you used aerosol adhesives _____

3. If you have not listed hobbies or household projects on the occupational history form, especially furniture refinishing, spray painting, or paint stripping, please do so.

III. Medical History**A. General**

1. Do you consider yourself to be in good health? If no, state reason(s).

2. Do you or have you ever had:

- a. Persistent thirst
- b. Frequent urination (three times or more at night)
- c. Dermatitis or irritated skin
- d. Nonhealing wounds

3. What prescription or nonprescription medications do you take, and for what reasons?

4. Are you allergic to any medications, and what type of reaction do you have?

B. Respiratory

1. Do you have or have you ever had any chest illnesses or diseases? Explain.

2. Do you have or have you ever had any of the following:

- a. Asthma
- b. Wheezing
- c. Shortness of breath

3. Have you ever had an abnormal chest X-ray? If so, when, where, and what were the findings?

4. Have you ever had difficulty using a respirator or breathing apparatus? Explain.

5. Do any chest or lung diseases run in your family? Explain.

6. Have you ever smoked cigarettes, cigars, or a pipe? Age started:

7. Do you now smoke?

8. If you have stopped smoking completely, how old were you when you stopped?

9. On the average of the entire time you smoked, how many packs of cigarettes, cigars, or bowls of tobacco did you smoke per day?

C. Cardiovascular

1. Have you ever been diagnosed with any of the following:

Which of the following apply to you now or did apply to you at some time in the past, even if the problem is controlled by medication? Please explain any yes answers (i.e., when problem was diagnosed, length of time on medication).

- a. High cholesterol or triglyceride level
- b. Hypertension (high blood pressure)
- c. Diabetes
- d. Family history of heart attack, stroke, or blocked arteries

2. Have you ever had chest pain? If so, answer the next five questions.

a. What was the quality of the pain (i.e., crushing, stabbing, squeezing)?

b. Did the pain go anywhere (i.e., into jaw, left arm)?

c. What brought the pain out?

d. How long did it last?

e. What made the pain go away?

3. Have you ever had heart disease, a heart attack, stroke, aneurysm, or blocked arteries anywhere in your body? Explain (when, treatment).

4. Have you ever had bypass surgery for blocked arteries in your heart or anywhere else? Explain.

5. Have you ever had any other procedures done to open up a blocked artery (balloon angioplasty, carotid endarterectomy, clot-dissolving drug)?

6. Do you have or have you ever had (explain each):

- a. Heart murmur
- b. Irregular heartbeat
- c. Shortness of breath while lying flat
- d. Congestive heart failure
- e. Ankle swelling
- f. Recurrent pain anywhere below the waist while walking

7. Have you ever had an electrocardiogram (EKG)? When?

8. Have you ever had an abnormal EKG? If so, when, where, and what were the findings?

9. Do any heart diseases, high blood pressure, diabetes, high cholesterol, or high triglycerides run in your family? Explain.

D. Hepatobiliary and Pancreas

1. Do you now or have you ever drunk alcoholic beverages? Age started: _____ Age stopped: _____

2. Average numbers per week:

a. Beers: _____, ounces in usual container: _____ b. Glasses of wine: _____, ounces per glass: _____ c. Drinks: _____, ounces in usual container: _____

3. Do you have or have you ever had (explain each):

a. Hepatitis (infectious, autoimmune, drug-induced, or chemical)

b. Jaundice

c. Elevated liver enzymes or elevated bilirubin

- d. Liver disease or cancer
- E. Central Nervous System

1. Do you or have you ever had (explain each):

- a. Headache
- b. Dizziness
- c. Fainting
- d. Loss of consciousness
- e. Garbled speech
- f. Lack of balance
- g. Mental/psychiatric illness
- h. Forgetfulness

F. Hematologic

1. Do you have, or have you ever had (explain each):

- a. Anemia
- b. Sickle cell disease or trait
- c. Glucose-6-phosphate dehydrogenase deficiency
- d. Bleeding tendency disorder

2. If not already mentioned previously, have you ever had a reaction to sulfa drugs or to drugs used to prevent or treat malaria? What was the drug? Describe the reaction.

B. Physical Examination

The complete physical examination, when coupled with the medical and occupational history, assists the physician or other licensed health care professional in detecting pre-existing conditions that might place the employee at increased risk, and establishes a baseline for future health monitoring. These examinations should include:

1. Clinical impressions of the nervous system, cardiovascular function and pulmonary function, with additional tests conducted where indicated or determined by the examining physician or other licensed health care professional to be necessary.

2. An evaluation of the advisability of the worker using a respirator, because the use of certain respirators places an additional burden on the cardiopulmonary system. It is necessary for the attending physician or other licensed health care professional to evaluate the cardiopulmonary function of these workers, in order to inform the employer in a written medical opinion of the worker's ability or fitness to work in an area requiring the use of certain types of respiratory protective equipment. The presence of facial hair or scars that might interfere with the worker's ability to wear certain types of respirators should also be noted during the examination and in the written medical opinion.

Because of the importance of lung function to workers required to wear certain types of respirators to protect themselves from MC exposure, these workers must receive an assessment of pulmonary function before they begin to wear a negative pressure respirator and at least annually thereafter. The recommended pulmonary function tests include measurement of the employee's forced vital capacity (FVC), forced expiratory volume at one second (FEV1), as well as calculation of the ratios of FEV1 to FVC, and the ratios of measured FVC and measured FEV1 to expected respective values corrected for variation due to age, sex, race, and height. Pulmonary function evaluation must be conducted by a physician or other licensed health care professional experienced in pulmonary function tests.

The following is a summary of the elements of a physical exam which would fulfill the requirements under the MC standard:

Physical Exam

I. Skin and appendages

1. Irritated or broken skin 2. Jaundice 3. Clubbing cyanosis, edema 4. Capillary refill time 5. Pallor

II. Head

1. Facial deformities 2. Scars 3. Hair growth

III. Eyes

1. Scleral icterus 2. Corneal arcus 3. Pupillary size and response 4. Fundoscopic exam

IV. Chest

1. Standard exam

V. Heart

1. Standard exam 2. Jugular vein distension 3. Peripheral pulses

VI. Abdomen

1. Liver span

VII. Nervous System

1. Complete standard neurologic exam

VIII. Laboratory

1. Hemoglobin and hematocrit 2. Alanine aminotransferase (ALT, SGPT) 3. Post-shift carboxyhemoglobin

I. Studies

1. Pulmonary function testing

2. Electrocardiogram

An evaluation of the oxygen carrying capacity of the blood of employees (for example by measured red blood cell volume) is considered useful, especially for workers acutely exposed to MC. It is also recommended, but not required, that end of shift carboxyhemoglobin levels be determined periodically, and any level above 3% for nonsmokers and above 10% for smokers should prompt an investigation of the worker and his workplace. This test is recommended because MC is metabolized to CO, which combines strongly with hemoglobin, resulting in a reduced capacity of the blood to transport oxygen in the body. This is of particular concern for cigarette smokers because they already have a diminished hemoglobin capacity due to the presence of CO in cigarette smoke.

C. Additional Examinations and Referrals

1. Examination by a Specialist

When a worker examination reveals unexplained symptoms or signs (i.e. in the physical examination or in the laboratory tests), follow-up medical examinations are necessary to assure that MC exposure is not adversely affecting the worker's health. When the examining physician or other licensed health care professional finds it necessary, additional tests should be included to determine the nature of the medical problem and the underlying cause. Where relevant, the worker should be sent to a specialist for further testing and treatment as deemed necessary. The final rule requires additional investigations to be covered and it also permits physicians or other licensed health care professionals to add appropriate or necessary tests to improve the diagnosis of disease should such tests become available in the future.

2. Emergencies

The examination of workers exposed to MC in an emergency should be directed at the organ systems most likely to

be affected. If the worker has received a severe acute exposure, hospitalization may be required to assure proper medical intervention. It is not possible to precisely define "severe," but the physician or other licensed health care professional's judgment should not merely rest on hospitalization. If the worker has suffered significant conjunctival, oral, or nasal irritation, respiratory distress, or discomfort, the physician or other licensed health care professional should instigate appropriate follow-up procedures. These include attention to the eyes, lungs and the neurological system. The frequency of follow-up examinations should be determined by the attending physician or other licensed health care professional. This testing permits the early identification essential to proper medical management of such workers.

D. Employer Obligations

The employer is required to provide the responsible physician or other licensed health care professional and any specialists involved in a diagnosis with the following information: a copy of the MC standard including relevant appendices, a description of the affected employee's duties as they relate to his or her exposure to MC; an estimate of the employee's exposure including duration (e.g., 15hr/wk, three 8-hour shifts/wk, full time); a description of any personal protective equipment used by the employee, including respirators; and the results of any previous medical determinations for the affected employee related to MC exposure to the extent that this information is within the employer's control.

E. Physicians' or Other Licensed Health Care Professionals' Obligations

The standard requires the employer to ensure that the physician or other licensed health care professional provides a written statement to the employee and the employer. This statement should contain the physician's or licensed health care professional's opinion as to whether the employee has any medical condition placing him or her at increased risk of impaired health from exposure to MC or use of respirators, as appropriate. The physician or other licensed health care professional should also state his or her opinion regarding any restrictions that should be placed on the employee's exposure to MC or upon the use of protective clothing or equipment such as respirators. If the employee wears a respirator as a result of his or her exposure to MC, the physician or other licensed health care professional's opinion should also contain a statement regarding the suitability of the employee to wear the type of respirator assigned.

Furthermore, the employee should be informed by the physician or other licensed health care professional about the cancer risk of MC and about risk factors for heart disease, and the potential for exacerbation of underlying heart disease by exposure to MC through its metabolism to carbon monoxide. Finally, the physician or other licensed health care professional should inform the employer that the employee has been told the results of the medical examination and of any medical conditions which require further explanation or treatment. This written opinion must not contain any information on specific findings or diagnosis unrelated to employee's occupational exposures.

The purpose in requiring the examining physician or other licensed health care professional to supply the employer with a written opinion is to provide the employer

with a medical basis to assist the employer in placing employees initially, in assuring that their health is not being impaired by exposure to MC, and to assess the employee's ability to use any required protective equipment.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 97-18-062, § 296-62-07475, filed 9/2/97, effective 12/1/97.]

WAC 296-62-07477 Appendix C.

Questions and Answers

Methylene Chloride Control in Furniture Stripping (Adapted from NIOSH publication No. 93-133)

Introduction

This appendix answers commonly asked questions about the hazards from exposure to methylene chloride. It also describes approaches to controlling methylene chloride exposure during the most common furniture stripping processes. Although these approaches were developed and field tested by the National Institute of Occupational Safety and Health, each setting requires custom installation because of the different air flow interferences at each site.

1. What is the Stripping Solution Base?

The most common active ingredient in paint removers is a chemical called methylene chloride. Methylene chloride is present in the paint remover to penetrate, blister, and finally lift the old finish. Other chemicals in paint removers work to accelerate the stripping process, to retard evaporation, and to act as thickening agents. These other ingredients may include: methanol, toluene, acetone, or paraffin.¹

2. Is Methylene Chloride Bad for Me?

Exposure to methylene chloride may cause short-term health effects or long-term health effects.

Short-Term (Acute) Health Effects

Exposure to high levels of paint removers over short periods of time can cause irritation to the skin, eyes, mucous membranes, and respiratory tracts. Other symptoms of high exposure are dizziness, headache, and lack of coordination. The occurrence of any of these symptoms indicates that you are being exposed to high levels of methylene chloride. At the onset of any of these symptoms, you should leave the work area, get some fresh air, and determine why the levels were high.

A portion of inhaled methylene chloride is converted by the body to carbon monoxide, which can lower the blood's ability to carry oxygen. When the solvent is used properly, however, the levels of carbon monoxide should not be hazardous. Individuals with cardiovascular or pulmonary health problems should check with their physician before using the paint stripper. Individuals experiencing severe symptoms such as shortness of breath or chest pains should obtain proper medical care immediately.¹

Long-Term (Chronic) Health Effects

Methylene chloride has been shown to cause cancer in certain laboratory animal tests. The available human studies do not provide the necessary information to determine whether methylene chloride causes cancer in humans. However, as a result of the animal studies, methylene chloride is considered a potential occupational carcinogen. There is also consider-

able indirect evidence to suggest that workers exposed to methylene chloride may be at an increased risk of developing ischemic heart disease. Therefore, it is prudent to minimize exposure to solvent vapors.³

3. What does the Methylene Chloride Standard Require?

On January 10, 1997, the Occupational Safety and Health Administration published a new regulation for methylene chloride. The standard establishes an eight-hour time-weighted average exposure limit of 25 parts per million (ppm), as well as a short-term exposure limit of 125 ppm determined from a 15 minute sampling period. That is a reduction from the current WISHA limit of 100 ppm. The standard also sets a 12.5 ppm action level (a level that would trigger periodic exposure monitoring and medical surveillance provisions).² WISHA adopted an identical standard on [date].

The National Institute for Occupational Safety and Health recommends that methylene chloride be regarded as a "potential occupational carcinogen." NIOSH further recommends that occupational exposure to methylene chloride be controlled to the lowest feasible limit. This recommendation was based on the observation of cancers and tumors in both rats and mice exposed to methylene chloride in air.⁵

4. How Can I Be Exposed to Methylene Chloride while Stripping Furniture?

Methylene chloride can be inhaled when vapors are in the air. Inhalation of the methylene chloride vapors is generally the most important source of exposure. Methylene chloride evaporates quicker than most chemicals. The odor threshold of methylene chloride is 300 ppm.⁶ Therefore, once you smell methylene chloride, you are being over-exposed. Pouring, moving, or stirring the chemical will increase the rate of evaporation.

Methylene chloride can be absorbed through the skin either by directly touching the chemical or through your gloves. Methylene chloride can be swallowed if it gets on your hands, clothes, or beard, or if food or drinks become contaminated.

5. How Can Breathing Exposures be Reduced?

Install a Local Exhaust Ventilation System

Local exhaust ventilation can be used to control exposures. Local exhaust ventilation systems capture contaminated air from the source before it spreads into the workers' breathing zone.⁷ If engineering controls are not effective, only a self-contained breathing apparatus equipped with a full face piece and operated in a positive-pressure mode or a supplied-air respirator affords the level of protection. Air-purifying respirators such as gas masks with organic vapor canisters can only be used for escape situations.⁸ These gas masks are not suitable for normal work situations because methylene chloride is poorly absorbed by the canister filtering material.

A local exhaust system consists of the following: a hood, a fan, ductwork, and a replacement air system.^{9,10,11} Two processes are commonly used in furniture stripping: flow-over and dip tanks. For flow-over systems there are two common local exhaust controls for methylene chloride - a slot hood

and a down draft hood. A slot hood of different design is most often used for dip tanks. (See Figures 1, 2, and 3.)

The hood is made of sheet metal and connected to the tank. All designs require a centrifugal fan to exhaust the fumes, ductwork connecting the hood and the fan, and a replacement air system to bring conditioned air into the building to replace the air exhausted.

In constructing or designing a slot or down draft hood, use the following data:

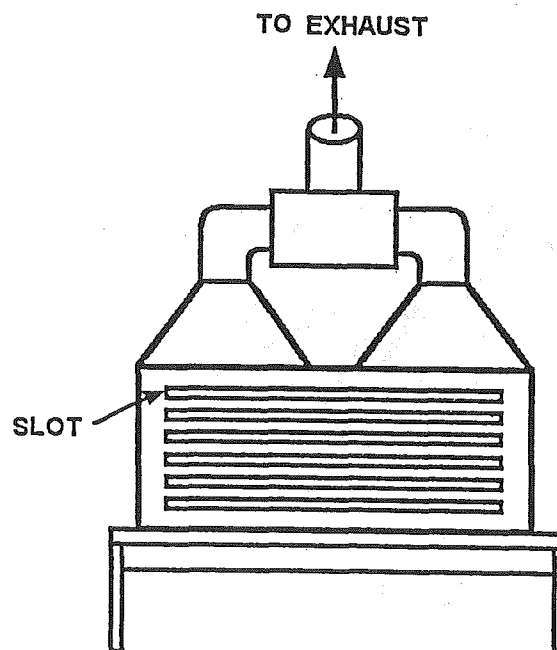


FIGURE 1 -- SLOT HOOD

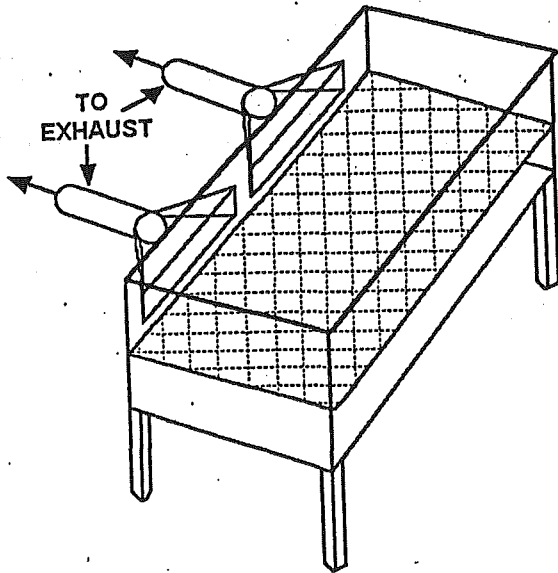


FIGURE 2 -- DOWNDRAFT HOOD

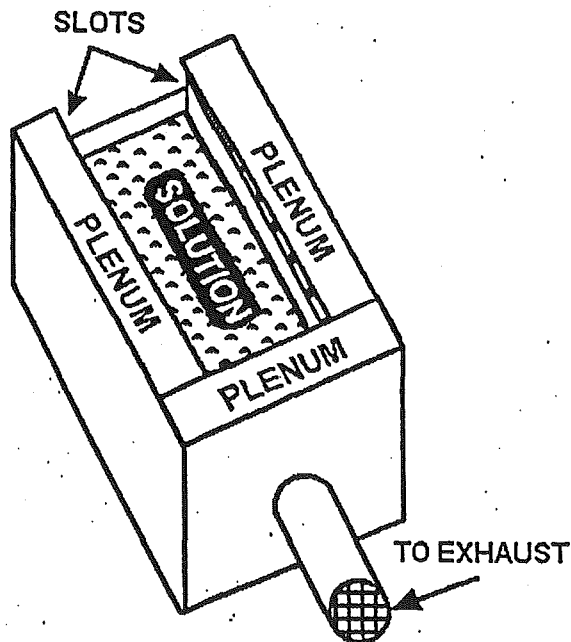


FIGURE 3 -- SLOT HOOD FOR DIP TANK

Safe Work Practices

Workers can lower exposures by decreasing their access to the methylene chloride.¹²

- 1) Turn on dip tank control system several minutes before entering the stripping area.

[Title 296 WAC—p. 1468]

- 2) Avoid unnecessary transferring or moving of the stripping solution.
- 3) Keep face out of the air stream between the solution-covered furniture and the exhaust system.
- 4) Keep face out of vapor zone above the stripping solution and the dip tank.
- 5) Retrieve dropped items with a long handled tool.
- 6) Keep the solution-recycling system off when not in use. Cover reservoir for recycling system.
- 7) Cover dip tank when not in use.
- 8) Provide adequate ventilation for rinse area.

How Can Skin Exposures Be Reduced?

Skin exposures can be reduced by wearing gloves whenever you are in contact with the stripping solution.¹³

- 1) Two gloves should be worn. The inner glove should be made from polyethylene/ethylene vinyl alcohol (e.g., Silver Shield®, or 4H®). This material, however, does not provide good physical resistance against tears, so an outer glove made from nitrile or neoprene should be worn.
- 2) Shoulder-length gloves will be more protective.
- 3) Change gloves before the break-through time occurs. Rotate several pairs of gloves throughout the day. Let the gloves dry in a warm well ventilated area at least over night before reuse.
- 4) Keep gloves clean by rinsing often. Keep gloves in good condition. Inspect the gloves before use for pin-holes, cracks, thin spots, and stiffer than normal or sticky surfaces.
- 5) Wear a face shield or goggles to protect face and eyes.

6. What Other Problems Can Occur?

Stripping Solution Temperature

Most manufacturers of stripping solution recommend controlling the solution to a temperature of 70°F. This temperature is required for the wax in the solution to form a vapor barrier on top of the solution to keep the solution from evaporating too quickly. If the temperature is too high, the wax will not form the vapor barrier. If it is too cold, the wax will solidify and separate from the solvent causing increased evaporation. Use a belt heater to heat the solution to the correct temperature. Call your solution manufacturer for the correct temperature for your solution.¹⁴

Make-Up Air

Air will enter a building in an amount to equal the amount of air exhausted whether or not provision is made for this replacement. If a local exhaust system is added a make-up or replacement air system must be added to replace the air removed. Without a replacement air system, air will enter the building through cracks causing uncontrollable eddy currents. If the building perimeter is tightly sealed, it will prevent the air from entering and severely decrease the amount exhausted from the ventilation system. This will cause the building to be under negative pressure and decrease the performance of the exhaust system.¹⁵

Dilution Ventilation

With general or dilution ventilation, uncontaminated air is moved through the workroom by means of fans or open windows, which dilutes the pollutants in the air. Dilution ventilation does not provide effective protection to other workers

and does not confine the methylene chloride vapors to one area.¹⁶

Phosgene Poisoning from Use of Kerosene Heaters

Do not use kerosene heaters or other open flame heaters while stripping furniture. Use of kerosene heaters in connection with methylene chloride can create lethal or dangerous concentrations of phosgene. Methylene chloride vapor is mixed with the air used for the combustion of kerosene in kerosene stoves. The vapor thus passes through the flames, coming into close contact with carbon monoxide at high temperatures. Any chlorine formed by decomposition may, under these conditions, react with carbon monoxide and form phosgene.¹⁷

REFERENCES

¹Halogenated Solvents Industry Alliance and Consumer Product Safety Commission [1990]. Stripping Paint from Wood (Pamphlet for consumers on how to strip furniture and precautions to take). Washington DC: Consumer Product Safety Commission.

²*Ibid.*

³NIOSH [1992]. NIOSH Testimony on Occupational Safety and Health Administration's proposed rule on occupational exposure to methylene chloride, September 21, 1992, OSHA Docket No. H-71. NIOSH policy statements. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

⁴56 Fed. Reg. 57036 [1991]. Occupational Safety and Health Administration: Proposed rule on occupational exposure to methylene chloride.

⁵NIOSH [1992].

⁶Kirk, R.E. and P.F. Othmer, Eds. [1978]. Encyclopedia of Chemical Technology, 3rd Ed., Vol. 5:690. New York: John Wiley & Sons, Inc.

⁷ACGIH [1988]. Industrial Ventilation: A Manual of Recommended Practice. 20th Ed. Cincinnati, OH: American Conference of Governmental Industrial Hygienists.

⁸NIOSH [1992].

⁹Fairfield, C.L. and A.A. Beasley [1991]. In-depth Survey Report at the Association for Retarded Citizens, Meadowlands, PA. The Control of Methylene Chloride During Furniture Stripping. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

¹⁰Fairfield, C.L. [1991]. In-depth Survey Report at the J.M. Murray Center, Cortland, NY. The Control of Methylene Chloride During Furniture Stripping. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

¹¹Hall, R.M., K.F. Martinez, and P.A. Jensen [1992]. In-depth Survey Report at Tri-County Furniture Stripping and Refinishing, Cincinnati, OH. The Control of Methylene Chloride During Furniture Stripping. Cincinnati, OH: U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

(1999 Ed.)

¹²Fairfield, C.L. and A.A. Beasley [1991]. In-depth Survey Report at the Association for Retarded Citizens, Meadowlands, PA. The Control of Methylene Chloride During Furniture Stripping. Cincinnati, OH: U.S. Department of Health and Human Service, Centers for Disease Control, National Institute for Occupational Safety and Health.

¹³Roder, M. [1991]. Memorandum of March 11, 1991 from Michael Roder of the Division of Safety Research to Cheryl L. Fairfield of the Division of Physical Sciences and Engineering, National Institute for Occupational Safety and Health, Centers for Disease Control, Public Health Service, U.S. Department of Health and Human Services.

¹⁴Kwick Kleen Industrial Solvents, Inc., [1981]. Operations Manual, Kwick Kleen Industrial Solvents, Inc., Vincennes, IN.

¹⁵ACGIH [1988].

¹⁶*Ibid.*

¹⁷Gerritsen, W.B. and C.H. Buschmann [1960]. Phosgene Poisoning Caused by the Use of Chemical Paint Removers containing Methylene Chloride in III-Ventilated Rooms Heated by Kerosene Stoves. British Journal of Industrial Medicine 17:187.

[Statutory Authority: RCW 49.17.040, [49.17].050, [49.17].060. 98-10-029, § 296-62-07477, filed 4/24/98, effective 7/24/98; 97-18-062, § 296-62-07477, filed 9/2/97, effective 12/1/97.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

PART H—AIR CONTAMINANTS

WAC 296-62-075 Air contaminants. (1) An employee's exposure to any substance listed in Table 1 of WAC 296-62-07515 shall be limited in accordance with the requirements of WAC 296-62-07501 through 296-62-07513.

(2) The following definitions are applicable to the limits in Table 1.

(a) Time weighted average (TWA) is the employee's average airborne exposure to any 8-hour work shift of a 40-hour work week which shall not be exceeded.

(b) Short term exposure limit (STEL) is the employee's 15-minute time weighted average exposure which shall not be exceeded at any time during a work day unless another time limit is specified in a parenthetical notation below the limit. If another time period is specified, the time weighted average exposure over that time period shall not be exceeded at any time during the working day.

(c) Ceiling is the employee's exposure which shall not be exceeded during any part of the work day. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time over a working day.

(d) The terms "substance," "air contaminant," and "material" are equivalent in meaning for WAC 296-62-075 through 296-62-07515.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 97-19-014, § 296-62-075, filed 9/5/97, effective 11/5/97. Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-075, filed 7/6/89, effective 8/7/89; Order 73-3, § 296-62-075, filed 5/7/73.]

WAC 296-62-07501 Airborne contaminants. (1) Permissible exposure limits (PELs) refer to airborne concentra-

tions of substances without regard to the use of respiratory protection and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect. Because of wide variation in individual susceptibility, however, a small percentage of workers may experience discomfort from some substances at concentrations at or below the permissible limit, a smaller percentage may be affected more seriously by aggravation of a pre-existing condition or by development of an occupational illness.

(2) Permissible exposure limits refer to time-weighted concentrations for an 8-hour workday within a 40-hour workweek which shall not be exceeded.

(a) The cumulative time-weighted average exposure for an 8-hour work shift shall be computed as follows:

$$E = \frac{C_a T_a + C_b T_b + \dots + C_n T_n}{8}$$

where:

E is the equivalent exposure for the working shift.

C is the concentration during any period of time T where the concentration remains constant.

T is the duration in hours of the exposure at the concentration C.

The value of E shall not exceed the eight-hour time-weighted average (TWA) limit in Table 1 (see WAC 296-62-07515), for the material involved.

(b) To illustrate the formula, assume that substance A has an 8-hour time-weighted average limit of 100 ppm as noted in Table 1 of WAC 296-62-07515. Assume that an employee is subject to the following exposure:

- Two hours exposure at 150 ppm
- Two hours exposure at 75 ppm
- Four hours exposure at 50 ppm

Substituting this information in the formula, we have

$$(2 \times 150 + 2 \times 75 + 4 \times 50) \div 8 = 81.25 \text{ ppm}$$

Since 81.25 ppm is less than 100 ppm, the 8-hour time-weighted average limit, the exposure is acceptable.

(3) Methods of compliance:

(a) To achieve compliance with these standards, the employer shall determine and implement feasible administrative or engineering controls.

(b) When administrative or engineering controls are not feasible to achieve full compliance, they shall nonetheless be used to reduce exposures to the lowest levels achievable by these controls.

(c) Any control equipment or technical measure utilized for the purpose of complying with WAC 296-62-07501(3) must be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used their use shall comply with WAC 296-62-071 through 296-62-07121.

(d) Upon request, the employer shall prepare and submit a written compliance plan to the director. This plan must include a description of the manner in which compliance will be achieved with respect to cited violations of WAC 296-62-07501(3), and shall include proposed abatement methods,

anticipated completion dates, and provision for progress reports to be sent to the department.

(4) An employee's exposure to any substance in Table 1 (see WAC 296-62-07515) which does not have a ceiling or a specified short-term exposure limit (STEL) shall not exceed the generic STEL which is computed by multiplying the applicable eight-hour time-weighted average (TWA) for the substance by the appropriate multiplier listed below.

Eight-hour TWA	Multiplier
PEL > 0-1	(ppm or mg/M ³) x 3
PEL > 1-10	(ppm or mg/M ³) x 2
PEL > 10-100	(ppm or mg/M ³) x 1.5
PEL > 100-1000	(ppm or mg/M ³) x 1.25
PEL > 1000	(ppm or mg/M ³) x 1

(5) Permissible limits are based on the best available information from industrial experience, from experimental human and animal studies, and, when possible, from a combination of the three. The basis on which the values are established may differ from substance to substance; protection against impairment of health may be a guiding factor for some, whereas reasonable freedom from irritation, narcosis, nuisance or other forms of stress may form the basis for others.

(6) The limits based on physical irritation shall be considered no less binding than those based on physical impairment. There is increasing evidence that physical irritation may initiate, promote or accelerate physical impairment through interaction with other chemical or biologic agents.

(7) In spite of the fact that serious injury is not believed likely as a result of exposure to the permissible limit concentrations, the best practice is to maintain concentrations of all atmospheric contaminants as low as is practical.

(8) These limits are intended for use in the practice of industrial hygiene and should be interpreted and applied only by a technically qualified person.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07501, filed 9/5/97, effective 11/5/97. Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-07501, filed 7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-07501, filed 1/15/82. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-015 (Order 81-20), § 296-62-07501, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-07501, filed 8/8/80; Order 73-3, § 296-62-07501, filed 5/7/73.]

WAC 296-62-07503 Ceiling vs. time-weighted average limits. (1) Although the time-weighted average concentration provides the most satisfactory, practical way of monitoring airborne agents for compliance with the limits, there are certain substances for which it is inappropriate. In the latter group are substances which are predominantly fast acting and whose permissible limit is based on this particular response. Substances with this type of response are controlled by a ceiling limit that shall not be exceeded during any part of the work day. It is implicit in these definitions that the manner of sampling to determine compliance with the limits for each group must differ; a single brief sample, that is applicable to a ceiling limit, is not appropriate to the time-weighted limit; here, a sufficient number of samples are needed to determine a time-weighted average concentration throughout a complete cycle of operations or throughout the work shift.

(2) Whereas the ceiling limit places a definite boundary which concentrations shall not be permitted to exceed, the time-weighted average limit requires an explicit limit to the excursions that are permissible above the listed values. The magnitude of these excursions are limited by an appropriate factor shown in WAC 296-62-07501(4).

[Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-07503, filed 7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07503, filed 8/8/80; Order 73-3, § 296-62-07503, filed 5/7/73.]

WAC 296-62-07505 "Skin" notation. Listed substances marked with an "X" in the "skin" column of Table 1 refer to the potential contribution to the overall exposure by the cutaneous route including mucous membranes and eye, either by airborne, or more particularly, by direct contact with the substance. Vehicles can alter skin absorption. Measures for the prevention of cutaneous absorption so that the permissible limit is not invalidated shall be taken. Such measures may include the use of gloves, coveralls, goggles, or other appropriate personal protective equipment, engineering controls or other work practices.

[Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-07505, filed 7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07505, filed 8/8/80; Order 73-3, § 296-62-07505, filed 5/7/73.]

WAC 296-62-07507 Mixtures. Special consideration shall be given to assessing the health hazards associated with exposure to mixtures of two or more substances which have similar health effects.

(1) In case of a mixture of air-contaminants compute the equivalent exposure as follows:

$$E_m = \frac{C_1}{L_1} + \frac{C_2}{L_2} + \dots + \frac{C_n}{L_n}$$

Where:

E_m is the equivalent exposure for the mixture.

C is the concentration of a particular contaminant.

L is the exposure limit for that contaminant, from Table 1 or 2.

The value of E_m shall not exceed unity (1).

(2) To illustrate the formula consider the following exposures:

Substance	Actual concentration of 8 hour exposure (ppm)	8 hr. TWA PEL (ppm)
B	500	1000
C	45	200
D	40	200

Substituting in the formula, we have:

$$E_m = 500 \div 1,000 + 45 \div 200 + 40 \div 200$$

$$E_m = 0.500 + 0.225 + 0.200$$

$$E_m = .925$$

Since E_m is less than unity (1), the exposure combination is within acceptable limits.

[Statutory Authority: Chapter 49.17 RCW. 90-03-029 (Order 89-20), § 296-62-07507, filed 1/11/90, effective 2/26/90; 89-15-002 (Order 89-06), § 296-62-07507, filed 7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07507, filed 8/8/80; Order 73-3, § 296-62-07507, filed 5/7/73.]

WAC 296-62-07509 Nuisance dusts. (1) In contrast to fibrogenic dusts which cause scar tissue to be formed in lungs when inhaled in excessive amounts, so-called "nuisance" dusts have a long history of little adverse effect on lungs and do not produce significant organic disease or toxic effect when exposures are kept under reasonable control. The nuisance dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lung when inhaled in sufficient amount. However, the lung-tissue reaction caused by inhalation of nuisance dusts has the following characteristics:

(a) The architecture of the air spaces remains intact,

(b) Collagen (scar tissue) is not formed to a significant extent,

(c) The tissue reaction is potentially reversible.

(2) Excessive concentrations of nuisance dusts in the workroom air may seriously reduce visibility, may cause unpleasant deposits in the eyes, ears and nasal passages, or cause injury to the skin or mucous membranes by chemical or mechanical action per se or by the rigorous skin cleansing procedures necessary for their removal.

(3) A permissible limit of 10 milligrams per cubic meter, of total dust < 1% SiO₂, or 5.0 mg/m³, respirable fraction, time weighted average, is mandatory for substances in these categories and for which no specific permissible limits have been assigned. This limit does not apply to those substances which may cause physiologic impairment at lower concentrations but for which a threshold limit has not yet been adopted.

(4) All inert or nuisance dusts, whether mineral, inorganic, or organic, not listed specifically by substance name, are covered by the particulate not otherwise regulated (PNOR) limit in Table 1: Limits for air contaminants, except: The exemption specified in subsection (3) of this section.

[Statutory Authority: Chapter 49.17 RCW. 93-01-067 (Order 92-15), § 296-62-07509, filed 12/11/92, effective 1/15/93. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07509, filed 8/8/80; Order 73-3, § 296-62-07509, filed 5/7/73.]

WAC 296-62-07510 Total particulate. Total particulate exposure shall not exceed a permissible limit of 10 milligrams per cubic meter (mg/M³) of air for total dust or 5 milligrams per cubic meter (mg/M³) for respirable dust. The use of this eight-hour time-weighted-average exposure limit does not preclude the application of other applicable limits in WAC 296-62-075 through 296-62-07515. Nor does it preclude the use of WAC 296-62-060 when substances not specifically listed in Table 1 are found to require a lower limit. This section does, however, limit the combined total concentration of all particulate contaminants whether or not specifically listed in Table 1.

[Statutory Authority: RCW 49.17.040, [49.17.050 and [49.17.060. 97-19-014, § 296-62-07510, filed 9/5/97, effective 11/5/97. Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-07510, filed

7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07510, filed 8/8/80.]

WAC 296-62-07511 Simple asphyxiants. "Inert" gases or vapors. A number of gases and vapors when present in high concentrations in air act primarily as simple asphyxiants without other significant physiologic effects. A PEL may not be established for each simple asphyxiant because the limiting factor is the available oxygen. The minimal oxygen content shall be 19.5 percent by volume under normal atmospheric pressure (equivalent to a partial pressure, pO_2 of 148 mm Hg). Atmospheres deficient in O_2 do not provide adequate warning and most simple asphyxiants are odorless. Several simple asphyxiants present an explosion hazard. Account shall be taken of this factor in limiting the concentration of the asphyxiant.

[Statutory Authority: Chapter 49.17 RCW. 89-15-002 (Order 89-06), § 296-62-07511, filed 7/6/89, effective 8/7/89. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07511, filed 8/8/80; Order 73-3, § 296-62-07511, filed 5/7/73.]

WAC 296-62-07513 Physical factors. It is recognized that such physical factors as heat, ultraviolet and ionizing radiation, humidity, abnormal pressure and the like may place added stress on the body so that the effects from exposure at a permissible limit may be altered. Most of these stresses act adversely to increase the toxic response of a substance. Although most permissible limits have built-in safety factors to guard against adverse effects to moderate deviations from normal environments, the safety factors of most substances are not of such a magnitude as to take care of gross deviations.

[Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 80-11-010 (Order 80-14), § 296-62-07513, filed 8/8/80; Order 73-3, § 296-62-07513, filed 5/7/73.]

WAC 296-62-07515 Control of chemical agents. Chemical agents shall be controlled in such a manner that the workers exposure shall not exceed the applicable limits in WAC 296-62-075 through 296-62-07515.

TABLE 1: LIMITS FOR AIR CONTAMINANTS
Permissible Exposure Limits (PEL)

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Abate, see Temephos								
Acetaldehyde	75-07-0	100	180	150	270			
Acetic acid	64-19-7	10	25					
Acetic anhydride	108-24-7					5.0	20	
Acetone	67-64-1	750	1800	1000	2400			
Acetonitrile	75-05-8	40	70	60	105			
2-Acetylaminofluorene (see WAC 296-62-073)	53-96-3							
Acetylene	74-86-2	Simple	Asphyxiant					
Acetylene dichloride (see 1,2-Dichloroethylene)								
Acetylene tetrabromide	79-27-6	1.0	14					
Acetylsalicylic acid (Aspirin)	50-78-2		5.0					
Acrolein	107-02-8	0.1	0.25	0.3	0.8			
Acrylamide	79-06-1		0.03					X
Acrylic acid	79-10-7	10	30					X
Acrylonitrile (see WAC 296-62-07336(3))	107-13-1							
Aldrin	309-00-2		0.25					X
Allyl alcohol	107-18-6	2.0	5.0	4.0	10			X
Allyl Chloride	107-05-1	1.0	3.0	2.0	6.0			
Allyl glycidyl ether (AGE)	106-92-3	5.0	22	10	44			
Allyl propyl disulfide	2179-59-1	2.0	12	3.0	18			
alpha-Alumina (see Aluminum oxide)	1344-28-1							
Total dust			10					
Respirable fraction			5.0 ^k					
Aluminum, metal and oxide (as Al)	7429-90-5							
Total dust			10					
Respirable fraction			5.0 ^k					
pyro powders			5.0					
welding fumes ^f			5.0					
soluble salts			2.0					
alkyls (NOC)			2.0					
Alundum (see Aluminum oxide)								
4-Aminodiphenyl (see WAC 296-62-073)	92-67-1							
2-Aminoethanol (see Ethanolamine)								
2-Aminopyridine	504-29-0	0.5	2.0					
Amitrole	61-82-5		0.2					
Ammonia	7664-41-7	25	18	35	27			

Occupational Health Standards

296-62-07515

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Ammonium chloride, fume	12125-02-9	—	10	—	20	—	—	—
Ammonium sulfamate (Ammate)	7773-06-0	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
n-Amyl acetate	628-63-7	100	525	—	—	—	—	—
sec-Amyl acetate	626-38-0	125	650	—	—	—	—	—
Aniline and homologues	62-53-3	2.0	8.0	—	—	—	—	X
Anisidine (o, p-isomers)	29191-52-4	0.1	0.5	—	—	—	—	X
Antimony and compounds (as Sb)	7440-36-0	—	0.5	—	—	—	—	—
ANTU (alpha Naphthyl thiourea)	86-88-4	—	0.3	—	—	—	—	—
Argon	7440-37-1	Simple	Asphyxiant	—	—	—	—	—
Arsenic, Organic compounds (as As)	7440-38-2	—	0.2	—	—	—	—	—
Arsenic, Inorganic compounds (as As) (when use is covered by WAC 296-62-07347)	7440-38-2	—	0.01	—	—	—	—	—
Arsenic, Inorganic compounds (as As) (when use is not covered by WAC 296-62-07347)	7440-38-2	—	0.2	—	—	—	—	—
Arsine	7784-42-1	0.05	0.2	—	—	—	—	—
Asbestos (see WAC 296-62-077 through 296-62-07753)	—	—	—	—	—	—	—	—
Asphalt (Petroleum fumes)	8052-42-4	—	5.0	—	—	—	—	—
Atrazine	1912-24-9	—	5.0	—	—	—	—	—
Azinphos methyl	86-50-0	—	0.2	—	—	—	—	X
Barium, soluble compounds (as Ba)	7440-39-3	—	0.5	—	—	—	—	—
Barium Sulfate	7727-43-7	—	—	—	—	—	—	—
Total dust	—	—	10.0	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Benomyl	17804-35-2	—	—	—	—	—	—	—
Total dust	—	0.8	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Benzene (see WAC 296-62-07523) ^d	71-43-2	1.0	—	5.0	—	—	—	—
Benzidine (see WAC 296-62-073)	92-87-5	—	—	—	—	—	—	—
p-Benzoquinone (see Quinone)	—	—	—	—	—	—	—	—
Benzo(a) pyrene (see Coal tar pitch volatiles)	—	—	—	—	—	—	—	—
Benzoyl peroxide	94-36-0	—	5.0	—	—	—	—	—
Benzyl chloride	100-44-7	1.0	5.0	—	—	—	—	—
Beryllium and beryllium compounds (as Be)	7440-41-7	—	0.002	—	0.005 (30 min.)	—	0.025	—
Biphenyl (see Diphenyl)	—	—	—	—	—	—	—	—
Bismuth telluride, Undoped	1304-82-1	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Bismuth telluride, Se-doped	—	—	5.0	—	—	—	—	—
Borates, tetra, sodium salts	—	—	—	—	—	—	—	—
Anhydrous	1330-43-4	—	1.0	—	—	—	—	—
Decahydrate	1303-96-4	—	5.0	—	—	—	—	—
Pentahydrate	12179-04-3	—	1.0	—	—	—	—	—
Boron oxide	1303-86-2	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Boron tribromide	10294-33-4	—	—	—	—	1.0	10	—
Boron trifluoride	7637-07-2	—	—	—	—	1.0	3.0	—
Bromacil	314-40-9	1.0	10	—	—	—	—	—
Bromine	7726-95-6	0.1	0.7	0.3	2.0	—	—	—
Bromine pentafluoride	7789-30-2	0.1	0.7	—	—	—	—	—
Bromochloromethane (see Chlorobromomethane)	—	—	—	—	—	—	—	—
Bromoform	15-25-2	0.5	5.0	—	—	—	—	X
Butadiene (1,3-butadiene)	106-99-0	1	2.2	5	—	—	—	—

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Butane	106-97-8	800	1,900					
Butanethiol (see Butyl mercaptan)								
2-Butanone (Methyl ethyl ketone)	78-93-3	200	590	300	885			
2-Butoxy ethanol (Butyl Cellosolve)	111-76-2	25	120					X
n-Butyl acetate	123-86-4	150	710	200	950			
sec-Butyl acetate	105-46-4	200	950					
tert-Butyl acetate	540-88-5	200	950					
Butyl acrylate	141-32-2	10	55					
n-Butyl alcohol	71-36-3					50	150	X
sec-Butyl alcohol	78-92-2	100	305					
tert-Butyl alcohol	75-65-0	100	300	150	450			
Butylamine	109-73-9					5.0	15	X
tert-Butyl chromate (see CrO ₃)	1189-85-1						0.1	X
n-Butyl glycidyl ether (BGE)	2426-08-6	25	135					
n-Butyl lactate	138-22-7	5.0	25					
Butyl mercaptan	109-79-5	0.5	1.5					
o-sec-Butylphenol	89-72-5	5.0	30					X
p-tert-Butyl-toluene	98-51-1	10	60	20	120			
Cadmium oxide fume (as Cd) (see WAC 296-62-074)	1306-19-0							
Cadmium dust and salts (as Cd) (see WAC 296-62-074)	7440-43-9							
Calcium arsenate (see WAC 296-62-07347)								
Calcium carbonate	1317-65-3							
Total dust			10					
Respirable fraction			5.0 ^k					
Calcium cyanamide	156-62-7		0.5					
Calcium hydroxide	1305-62-0		5.0					
Calcium oxide	1305-78-8		2.0					
Calcium silicate	1344-95-2							
Total dust			10					
Respirable fraction			5.0 ^k					
Calcium sulfate	7778-18-9							
Total dust			10					
Respirable fraction			5.0 ^k					
Camphor (synthetic)	76-22-2		2.0					
Caprolactam	105-60-2							
Dust			1.0		3.0			
Vapor		5.0	20	10	40			
Captafol (Difolatan)	2425-06-1		0.1					X
Captan	133-06-2		5.0					
Carbaryl (Sevin)	63-25-2		5.0					
Carbofuran (Furadon)	1563-66-2		0.1					
Carbon black	1333-86-4		3.5					
Carbon dioxide	124-38-9	5,000	9,000	30,000	54,000			
Carbon disulfide	75-15-0	4.0	12	12	36			X
Carbon monoxide	630-08-0	35	40			200 ^j	229 ^j	
Carbon tetrabromide	558-13-4	0.1	1.4	0.3	4.0			
Carbon tetrachloride	56-23-5	2.0	12.6					X
Carbonyl chloride (see Phosgene)								
Carbonyl fluoride	353-50-4	2.0	5.0	5.0	15			
Catechol (Pyrocatechol)	120-80-9	5.0	20					X
Cellulose (paper fiber)	9004-34-6							
Total dust			10					
Respirable fraction			5.0 ^k					
Cesium hydroxide	21351-79-1		2.0					
Chlordane	57-74-9		0.5					X
Chlorinated camphene	8001-35-2		0.5		1.0			X
Chlorinated diphenyl oxide	55720-99-5		0.5					
Chlorine	7782-50-5	0.5	1.5	1.0	3.0	1.0	3.0	
Chlorine dioxide	10049-04-4	0.1	0.3	0.3	0.9			
Chlorine trifluoride	7790-91-2					0.1	0.4	
Chloroacetaldehyde	107-20-0					1.0	3.0	
a-Chloroacetophenone (Phenacyl chloride)	532-21-4	0.05	0.3					

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Substance	CAS ^b Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Chloroacetyl chloride	79-04-9	0.05	0.2	—	—	—	—	—
Chlorobenzene (Monochlorobenzene)	108-90-7	75	350	—	—	—	—	—
o-Chlorobenzylidene malononitrile (OCBM)	2698-41-1	—	—	—	—	0.05	0.4	X
Chlorobromomethane	74-97-5	200	1,050	—	—	—	—	—
2-Chloro-1, 3-butadiene (see beta-Chloroprene)	—	—	—	—	—	—	—	—
Chlorodifluoromethane	75-45-6	1,000	3,500	—	—	—	—	—
Chlorodiphenyl (42% Chlorine) (PCB)	53469-21-9	—	1.0	—	—	—	—	X
Chlorodiphenyl (54% Chlorine) (PCB)	11097-69-1	—	0.5	—	—	—	—	X
1-Chloro-2, 3-epoxypropane (see Epichlorhydrin)	—	—	—	—	—	—	—	—
2-Chloroethanol (see Ethylene chlorohydrin)	—	—	—	—	—	—	—	—
Chloroethylene (see vinyl chloride)	—	—	—	—	—	—	—	—
Chloroform (Trichloromethane)	67-66-3	2.0	9.78	—	—	—	—	—
1-Chloro-1-nitropropane	600-25-9	2.0	10	—	—	—	—	—
bis-Chloromethyl ether (see WAC 296-62-073)	542-88-1	—	—	—	—	—	—	—
Chloromethyl methyl ether (see Methyl carbomethyl ether)	107-30-2	—	—	—	—	—	—	—
Chloropentafluoroethane	76-15-3	1,000	6,320	—	—	—	—	—
Chloropicrin	76-06-2	0.1	0.7	—	—	—	—	—
beta-Chloroprene	126-99-8	10	35	—	—	—	—	X
o-Chlorostyrene	2039-87-4	50	285	75	428	—	—	—
o-Chlorotoluene	95-49-8	50	250	—	—	—	—	—
2-Chloro-6-trichloromethyl pyridine (see Nitrapyrin)	1929-82-4	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Chlorpyrifos	2921-88-2	—	0.2	—	—	—	—	X
Chromic acid and chromates (as CrO ₃)	Varies with compounds	—	—	—	—	—	0.1	—
Chromium, sol, chromic, chromous salts (as Cr)	7440-47-3	—	0.5	—	—	—	—	—
Chromium (VI) compounds (as Cr)	—	—	0.05	—	—	—	—	—
Chromium Metal and insoluble salts	7440-47-3	—	0.5	—	—	—	—	—
Chromyl chloride	14977-61-8	0.025	0.15	—	—	—	—	—
Chrysene (see Coal tar pitch volatiles)	—	—	—	—	—	—	—	—
Clopidol	2971-90-6	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Coal dust (less than 5% SiO ₂) Respirable fraction	—	—	2.0 ^g	—	—	—	—	—
Coal dust (greater than or equal to 5% SiO ₂) Respirable fraction	—	—	0.1 ^g	—	—	—	—	—
Coal tar pitch volatiles (benzene soluble fraction anthracene, BaP, phenanthrene, acridine, chrysene, pyrene)	65996-93-2	—	0.2	—	—	—	—	—
Cobalt, metal fume & dust (as Co)	7440-48-4	—	0.05	—	—	—	—	—
Cobalt carbonyl (as Co)	10210-68-1	—	0.1	—	—	—	—	—
Cobalt hydrocarbonyl (as Co)	16842-03-8	—	0.1	—	—	—	—	—
Coke oven emissions (see WAC 296-62-200)	—	—	—	—	—	—	—	—
Copper fume (as Cu)	7440-50-8	—	0.1	—	—	—	—	—
Dusts and mists (as Cu)	—	—	1.0	—	—	—	—	—
Cotton dust (raw) ^e	—	—	1.0	—	—	—	—	—
Corundum (see Aluminum oxide)	—	—	—	—	—	—	—	—
Crag herbicide (Sesone) Total dust	136-78-7	—	10	—	—	—	—	—

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Respirable fraction			5.0 ^k					
Cresol (all isomers)	1319-77-3	5.0	22					X
Crotonaldehyde	123-73-9; 4170-30-3	2.0	6.0					
Crufomate	299-86-5		5.0					
Cumene	98-82-8	50	245					X
Cyanamide	420-04-2		2.0					
Cyanide (as CN)	Varies with compound		5.0					X
Cyanogen	460-19-5	10	20					
Cyanogen chloride	506-77-4					0.3	0.6	
Cyclohexane	110-82-7	300	1,050					
Cyclohexanol	108-93-0	50	200					X
Cyclohexanone	108-94-1	25	100					X
Cyclohexene	110-83-8	300	1,015					
Cyclohexylamine	108-91-8	10	40					
Cyclonite (see RDX)	121-82-4		1.5					X
Cyclopentadiene	542-92-7	75	200					
Cyclopentane	287-92-3	600	1,720					
Cyhexatin	13121-70-5		5.0					
2,4-D (Dichlorophenoxy- acetic acid)	94-75-7		10					
DDT (Dichlorodiphenyltri- chloroethane)	50-29-3		1.0					X
DDVP, Dichlorvos	62-73-7	0.1	1.0					X
Decaborane	17702-41-9	0.05	0.3	0.15	0.9			X
Demeton	8065-48-3	0.01	0.1					X
Diacetone alcohol (4-hydroxy-4-methyl- 2-pentanone)	123-42-2	50	240					
1, 2-Diaminoethane (see Ethylenediamine)								
Diazinon	333-41-5		0.1					X
Diazomethane	334-88-3	0.2	0.4					
Diborane	19287-45-7	0.1	0.1					
Dibrom (see Naled)								
1, 2-Dibromo-3-chloropropane (DBCP) (see WAC 296-62-07342)	96-12-8							
2-N-Dibutylamino ethanol	102-81-8	2.0	14					X
Dibutyl phosphate	107-66-4	1.0	5.0	2.0	10			
Dibutyl phthalate	84-74-2		5.0					
Dichloroacetylene	7572-29-4					0.1	0.4	
o-Dichlorobenzene	95-50-1					50	300	
p-Dichlorobenzene	106-46-7	75	450	110	675			
3, 3'-Dichlorobenzidine (see WAC 296-62-073)	91-94-1							
Dichlorodifluoromethane	75-71-8	1,000	4,950					
1, 3-Dichloro-5, 5-dimethyl hydantoin	118-52-5		0.2		0.4			
1, 1-Dichloroethane	75-34-3	100	400					
1, 2-Dichloroethane (see Ethylene dichloride)								
1, 2-Dichloroethylene	540-59-0	200	790					
1, 1-Dichloroethylene (see Vinylidene chloride)								
Dichloroethyl ether	111-44-4	5.0	30	10	60			X
Dichlorofluoromethane	75-43-4	10	40					
Dichloromethane (see Methylene chloride)								
1, 1-Dichloro-1-nitroethane	594-72-9	2.0	10.	10.				
1, 2-Dichloropropane (see Propylene dichloride)								
Dichloropropene	542-75-6	1.0	5.0					X
2, 2-Dichloropropionic acid	75-99-0	1.0	6.0					
Dichlorotetrafluoroethane	76-14-2	1,000	7,000					
Dichlorvos (DDVP)	62-73-7	0.1	1.0					X
Dicrotophos	141-66-2		0.25					X
Dicyclopentadiene	77-73-6	5.0	30					
Dicyclopentadienyl iron Total dust	102-54-5		10					

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Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Respirable fraction			5.0 ^k					
Dieldrin	60-57-1		0.25					X
Diethanolamine	111-42-2	3.0	15					
Diethylamine	109-89-7	10	30	25	75			
2-Diethylaminoethanol	100-37-8	10	50					X
Diethylene triamine	111-40-0	1.0	4.0					X
Diethyl ether (see Ethyl ether)								
Diethyl ketone	96-22-0	200	705					
Diethyl phthalate	84-66-2		5.0					
Diffluorodibromomethane	75-61-6	100	860					
Diglycidyl ether (DGE)	2238-07-5	0.1	0.5					
Dihydroxybenzene (see Hydroquinone)								
Diisobutyl ketone	108-83-8	25	150					
Diisopropylamine	108-18-9	5.0	20					X
Dimethoxymethane (see Methylal)								
Dimethyl acetamide	127-19-5	10	35					X
Dimethylamine	124-40-3	10	18					
4-Dimethylaminoazobenzene (see WAC 296-62-073)	60-11-7							
Dimethylaminobenzene (see Xylidene)								
Dimethylaniline (N, N-Dimethylaniline)	121-69-7	5.0	25	10	50			X
Dimethylbenzene (see Xylene)								
Dimethyl-1, 2-dibromo-2, 2-dichloroethyl phosphate (see Naled)	300-76-5		3.0					X
Dimethylformamide	68-12-2	10	30					X
2, 6-Dimethylheptanone (see Diisobutyl ketone)								
1, 1-Dimethylhydrazine	57-14-7	0.5	1.0					X
Dimethyl phthalate	131-11-3		5.0					
Dimethyl sulfate	77-78-1	0.1	0.5					X
Dinitolmide (3, 5-Dinitro-o-toluamide)	148-01-6		5.0					
Dinitrobenzene (all isomers)	(alpha) 528-29-0; (meta) 99-65-0; (para) 100-25-4	0.15	1.0					X
Dinitro-o-cresol	534-52-1		0.2					X
Dinitrotoluene	25321-14-6		1.5					X
Dioxane (Diethylene dioxide)	123-91-1	25	90					X
Dioxathion	78-34-2		0.2					X
Diphenyl (Biphenyl)	92-52-4	0.2	1.0					
Diphenylamine	122-39-4		10					
Diphenylmethane diisocyanate (see Methylene bisphenyl isocyanate (MDI))								
Dipropylene glycol methyl ether	34590-94-8	100	600	150	900			X
Dipropyl ketone	123-19-3	50	235					
Diquat	85-00-7		0.5					
Di-sec, Octyl phthalate (Di-2-ethylhexylphthalate)	117-81-7		5.0		10			
Disulfiram	97-77-8		2.0					
Disulfoton	298-04-4		0.1					X
2, 6-Di-tert-butyl-p-cresol	128-37-0		10					
Diuron	330-54-1		10					
Divinyl benzene	1321-74-0	10	50					
Emery	12415-34-8							
Total dust			10					
Respirable fraction			5.0 ^k					
Endosulfan (Thiodan)	115-29-7		0.1					X
Endrin	72-20-8		0.1					X
Epichlorhydrin	106-89-8	2.0	8.0					X
EPN	2104-64-5		0.5					X
1, 2-Epoxypropane (see Propylene oxide)								
2, 3-Epoxy-1-propanol (see Glycidol)								
Ethane		Simple	Asphyxiant					
Ethanethiol (see Ethyl mercaptan)								

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Ethanolamine	141-43-5	3.0	8.0	6.0	15	—	—	—
Ethion	563-12-2	—	0.4	—	—	—	—	X
2-Ethoxyethanol	110-80-5	5.0	19	—	—	—	—	X
2-Ethoxyethyl acetate (Cellosolve acetate)	111-15-9	5.0	27	—	—	—	—	X
Ethyl acetate	141-78-6	400	1,400	—	—	—	—	—
Ethyl acrylate	140-88-5	5.0	20	25	100	—	—	X
Ethyl alcohol (ethanol)	64-17-5	1,000	1,900	—	—	—	—	—
Ethylamine	75-04-07	10	18	—	—	—	—	—
Ethyl amyl ketone (5-Methyl-3-heptanone)	541-85-5	25	130	—	—	—	—	—
Ethyl benzene	100-41-4	100	435	125	545	—	—	—
Ethyl bromide	74-96-4	200	890	250	1,110	—	—	—
Ethyl butyl ketone (3-Heptanone)	106-35-4	50	230	—	—	—	—	—
Ethyl chloride	75-00-3	1,000	2,600	—	—	—	—	—
Ethylene	74-85-1	Simple	Asphyxiant	—	—	—	—	—
Ethylene chlorohydrin	107-07-3	—	—	—	—	1.0	3.0	X
Ethylenediamine	107-15-3	10	25	—	—	—	—	X
Ethylene dibromide	106-93-4	0.1	—	0.5	—	—	—	—
Ethylene dichloride	107-06-2	1.0	4.0	2.0	8.0	—	—	—
Ethylene glycol	107-21-1	—	—	—	—	50	125	—
Ethylene glycol dinitrate	628-96-6	—	—	—	0.1	—	—	X
Ethylene glycol monomethyl ether acetate (Methyl cellosolve acetate)	—	5.0	24	—	—	—	—	X
Ethyleneimine (see WAC 296-62-073)	151-56-4	—	—	—	—	—	—	X
Ethylene oxide (see WAC 296-62-07359)	75-21-8	1.0	2.0	—	—	—	—	—
Ethyl ether	60-29-7	400	1,200	500	1,500	—	—	—
Ethyl formate	109-94-4	100	300	—	—	—	—	—
Ethylidene chloride (see 1, 1-Dichloroethane)	—	—	—	—	—	—	—	—
Ethylidene norbornene	16219-75-3	—	—	—	—	5.0	25	—
Ethyl mercaptan	75-08-1	0.5	1.0	—	—	—	—	—
n-Ethylmorpholine	100-74-3	5.0	23	—	—	—	—	X
Ethyl sec-amyl ketone (5-methyl-3-heptanone)	—	25	130	—	—	—	—	—
Ethyl silicate	78-10-4	10	85	—	—	—	—	—
Fenamiphos	22224-92-6	—	0.1	—	—	—	—	X
Fensulfothion (Dasanit)	115-90-2	—	0.1	—	—	—	—	—
Fenthion	55-38-9	—	0.2	—	—	—	—	X
Ferbam	14484-64-1	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Ferrovandium dust	12604-58-9	—	1.0	—	3.0	—	—	—
Fluorides (as F)	Varies with compound	—	2.5	—	—	—	—	—
Fluorine	7782-41-4	0.1	0.2	—	—	—	—	—
Fluorotrichloromethane (see Trichlorofluoro methane)	75-69-4	—	—	—	—	1,000	5,600	—
Fonofos	944-22-9	—	0.1	—	—	—	—	X
Formaldehyde (see WAC 296-62-07540)	50-00-0	0.75	—	2.0	—	—	—	—
Formamide	75-12-7	20	30	30	45	—	—	—
Formic acid	64-18-6	5.0	9.0	—	—	—	—	—
Furfural	98-01-1	2.0	8.0	—	—	—	—	X
Furfuryl alcohol	98-00-0	10	40	15	60	—	—	X
Gasoline	8006-61-9	300	900	500	1,500	—	—	—
Germanium tetrahydride	7782-65-2	0.2	0.6	—	—	—	—	—
Glass, fibrous or dust	—	—	10	—	—	—	—	—
Gluteraldehyde	111-30-8	—	—	—	—	0.2	0.8	—
Glycerin mist	56-81-5	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Glycidol (2, 3-Epoxy-1-propanol)	556-52-5	25	75	—	—	—	—	—
Glycol monoethyl ether (see 2-Ethoxyethanol)	—	—	—	—	—	—	—	—
Grain dust (oat, wheat, barley)	—	—	10	—	—	—	—	—
Graphite, natural	7782-42-5	—	—	—	—	—	—	—

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Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Respirable dust	—	—	2.5 ^k	—	—	—	—	—
Graphite, Synthetic	—	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Guthion (see Azinphosmethyl)	—	—	—	—	—	—	—	—
Gypsum	13397-24-5	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Hafnium	7440-58-6	—	0.5	—	—	—	—	—
Helium	—	Simple	Asphyxiant	—	—	—	—	—
Heptachlor	76-44-8	—	0.5	—	—	—	—	X
Heptane (n-heptane)	142-82-5	400	1,600	500	2,000	—	—	—
2-Heptanone (see Methyl n-amyl ketone)	—	—	—	—	—	—	—	—
3-Heptanone (see Ethyl butyl ketone)	—	—	—	—	—	—	—	—
Hexachlorobutadiene	87-68-3	0.02	0.24	—	—	—	—	X
Hexachlorocyclopentadiene	77-47-4	0.01	0.1	—	—	—	—	—
Hexachloroethane	67-72-1	1.0	10	—	—	—	—	X
Hexachloronaphthalene	1335-87-1	—	0.2	—	—	—	—	X
Hexafluoroacetone	684-16-2	0.1	0.7	—	—	—	—	X
Hexane	—	—	—	—	—	—	—	—
n-hexane	110-54-3	50	180	—	—	—	—	—
other Isomers	Varies with compound	500	1,800	1,000	3,600	—	—	—
2-Hexanone (Methyl-n-butyl ketone)	591-78-6	5.0	20	—	—	—	—	—
Hexone (Methyl isobutyl ketone)	108-10-1	50	205	75	300	—	—	—
sec-Hexyl acetate	108-84-9	50	300	—	—	—	—	—
Hexylene Glycol	107-41-5	—	—	—	—	25	125	—
Hydrazine	302-01-2	0.1	0.1	—	—	—	—	X
Hydrogen	—	Simple	Asphyxiant	—	—	—	—	—
Hydrogenated terphenyls	61788-32-7	0.5	5.0	—	—	—	—	—
Hydrogen bromide	10035-10-6	—	—	—	—	3.0	10	—
Hydrogen chloride	7647-01-0	—	—	—	—	5.0	7.0	—
Hydrogen cyanide	74-90-8	—	—	4.7	5.0	—	—	X
Hydrogen fluoride	7664-39-3	—	—	—	—	3.0	2.5	—
Hydrogen peroxide	7722-84-1	1.0	1.4	—	—	—	—	—
Hydrogen selenide (as Se)	7783-07-5	0.05	0.2	—	—	—	—	—
Hydrogen Sulfide	7783-06-4	10	14	15	21	—	—	—
Hydroquinone	123-31-9	—	2.0	—	—	—	—	—
4-Hydroxy-4-methyl-2-pentanone (see Diacetone alcohol)	—	—	—	—	—	—	—	—
2-Hydroxypropyl acrylate	999-61-1	0.5	3.0	—	—	—	—	X
Indene	95-13-6	10	45	—	—	—	—	—
Indium and compounds (as In)	7440-74-6	—	0.1	—	—	—	—	—
Iodine	7553-56-2	—	—	—	—	0.1	1.0	—
Iodoform	75-47-8	0.6	10	—	—	—	—	—
Iron oxide dust and fume (as Fe)	1309-37-1	—	—	—	—	—	—	—
Total particulate	—	—	5.0	—	—	—	—	—
Iron pentacarbonyl (as Fe)	13463-40-6	0.1	0.8	0.2	1.6	—	—	—
Iron salts, soluble (as Fe)	Varies with compound	—	1.0	—	—	—	—	—
Isoamyl acetate	123-92-2	100	525	—	—	—	—	—
Isoamyl alcohol (primary and secondary)	123-51-3	100	360	125	450	—	—	—
Isobutyl acetate	110-19-0	150	700	—	—	—	—	—
Isobutyl alcohol	78-83-1	50	150	—	—	—	—	—
Isooctyl alcohol	26952-21-6	50	270	—	—	—	—	X
Isophorone	78-59-1	4.0	23	—	—	5.0	25	—
Isophorone diisocyanate	4098-71-9	0.005	0.045	0.02	—	—	—	X
Isopropoxyethanol	109-59-1	25	105	—	—	—	—	—
Isopropyl acetate	108-21-4	250	950	310	1,185	—	—	—
Isopropyl alcohol	67-63-0	400	980	500	1,225	—	—	—
Isopropylamine	75-31-0	5.0	12	10	24	—	—	—
N-Isopropylaniline	768-52-5	2.0	10	—	—	—	—	X
Isopropyl ether	108-20-3	250	1,050	—	—	—	—	—
Isopropyl glycidyl ether (IGE)	4016-14-2	50	240	75	360	—	—	—
Kaolin	—	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Respirable fraction			5.0 ^k					
Ketene	463-51-4	0.5	0.9	1.5	3.0			
Lead inorganic (as Pb) (see WAC 296-62-07521)	7439-92-1		0.05					
Lead arsenate (see WAC 296-62-07347)	3687-31-8		0.05					
Lead chromate	7758-97-6		0.05					
Limestone	1317-65-3							
Total dust			10					
Respirable fraction			5.0 ^k					
Lindane	58-89-9		0.5					X
Lithium hydride	7580-67-8		0.025					
L.P.G. (liquified petroleum gas)	68476-85-7	1,000	1,800					
Magnesite	546-93-0							
Total dust			10					
Respirable fraction			5.0 ^k					
Magnesium oxide fume	1309-48-4							
Total particulate			10					
Malathion	121-75-5							
Total dust			10					X
Maleic anhydride	108-31-6	0.25	1.0					
Manganese and compound (as Mn)	7439-96-5						5.0	
Manganese tetroxide and fume (as Mn)	7439-96-5		1.0		3.0			
Manganese cyclopentadienyl tricarbonyl (as Mn)	12079-65-1		0.1					X
Manganese tetroxide (as Mn)	1317-35-7		1.0					
Marble	1317-65-3							
Total dust			10					
Respirable fraction			5.0 ^k					
Mercury (aryl and inorganic) (as Hg)	7439-97-6						0.1	X
Mercury (organo-alkyl compounds) (as Hg)	7439-97-6		0.01		0.03			X
Mercury (vapor) (as Hg)	7439-97-6		0.05					X
Mesityl oxide	141-79-7	15	60	25	100			
Methacrylic acid	79-41-4	20	70					X
Methane		Simple	Asphyxiant					
Methanethiol (see Methyl mercaptan)								
Methomyl (lannate)	16752-77-5		2.5					
Methoxychlor	72-43-5							
Total dust			10					
2-Methoxyethanol (Methyl cellosolve)	109-86-4	5.0	16					X
4-Methoxyphenol	150-76-5		5.0					
Methyl acetate	79-20-9	200	610	250	760			
Methyl acetylene (propyne)	74-99-7	1,000	1,650					
Methyl acetylene-propadiene mixture (MAPP)		1,000	1,800	1,250	2,250			
Methyl acrylate	96-33-3	10	35					X
Methylacrylonitrile	126-98-7	1.0	3.0					X
Methylal (Dimethoxy-methane)	109-87-5	1,000	3,100					
Methyl alcohol (methanol)	67-56-1	200	260	250	325			X
Methylamine	74-89-5	10	12					
Methyl amyl alcohol (see Methyl isobutyl carbinol)								
Methyl n-aryl ketone (2-Heptanone)	110-43-0	50	235					
N-Methyl aniline (see Monomethyl aniline)								
Methyl bromide	74-83-9	5.0	20					X
Methyl butyl ketone (see 2-Hexanone)								
Methyl cellosolve (see 2-Methoxyethanol)	109-86-4	5.0	16					X
Methyl cellosolve acetate (2-Methoxyethyl acetate)	110-49-6	5.0	24					X
Methyl chloride	74-87-3	50	105	100	210			
Methyl chloroform (1, 1, 1-trichloroethane)	71-55-6	350	1,900	450	2,450			

Occupational Health Standards

296-62-07515

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Methyl chloromethyl ether (see WAC 296-62-073)	107-30-2	—	—	—	—	—	—	—
Methyl 2-cyanoacrylate	137-05-3	2.0	8.0	4.0	16	—	—	—
Methylcyclohexane	108-87-2	400	1,600	—	—	—	—	—
Methylcyclohexanol	25639-42-3	50	235	—	—	—	—	—
Methylcyclohexanone	583-60-8	50	230	75	345	—	—	X
Methylcyclopentadienyl manganese tricarbonyl (as Mn)	12108-13-3	—	0.2	—	—	—	—	X
Methyl demeton	8022-00-2	—	0.5	—	—	—	—	X
Methylene bisphenyl isocyanate (MDI)	101-68-8	—	—	—	—	0.02	0.2	—
4, 4'-Methylene bis (2-chloroaniline (MBOCA)) (see WAC 296-62-073)	101-14-4	0.02	0.22	—	—	—	—	X
Methylene bis (4-cyclohexylisocyanate)	5124-30-1	—	—	—	—	0.01	0.11	—
Methylene chloride	75-09-2	100	—	500	—	—	—	—
4, 4-Methylene dianiline	101-77-9	0.1	0.8	—	—	—	—	X
Methyl ethyl ketone (MEK) (see 2-Butanone)	78-93-3	—	—	—	—	—	—	—
Methyl ethyl ketone peroxide (MEKP)	1338-23-4	—	—	—	—	0.2	1.5	—
Methyl formate	107-31-3	100	250	150	375	—	—	—
5-Methyl-3-heptanone (see Ethyl amyl ketone)	—	—	—	—	—	—	—	—
Methyl hydrazine (see Monomethyl hydrazine)	60-34-4	—	—	—	—	0.2	0.35	X
Methyl iodide	74-88-4	2.0	10	—	—	—	—	X
Methyl isoamyl ketone	110-12-3	50	240	—	—	—	—	—
Methyl isobutyl carbinol	108-11-2	25	100	40	165	—	—	X
Methyl isobutyl ketone (see Hexone)	—	—	—	—	—	—	—	—
Methyl isocyanate	624-83-9	0.02	0.05	—	—	—	—	X
Methyl isopropyl ketone	563-80-4	200	705	—	—	—	—	—
Methyl mercaptan	74-93-1	0.5	1.0	—	—	—	—	—
Methyl methacrylate	80-62-6	100	410	—	—	—	—	—
Methyl parathion	298-00-0	—	0.2	—	—	—	—	X
Methyl propyl ketone (see 2-Pentanone)	—	—	—	—	—	—	—	—
Methyl silicate	684-84-5	1.0	6.0	—	—	—	—	—
alpha-Methyl styrene	98-83-9	50	240	100	485	—	—	—
Mevinphos (see Phosdrin)	—	—	—	—	—	—	—	—
Metribuzin	21087-64-9	—	5.0	—	—	—	—	—
Mica (see Silicates)	—	—	—	—	—	—	—	—
Molybdenum (as Mo)	7439-98-7	—	—	—	—	—	—	—
Soluble compounds	—	—	5.0	—	—	—	—	—
Insoluble compounds	—	—	—	—	—	—	—	—
Total dust	—	—	—	10	—	—	—	—
Monocrotophos (Azodrin)	6923-22-4	—	0.25	—	—	—	—	—
Monomethyl aniline	100-61-8	0.5	2.0	—	—	—	—	X
Monomethyl hydrazine	—	—	—	—	—	0.2	0.35	—
Morpholine	110-91-8	20	70	30	105	—	—	X
Naled	300-76-5	—	3.0	—	—	—	—	X
Naphtha (Coal tar)	8030-30-6	100	400	—	—	—	—	X
Naphthalene	91-20-3	10	50	15	75	—	—	—
alpha-Naphthylamine (see WAC 296-62-073)	134-32-7	—	—	—	—	—	—	—
beta-Naphthylamine (see WAC 296-62-073)	91-59-8	—	—	—	—	—	—	—
Neon	7440-01-9	Simple	Asphyxiant	—	—	—	—	—
Nickel carbonyl (as Ni)	13463-39-3	0.001	0.007	—	—	—	—	—
Nickel (as Ni)	7440-02-0	—	—	—	—	—	—	—
Metal and insoluble compounds	—	—	1.0	—	—	—	—	—
Soluble compounds	—	—	0.1	—	—	—	—	—
Nicotine	54-11-5	—	0.5	—	—	—	—	X
Nitrapyrin (see 2-Chloro-6 trichloromethyl pyridine)	1929-82-4	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Nitric acid	7697-37-2	2.0	5.0	4.0	10	—	—	—
Nitric oxide	10102-43-9	25	30	—	—	—	—	—
p-Nitroaniline	100-01-6	—	3.0	—	—	—	—	X
Nitrobenzene	98-95-3	1.0	5.0	—	—	—	—	X
4-Nitrobiphenyl (see WAC 296-62-073)	92-93-3	—	—	—	—	—	—	—
p-Nitrochlorobenzene	100-00-5	—	0.5	—	—	—	—	X
4-Nitrodiphenyl (see WAC 296-62-073)	—	—	—	—	—	—	—	—
Nitroethane	79-24-3	100	310	—	—	—	—	—
Nitrogen	7727-37-9	Simple	Asphyxiant	—	—	—	—	—
Nitrogen dioxide	10102-44-0	—	—	1.0	1.8	—	—	—
Nitrogen trifluoride	7783-54-2	10	29	—	—	—	—	—
Nitroglycerin	55-63-0	—	—	—	0.1	—	—	X
Nitromethane	75-52-5	100	250	—	—	—	—	—
1-Nitropropane	108-03-2	25	90	—	—	—	—	—
2-Nitropropane	79-46-9	10	35	—	—	—	—	—
N-Nitrosodimethylamine (see WAC 296-62-073)	62-75-9	—	—	—	—	—	—	—
Nitrotoluene	—	—	—	—	—	—	—	—
o-isomer	88-72-2	2.0	11	—	—	—	—	X
m-isomer	98-08-2	2.0	11	—	—	—	—	X
p-isomer	99-99-0	2.0	11	—	—	—	—	X
Nitrotirchloromethane (see Chloropicrin)	—	—	—	—	—	—	—	—
Nitrous Oxide (Nitrogen oxide)	10024-97-2	50	90	—	—	—	—	—
Nonane	111-84-2	200	1,050	—	—	—	—	—
Octachloronaphthalene	2234-13-1	—	0.1	—	0.3	—	—	X
Octane	111-65-9	300	1,450	375	1,800	—	—	—
Oil mist, mineral (particulate)	8012-95-1	—	5.0	—	—	—	—	—
Osmium tetroxide (as Os)	20816-12-0	0.0002	0.002	0.0006	0.006	—	—	—
Oxalic acid	144-62-7	—	1.0	—	2.0	—	—	—
Oxygen difluoride	7783-41-7	—	—	—	—	0.05	0.1	—
Ozone	10028-15-6	0.1	0.2	0.3	0.6	—	—	—
Paraffin wax fume	8002-74-2	—	2.0	—	—	—	—	—
Paraquat (Respirable dust)	4685-14-7	—	0.1 ^k	—	—	—	—	X
1910-42-5	—	—	—	—	—	—	—	—
2074-50-2	—	—	—	—	—	—	—	—
Parathion	56-38-2	—	0.1	—	—	—	—	X
Particulate polycyclic aromatic hydrocarbons (see coal tar pitch volatiles)	—	—	—	—	—	—	—	—
Particulates not otherwise regulated (see WAC 296-62-07510)	—	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Pentaborane	19624-22-7	0.005	0.01	0.015	0.03	—	—	—
Pentachloronaphthalene	1321-64-8	—	0.5	—	—	—	—	X
Pentachlorophenol	87-86-5	—	0.5	—	—	—	—	X
Pentaerythritol	115-77-5	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Pentane	109-66-0	600	1,800	750	2,250	—	—	—
2-Pentanone (methyl propyl ketone)	107-87-9	200	700	250	875	—	—	—
Perchloroethylene (tetrachloroethylene)	127-18-4	25	170	—	—	—	—	—
Perchloromethyl mercaptan	594-42-3	0.1	0.8	—	—	—	—	—
Perchloryl fluoride	7616-94-6	3.0	14	6.0	28	—	—	—
Perlite	—	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Petroleum distillates (Naptha) (Rubber Solvent)	—	100	400	—	—	—	—	—
Phenol	108-95-2	5.0	19	—	—	—	—	X
Phenothiazine	92-84-2	—	5.0	—	—	—	—	X
p-Phenylene diamine	106-50-3	—	0.1	—	—	—	—	X
Phenyl ether (vapor)	101-84-8	1.0	7.0	—	—	—	—	—
Phenyl ether-diphenyl mixture (vapor)	—	1.0	7.0	—	—	—	—	—

Occupational Health Standards

296-62-07515

Substance	CAS ^b Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Phenylethylene (see Styrene)								
Phenyl glycidyl ether (PGE)	122-60-1	1.0	6.0					
Phenylhydrazine	100-63-0	5.0	20	10	45			X
Phenyl mercaptan	108-98-5	0.5	2.0					
Phenylphosphine	638-21-1					0.05	0.25	
Phorate	298-02-2		0.05		0.2			X
Phosdrin (Mevinphos)	7786-34-7	0.01	0.1	0.03	0.3			X
Phosgene (carbonyl chloride)	75-44-5	0.1	0.4					
Phosphine	7803-51-2	0.3	0.4	1.0	1.0			
Phosphoric acid	7664-38-2		1.0		3.0			
Phosphorus (yellow)	7723-14-0		0.1					
Phosphorous oxychloride	10025-87-3	0.1	0.6					
Phosphorus pentachloride	10026-13-8	0.1	1.0					
Phosphorus pentasulfide	1314-80-3		1.0		3.0			
Phosphorus trichloride	7719-12-2	0.2	1.5	0.5	3.0			
Phthalic anhydride	85-44-9	1.0	6.0					
m-Phthalodinitrile	626-17-5		5.0					
Picloram	1918-02-1							
Total dust			10					
Respirable fraction			5.0 ^k					
Picric acid	88-89-1		0.1					X
Pindone	83-26-1		0.1					
(2-Pivalyl-1, 3-indandione)								
Piperazine dihydrochloride	142-64-3		5.0					
Pival (see Pindone)								
Plaster of Paris	26499-65-0							
Total dust			10					
Respirable fraction			5.0 ^k					
Platinum (as Pt)	7440-06-4							
Metal			1.0					
Soluble salts			0.002					
Polychlorobiphenyls (see Chlorodiphenyls)								
Portland cement	65997-15-1							
Total dust			10					
Respirable fraction			5.0 ^k					
Potassium hydroxide	1310-58-3						2.0	
Propane	74-98-6	1,000	1,800					
Propargyl alcohol	107-19-7	1.0	2.0					X
beta-Propiolactone (see WAC 296-62-073)	57-57-8							
Propionic acid	79-09-4	10	30					
Propoxur (Baygon)	114-26-1		0.5					
n-Propyl acetate	109-60-4	200	840	250	1,050			
n-Propyl alcohol	71-23-8	200	500	250	625			X
n-Propyl nitrate	627-13-4	25	105	40	170			
Propylene		Simple	Asphyxiant					
Propylene dichloride (1, 2-Dichloropropane)	78-87-5	75	350	110	510			
Propylene glycol dinitrate	6423-43-4	0.05	0.3					X
Propylene glycol monomethyl ether	107-98-2	100	360	150	540			
Propylene imine	75-55-8	2.0	5.0					X
Propylene oxide	75-56-9	20	50					
Propyne (see Methyl acetylene)								
Pyrethrum	8003-34-7		5.0					
Pyridine	110-86-1	5.0	15					
Quinone	106-51-4	0.1	0.4					
RDX (see Cyclonite)			1.5					X
Resorcinol	108-46-3	10	45	20	90			
Rhodium (as Rh)	7440-16-6							
Insoluble compounds, Metal fumes and dusts				0.1				
Soluble compounds, salts			0.001					
Ronnel	299-84-3		10					
Rosin core solder, pyrolysis products (as formaldehyde)			0.1					
Rotenone	83-79-4		5.0					
Rouge								
Total dust			10					
Respirable fraction			5.0 ^k					
Rubber solvent (naphtha)	8002-05-9	100	400					

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Selenium compounds (as Se)	7782-49-2	—	0.2	—	—	—	—	—
Selenium hexafluoride (as Se)	7783-79-1	0.05	0.2	—	—	—	—	—
Sesone (see Crag herbicide)	—	—	—	—	—	—	—	—
Silane (see Silicon tetrahydride)	—	—	—	—	—	—	—	—
Silica, amorphous, precipitated and gel	112926-00-8	—	6.0	—	—	—	—	—
Silica, amorphous, diatomaceous earth, containing less than 1% crystalline silica	61790-53-2	—	—	—	—	—	—	—
Total dust	—	—	6.0	—	—	—	—	—
Respirable fraction	—	—	3.0 ^k	—	—	—	—	—
Silica, crystalline cristobalite, respirable dust	14464-46-1	—	0.05 ^k	—	—	—	—	—
Silica, crystalline quartz, respirable dust	14808-60-7	—	0.1 ^k	—	—	—	—	—
Silica, crystalline tripoli (as quartz), respirable dust	1317-95-9	—	0.1 ^k	—	—	—	—	—
Silica, crystalline tridymite, respirable dust	15468-32-3	—	0.05 ^k	—	—	—	—	—
Silica, fused, respirable dust	60676-86-0	—	0.1 ^k	—	—	—	—	—
Silicates (less than 1% crystalline silica)	—	—	—	—	—	—	—	—
Mica (Respirable dust)	12001-26-2	—	3.0 ^k	—	—	—	—	—
Soapstone, Total dust	—	—	6.0	—	—	—	—	—
Soapstone, Respirable dust	—	—	3.0 ^k	—	—	—	—	—
Talc (containing asbestos): use asbestos limit (see WAC 296-62-07705)	—	—	—	—	—	—	—	—
Talc (containing no asbestos), Respirable dust	14807-96-6	—	2.0 ^k	—	—	—	—	—
Tremolite (see WAC 296-62-07705)	—	—	—	—	—	—	—	—
Silicon	7440-21-3	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Silicon Carbide	409-21-2	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Silicon tetrahydride	7803-62-5	5.0	7.0	—	—	—	—	—
Silver, metal dust and soluble compounds (as Ag)	7440-22-4	—	0.01	—	—	—	—	—
Soapstone (see Silicates)	—	—	—	—	—	—	—	—
Sodium azide	26628-22-8	—	—	—	—	—	—	—
(as HN ₃)	—	—	—	—	—	0.1	0.3	X
(as NaN ₃)	—	—	—	—	—	0.1	0.3	X
Sodium bisulfite	7631-90-5	—	5.0	—	—	—	—	—
Sodium-2, 4-dichlorophenoxyethyl sulfate (see Crag herbicide)	—	—	—	—	—	—	—	—
Sodium fluoroacetate	62-74-8	—	0.05	—	0.15	—	—	X
Sodium hydroxide	1310-73-2	—	—	—	—	—	2.0	—
Sodium metabisulfite	7681-57-4	—	5.0	—	—	—	—	—
Starch	9005-25-8	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Stibine	7803-52-3	0.1	0.5	—	—	—	—	—
Stoddard solvent	8052-41-3	100	525	—	—	—	—	—
Strychnine	57-24-9	—	0.15	—	—	—	—	—
Styrene	100-42-5	50	215	100	425	—	—	—
Subtilisins	9014-01-1	—	—	—	0.00006 (60min.) ⁱ	—	—	—
Sucrose	57-50-1	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Sulfotep (see TEDP)	—	—	—	—	—	—	—	X
Sulfur dioxide	7446-09-5	2.0	5.0	5.0	13	—	—	—
Sulfur hexafluoride	2551-62-4	1,000	6,000	—	—	—	—	—
Sulfuric acid	7664-93-9	—	1.0	—	—	—	—	—

Occupational Health Standards

296-62-07515

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
Sulfur monochloride	10025-67-9	—	—	—	—	1.0	6.0	—
Sulfur pentafluoride	5714-22-1	—	—	—	—	0.01	0.1	—
Sulfur tetrafluoride	7783-60-0	—	—	—	—	0.1	0.4	—
Sulfuryl fluoride	2699-79-8	5.0	20	10	40	—	—	—
Sulprofos	35400-43-2	—	1.0	—	—	—	—	—
Systox (see Demeton)	—	—	—	—	—	—	—	—
2, 4, 5-T	93-76-5	—	10	—	—	—	—	—
Talc (see Silicates)	—	—	—	—	—	—	—	—
Tantalum	7440-25-7	—	5.0	—	—	—	—	—
Metal and oxide dusts	—	—	—	—	—	—	—	—
TEDP (Sulfotep)	3689-24-5	—	0.2	—	—	—	—	X
Tellurium and compounds (as Te)	13494-80-9	—	0.1	—	—	—	—	—
Tellurium hexafluoride (as Te)	7783-80-4	0.02	0.2	—	—	—	—	—
Temephos	3383-96-8	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
TEPP	107-49-3	0.004	0.05	—	—	—	—	X
Terphenyls	26140-60-3	—	—	—	—	0.5	5.0	—
1, 1, 1, 2-Tetrachloro-2, 2-difluoroethane	76-11-0	500	4,170	—	—	—	—	—
1, 1, 2, 2-Tetrachloro-1, 2-difluoroethane	76-12-0	500	4,170	—	—	—	—	—
1, 1, 2, 2-Tetrachloroethane	79-34-5	1.0	7.0	—	—	—	—	X
Tetrachloroethylene	—	—	—	—	—	—	—	—
(see Perchloroethylene)	—	—	—	—	—	—	—	—
Tetrachloromethane	—	—	—	—	—	—	—	—
(see Carbon tetrachloride)	—	—	—	—	—	—	—	—
Tetrachloronaphthalene	1335-88-2	—	2.0	—	—	—	—	X
Tetraethyl lead (as Pb)	78-00-2	—	0.075	—	—	—	—	X
Tetrahydrofuran	109-99-9	200	590	250	735	—	—	—
Tetramethyl lead (as Pb)	75-74-1	—	0.075	—	—	—	—	X
Tetramethyl succinonitrile	3333-52-6	0.5	3.0	—	—	—	—	X
Tetranitromethane	509-14-8	1.0	8.0	—	—	—	—	—
Tetrasodium pyrophosphate	7722-88-5	—	5.0	—	—	—	—	—
Tetryl (2, 4, 6-trinitrophenyl- methylnitramine)	479-45-8	—	1.5	—	—	—	—	X
Thallium (soluble compounds) (as Tl)	7440-28-0	—	0.1	—	—	—	—	X
4, 4-Thiobis (6-tert-butyl-m-cresol)	96-69-5	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Thioglycolic acid	68-11-1	1.0	4.0	—	—	—	—	X
Thionyl chloride	7719-09-7	—	—	—	—	1.0	5.0	—
Thiram	137-26-8	—	5.0	—	—	—	—	—
(see WAC 296-62-07519)	—	—	—	—	—	—	—	—
Tin (as Sn)	7440-31-5	—	2.0	—	—	—	—	—
Inorganic compounds (except oxides)	—	—	—	—	—	—	—	—
Tin, Organic compounds (as Sn)	7440-31-5	—	0.1	—	—	—	—	X
Tin Oxide (as Sn)	21651-19-4	—	2.0	—	—	—	—	—
Titanium dioxide	13463-67-7	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Toluene	108-88-3	100	375	150	560	—	—	—
Toluene-2, 4-diisocyanate (TDI)	584-84-9	0.005	0.04	0.02	0.15	—	—	—
m-Toluidine	108-44-1	2.0	9.0	—	—	—	—	X
o-Toluidine	95-53-4	2.0	9.0	—	—	—	—	X
p-Toluidine	106-49-0	2.0	9.0	—	—	—	—	X
Toxaphene	—	—	—	—	—	—	—	—
(see Chlorinated camphene)	—	—	—	—	—	—	—	—
Tremolite (see Silicates)	—	—	—	—	—	—	—	—
Tributyl phosphate	126-73-8	0.2	2.5	—	—	—	—	—
Trichloroacetic acid	76-03-9	1.0	7.0	—	—	—	—	—
1, 2, 4-Trichlorobenzene	120-82-1	—	—	—	—	5.0	40	—
1, 1, 1-Trichloroethane	—	—	—	—	—	—	—	—
(see Methyl chloroform)	—	—	—	—	—	—	—	—
1, 1, 2-Trichloroethane	79-00-5	10	45	—	—	—	—	—
Trichloroethylene	79-01-6	50	270	200	1,080	—	—	—
Trichlorofluoromethane	75-69-4	—	—	—	—	1,000	5,600	—
Trichloromethane	—	—	—	—	—	—	—	—
(see Chloroform)	—	—	—	—	—	—	—	—
Trichloronaphthalene	1321-65-9	—	5.0	—	—	—	—	X

Substance	CAS ^h Number	TWA		STEL ^c		CEILING		Skin Designation
		ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	ppm ^a	mg/m ^{3b}	
1, 2, 3-Trichloropropane	96-18-4	10	60	—	—	—	—	X
1, 1, 2-Trichloro-1, 2, 2-trifluoroethane	76-13-1	1,000	7,600	1,250	9,500	—	—	—
Tricyclohexyltin hydroxide (see Cyhexatin)	—	—	—	—	—	—	—	—
Triethylamine	121-44-8	10	40	15	60	—	—	—
Trifluorobromomethane	75-63-8	1,000	6,100	—	—	—	—	—
Trimellitic anhydride	552-30-7	0.005	0.04	—	—	—	—	—
Trimethylamine	75-50-3	10	24	15	36	—	—	—
Trimethyl benzene	25551-13-7	25	125	—	—	—	—	—
Trimethyl phosphite	121-45-9	2.0	10	—	—	—	—	—
2, 4, 6-Trinitrophenol (see Picric acid)	—	—	—	—	—	—	—	—
2, 4, 6-Trinitrophenyl- methylnitramine (see Tetryl)	—	—	—	—	—	—	—	—
2, 4, 6-Trinitrotoluene (TNT)	118-96-7	—	0.5	—	—	—	—	X
Triorthocresyl phosphate	78-30-8	—	0.1	—	—	—	—	X
Triphenyl amine	603-34-9	—	5.0	—	—	—	—	—
Triphenyl phosphate	115-86-6	—	3.0	—	—	—	—	—
Tungsten (as W)	7440-33-7	—	—	—	—	—	—	—
Soluble compounds	—	—	1.0	—	3.0	—	—	—
Insoluble compounds	—	—	5.0	—	10	—	—	—
Turpentine	8006-64-2	100	560	—	—	—	—	—
Uranium (as U)	7440-61-1	—	—	—	—	—	—	—
Soluble compounds	—	—	0.05	—	—	—	—	—
Insoluble compounds	—	—	0.2	—	0.6	—	—	—
n-Valeraldehyde	110-62-3	50	175	—	—	—	—	—
Vanadium (as V ₂ O ₅)	1314-62-1	—	0.05	—	—	—	—	—
Respirable dust and fume	—	—	—	—	—	—	—	—
Vegetable oil mist	—	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Vinyl acetate	108-05-1	10	30	20	60	—	—	—
Vinyl benzene (see Styrene)	—	—	—	—	—	—	—	—
Vinyl bromide	593-60-2	5.0	20	—	—	—	—	—
Vinyl chloride (see WAC 296-62-07329)	75-01-4	—	—	—	—	—	—	—
Vinyl cyanide (see Acrylonitrile)	—	—	—	—	—	—	—	—
Vinyl cyclohexene dioxide	106-87-6	10	60	—	—	—	—	X
Vinyl toluene	25013-15-4	50	240	—	—	—	—	—
Vinylidene chloride (1, 1-Dichloroethylene)	75-35-4	1.0	4.0	—	—	—	—	—
VM & P Naphtha	8032-32-4	300	1,350	400	1,800	—	—	—
Warfarin	81-81-2	—	0.1	—	—	—	—	—
Welding fumes ^f (total particulate)	—	—	5.0	—	—	—	—	—
Wood dust	—	—	—	—	—	—	—	—
Nonallergenic; All soft woods and hard woods except allergenics	—	—	5.0	—	10	—	—	—
Allergenic; (e.g. cedar, mahogany and teak)	—	—	2.5	—	—	—	—	—
Xylenes (Xylol) (o-, m-, p-isomers)	1330-20-7	100	435	150	655	—	—	—
m-Xylene alpha, alpha-diamine	1477-55-0	—	—	—	—	—	0.1	X
Xylidine	1300-73-8	2.0	10	—	—	—	—	X
Yttrium	7440-65-5	—	1.0	—	—	—	—	—
Zinc chloride fume	7646-85-7	—	1.0	—	2.0	—	—	—
Zinc chromate (as CrO ₃)	Varies with compound	—	0.05	—	—	—	0.1	—
Zinc oxide	1314-13-2	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Zinc oxide fume	1314-13-2	—	5.0	—	10	—	—	—
Zinc stearate	557-05-1	—	—	—	—	—	—	—
Total dust	—	—	10	—	—	—	—	—
Respirable fraction	—	—	5.0 ^k	—	—	—	—	—
Zirconium compounds (as Zr)	7440-67-2	—	5.0	—	10	—	—	—

- Notes: a Parts of vapor or gas per million parts of contaminated air by volume at 25 degrees C and 760 mm Hg pressure (torr).
- b Milligrams of substance per cubic meter of air. When a numerical entry for a substance is in the mg/m³ column and not in the ppm column, then the number in the mg/m³ column is exact. When numerical entries for a substance are in both the ppm and mg/m³ columns, then the number in the ppm column is exact and the number in the mg/m³ column may be rounded off.
- c Duration is for 15 minutes, unless otherwise noted.
- d The final benzene standard in WAC 296-62-07523 applies to all occupational exposures to benzene except some sub-segments of industry where exposures are consistently under the action level (i.e., distribution and sale of fuels, sealed containers and pipelines, coke production, oil and gas drilling and production, natural gas processing, and the percentage exclusion for liquid mixtures).
- e This 8-hour TWA applies to respirable dust as measured by a vertical elutriator cotton dust sampler or equivalent instrument. The time-weighted average applies to the cotton waste processing operations of waste recycling (sorting, blending, cleaning, and willowing) and garretting. See also WAC 296-62-14533 for cotton dust limits applicable to other sectors.
- f As determined from breathing-zone air samples.
- g Both concentration and percent quartz for the application of this limit are to be determined from the fraction passing a size-selector with the following characteristics:

Aerodynamic diameter (unit density sphere)	Percent passing selector
1	97
2	91
3	74
4	50
5	30
6	17
7	9
8	5
10	1

- h The CAS number is for information only. Enforcement is based on the substance name. For an entry covering more than one metal compound measured as the metal, the CAS number for the metal is given — not CAS numbers for the individual compounds.
- i Compliance with the subtilisins PEL is assessed by sampling with a high volume sampler (600-800 liters per minute) for at least 60 minutes.
- j Sampling for the carbon monoxide ceiling shall be averaged over 5 minutes but an instantaneous reading over 1500 ppm shall not be exceeded.
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[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 98-10-029, § 296-62-07515, filed 4/24/98, effective 7/24/98; 97-19-014, § 296-62-07515, filed 9/5/97, effective 11/5/97. Statutory Authority: Chapter 49.17 RCW. 96-17-056, § 296-62-07515, filed 8/20/96, effective 10/15/96; 93-01-067 (Order 92-15), § 296-62-07515, filed 12/11/92, effective 1/15/93; 91-11-

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PART I—AIR CONTAMINANTS (SPECIFIC)

WAC 296-62-07517 Reserved.

[Statutory Authority: Chapter 49.17 RCW. 90-09-026 (Order 90-01), § 296-62-07517, filed 4/10/90, effective 5/25/90; 87-24-051 (Order 87-24), § 296-62-07517, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07517, filed 4/27/87. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-18-029 (Order 81-21), § 296-62-07517, filed 8/27/81; 81-16-015 (Order 81-20), § 296-62-07517, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-07517, filed 8/8/80; Order 77-12, § 296-62-07517, filed 7/11/77; Order 73-3, § 296-62-07517, filed 5/7/73.]

WAC 296-62-07519 Thiram. (1) Scope and application. This section applies to occupational exposure to thiram (tetramethylthiuram disulfide), in addition to those requirements listed in WAC 296-62-07515. Nothing in this section shall preclude the application of other appropriate standards and regulations to minimize worker exposure to thiram.

(2) Definitions. The following definitions are applicable to this section:

(a) Clean - the absence of dirt or materials which may be harmful to a worker's health.

(b) Large seedlings - those seedlings of such size, either by length or breadth, that it is difficult to avoid contact of the thiram treated plant with the mouth or face during planting operations.

(3) General requirements.

(a) Workers should not be allowed to work more than five days in any seven day period with or around the application of thiram or thiram treated seedlings.

(b) Washing and worker hygiene.

(i) Workers shall wash their hands prior to eating or smoking at the close of work.

(ii) Warm (at least 85°F, 29.4°C) wash water and single use hand wiping materials shall be provided for washing.

(iii) The warm water and hand wiping materials shall be at fixed work locations or at the planting unit.

(iv) Where warm water is not available within 15 minutes travel time, nonalcoholic based waterless hand cleaner shall be provided.

(v) Every planter or nursery worker shall be advised to bathe or shower daily.

(vi) The inside of worker carrying vehicles shall be washed or vacuumed and wiped down at least weekly during the period of thiram use.

(c) Personal protective measures.

(i) Clothing shall be worn by workers to reduce skin contact with thiram to the legs, arms and torso.

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PART I—AIR CONTAMINANTS (SPECIFIC)

WAC 296-62-07517 Reserved.

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(3) General requirements.

(a) Workers should not be allowed to work more than five days in any seven day period with or around the application of thiram or thiram treated seedlings.

(b) Washing and worker hygiene.

(i) Workers shall wash their hands prior to eating or smoking at the close of work.

(ii) Warm (at least 85°F, 29.4°C) wash water and single use hand wiping materials shall be provided for washing.

(iii) The warm water and hand wiping materials shall be at fixed work locations or at the planting unit.

(iv) Where warm water is not available within 15 minutes travel time, nonalcoholic based waterless hand cleaner shall be provided.

(v) Every planter or nursery worker shall be advised to bathe or shower daily.

(vi) The inside of worker carrying vehicles shall be washed or vacuumed and wiped down at least weekly during the period of thiram use.

(c) Personal protective measures.

(i) Clothing shall be worn by workers to reduce skin contact with thiram to the legs, arms and torso.

(ii) For those workers who have thiram skin irritations, exposed areas of the body shall be protected by a suitable barrier cream.

(iii) Clothing worn by workers shall be washed or changed at least every other day.

(iv) Only impervious gloves may be worn by workers.

(v) Workers hands should be clean of thiram before placing them into gloves.

(vi) Thiram applicators shall be provided with and use respiratory protection in accordance with WAC 296-62-071, disposable coveralls or rubber slickers or other impervious clothing, rubberized boots, head covers and rubberized gloves.

(vii) Nursery workers, other than applicators, who are likely to be exposed to thiram shall be provided with and use disposable coveralls or rubber slickers or other impervious clothing, impervious footwear and gloves, and head covers in accordance with WAC 296-24-075, unless showers have been provided and are used.

(viii) Eye protection according to WAC 296-24-078, shall be provided and worn by workers who may be exposed to splashes of thiram during spraying, plug bundling, belt line grading and plugging or other operations.

(ix) Item (viii) of this subdivision need not be complied with where pressurized emergency eye wash fountains are within 10 seconds travel time of the work location. (Approved respirator - see WAC 296-62-071.)

(x) A dust mask shall be worn, when planting large seedlings, to avoid mouth and face contact with the thiram treated plant unless equally effective measures or planting practices have been established.

(d) Food handling.

(i) Food snacks, beverages, smoking materials, or any other item which is consumed shall not be stored or consumed in the packing area of the nursery.

(ii) Worker carrying vehicles shall have a clean area for carrying lunches.

(iii) The clean area of the vehicle shall be elevated from the floor and not used to carry other than food or other consumable items.

(iv) The carrying of lunches, food or other consumable items in tree planting bags is prohibited.

(v) Care shall be taken to insure that worker exposure to thiram spray, including downwind driftings, is minimized or eliminated.

(vi) When bags that contained thiram or thiram treated seedlings are burned, prevent worker exposure to the smoke.

(e) Thiram use and handling.

(i) Thiram treated seedlings shall be allowed to dry or stabilize prior to packing.

(ii) Seedlings shall be kept moist during packing and whenever possible during planting operations.

(iii) Floors, where thiram is used, shall not be dry swept but instead vacuumed, washed or otherwise cleaned at least daily.

(iv) Silica chips used to cover thiram treated seedling plugs shall be removed at the nursery.

(f) Training.

(i) Each worker engaged in operations where exposure to thiram may occur shall be provided training on the hazards of

thiram, as well as the necessary precautions for its safe use and handling.

(ii) The training shall include instruction in:

(A) The nature of the health hazard(s) from exposure to thiram including specifically the potential for alcohol intolerance, drug interaction, and skin irritation;

(B) The specific nature of operations which could result in exposure to thiram and the necessary protective steps;

(C) The purpose for, proper use, and limitations of protective devices including respirators and clothing;

(D) The necessity for and requirements of good personal hygiene; and

(E) A review of the thiram rules at the worker's first training and indoctrination, and annually thereafter.

(4) Effective date. This standard shall become effective 30 days after being filed with the code reviser.

[Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240. 81-16-016 (Order 81-19), § 296-62-07519, filed 7/27/81.]

WAC 296-62-07521 Lead. (1) Scope and application.

(a) This section applies to all occupational exposure to lead, except as provided in subdivision (1)(b).

(b) This section does not apply to the construction industry or to agricultural operations covered by chapter 296-306 WAC.

(2) Definitions as applicable to this part.

(a) "Action level" - employee exposure, without regard to the use of respirators, to an airborne concentration of lead of thirty micrograms per cubic meter of air ($30 \mu\text{g}/\text{m}^3$) averaged over an eight-hour period.

(b) "Director" - the director of the department of labor and industries.

(c) "Lead" - metallic lead, all inorganic lead compounds, and organic lead soaps. Excluded from this definition are all other organic lead compounds.

(3) General requirements.

(a) Employers will assess the hazards of lead in the work place and provide information to the employees about the hazards of the lead exposures to which they may be exposed.

(b) Information provided shall include:

(i) Exposure monitoring (including employee notification);

(ii) Written compliance programs;

(iii) Respiratory protection programs;

(iv) Personnel protective equipment and housekeeping;

(v) Medical surveillance and examinations;

(vi) Training requirements;

(vii) Recordkeeping requirements.

(4) Permissible exposure limit (PEL).

(a) The employer shall assure that no employee is exposed to lead at concentrations greater than fifty micrograms per cubic meter of air ($50 \mu\text{g}/\text{m}^3$) averaged over an eight-hour period.

(b) If an employee is exposed to lead for more than eight hours in any work day, the permissible exposure limit, as a time weighted average (TWA) for that day, shall be reduced according to the following formula:

$$\text{Maximum permissible limit (in } \mu\text{g}/\text{m}^3) = 400 \div \text{hours worked in the day.}$$

(c) When respirators are used to supplement engineering and work practice controls to comply with the PEL and all the requirements of subsection (7) have been met, employee exposure, for the purpose of determining whether the employer has complied with the PEL, may be considered to be at the level provided by the protection factor of the respirator for those periods the respirator is worn. Those periods may be averaged with exposure levels during periods when respirators are not worn to determine the employee's daily TWA exposure.

(5) Exposure monitoring.

(a) General.

(i) For the purposes of subsection (5), employee exposure is that exposure which would occur if the employee were not using a respirator.

(ii) With the exception of monitoring under subdivision (5)(c), the employer shall collect full shift (for at least seven continuous hours) personal samples including at least one sample for each shift for each job classification in each work area.

(iii) Full shift personal samples shall be representative of the monitored employee's regular, daily exposure to lead.

(b) Initial determination. Each employer who has a workplace or work operation covered by this standard shall determine if any employee may be exposed to lead at or above the action level.

(c) Basis of initial determination.

(i) The employer shall monitor employee exposures and shall base initial determinations on the employee exposure monitoring results and any of the following, relevant considerations:

(A) Any information, observations, or calculations which would indicate employee exposure to lead;

(B) Any previous measurements of airborne lead; and

(C) Any employee complaints of symptoms which may be attributable to exposure to lead.

(ii) Monitoring for the initial determination may be limited to a representative sample of the exposed employees who the employer reasonably believes are exposed to the greatest airborne concentrations of lead in the workplace.

(iii) Measurements of airborne lead made in the preceding twelve months may be used to satisfy the requirement to monitor under item (5)(c)(i) if the sampling and analytical methods used meet the accuracy and confidence levels of subdivision (5)(i) of this section.

(d) Positive initial determination and initial monitoring.

(i) Where a determination conducted under subdivision (5)(b) and (5)(c) of this section shows the possibility of any employee exposure at or above the action level, the employer shall conduct monitoring which is representative of the exposure for each employee in the workplace who is exposed to lead.

(ii) Measurements of airborne lead made in the preceding twelve months may be used to satisfy this requirement if the sampling and analytical methods used meet the accuracy and confidence levels of subdivision (5)(i) of this section.

(e) Negative initial determination. Where a determination, conducted under subdivisions (5)(b) and (5)(c) of this section is made that no employee is exposed to airborne concentrations of lead at or above the action level, the employer

shall make a written record of such determination. The record shall include at least the information specified in subdivision (5)(c) of this section and shall also include the date of determination, location within the worksite, and the name and social security number of each employee monitored.

(f) Frequency.

(i) If the initial monitoring reveals employee exposure to be below the action level the measurements need not be repeated except as otherwise provided in subdivision (5)(g) of this section.

(ii) If the initial determination or subsequent monitoring reveals employee exposure to be at or above the action level but below the permissible exposure limit the employer shall repeat monitoring in accordance with this subsection at least every six months. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least seven days apart, are below the action level at which time the employer may discontinue monitoring for that employee except as otherwise provided in subdivision (5)(g) of this section.

(iii) If the initial monitoring reveals that employee exposure is above the permissible exposure limit the employer shall repeat monitoring quarterly. The employer shall continue monitoring at the required frequency until at least two consecutive measurements, taken at least seven days apart, are below the PEL but at or above the action level at which time the employer shall repeat monitoring for that employee at the frequency specified in item (5)(f)(ii), except as otherwise provided in subdivision (5)(g) of this section.

(g) Additional monitoring. Whenever there has been a production, process, control or personnel change which may result in new or additional exposure to lead, or whenever the employer has any other reason to suspect a change which may result in new or additional exposures to lead, additional monitoring in accordance with this subsection shall be conducted.

(h) Employee notification.

(i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of the results which represent that employee's exposure.

(ii) Whenever the results indicate that the representative employee exposure, without regard to respirators, exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken or to be taken to reduce exposure to or below the permissible exposure limit.

(i) Accuracy of measurement. The employer shall use a method of monitoring and analysis which has an accuracy (to a confidence level of ninety-five percent) of not less than plus or minus twenty percent for airborne concentrations of lead equal to or greater than 30 $\mu\text{g}/\text{m}^3$.

(6) Methods of compliance.

(a) Engineering and work practice controls.

(i) Where any employee is exposed to lead above the permissible exposure limit for more than thirty days per year, the employer shall implement engineering and work practice controls (including administrative controls) to reduce and maintain employee exposure to lead in accordance with the implementation schedule in Table I below, except to the

extent that the employer can demonstrate that such controls are not feasible. Wherever the engineering and work practice controls which can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest feasible level and shall supplement them by the use of respiratory protection which complies with the requirements of subsection (7) of this section.

(ii) Where any employee is exposed to lead above the permissible exposure limit, but for thirty days or less per year, the employer shall implement engineering controls to reduce exposures to 200 µg/m³, but thereafter may implement any combination of engineering, work practice (including administrative controls), and respiratory controls to reduce and maintain employee exposure to lead to or below 50 µg/m³.

TABLE 1

Industry	Compliance dates: ¹ (50 µg/m ³)
Lead chemicals, secondary copper smelting.	July 19, 1996
Nonferrous foundries	July 19, 1996. ²
Brass and bronze ingot manufacture.	6 years. ³

¹ Calculated by counting from the date the stay on implementation of subsection (6)(a) was lifted by the U.S. Court of Appeals for the District of Columbia, the number of years specified in the 1978 lead standard and subsequent amendments for compliance with the PEL of 50 µg/m³ for exposure to airborne concentrations of lead levels for the particular industry.

² Large nonferrous foundries (20 or more employees) are required to achieve the PEL of 50 µg/m³ by means of engineering and work practice controls. Small nonferrous foundries (fewer than 20 employees) are required to achieve an 8-hour TWA of 75 µg/m³ by such controls.

³ Expressed as the number of years from the date on which the Court lifts the stay on the implementation of subsection (6)(a) for this industry for employers to achieve a lead in air concentration of 75 µg/m³. Compliance with subsection (6) in this industry is determined by a compliance directive that incorporates elements from the settlement agreement between OSHA and representatives of the industry.

(b) Respiratory protection. Where engineering and work practice controls do not reduce employee exposure to or below the 50 µg/m³ permissible exposure limit, the employer shall supplement these controls with respirators in accordance with subsection (7).

(c) Compliance program.

(i) Each employer shall establish and implement a written compliance program to reduce exposures to or below the permissible exposure limit, and interim levels if applicable, solely by means of engineering and work practice controls in accordance with the implementation schedule in subdivision (6)(a).

(ii) Written plans for these compliance programs shall include at least the following:

(A) A description of each operation in which lead is emitted; e.g., machinery used, material processed, controls in place, crew size, employee job responsibilities, operating procedures and maintenance practices;

(B) A description of the specific means that will be employed to achieve compliance, including engineering

plans and studies used to determine methods selected for controlling exposure to lead;

(C) A report of the technology considered in meeting the permissible exposure limit;

(D) Air monitoring data which documents the source of lead emissions;

(E) A detailed schedule for implementation of the program, including documentation such as copies of purchase orders for equipment, construction contracts, etc.;

(F) A work practice program which includes items required under subsections (8), (9) and (10) of this regulation;

(G) An administrative control schedule required by subdivision (6)(f), if applicable; and

(H) Other relevant information.

(iii) Written programs shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, any affected employee or authorized employee representatives.

(iv) Written programs shall be revised and updated at least every six months to reflect the current status of the program.

(d) Mechanical ventilation.

(i) When ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system in controlling exposure, such as capture velocity, duct velocity, or static pressure shall be made at least every three months. Measurements of the system's effectiveness in controlling exposure shall be made within five days of any change in production, process, or control which might result in a change in employee exposure to lead.

(ii) Recirculation of air. If air from exhaust ventilation is recirculated into the workplace, the employer shall assure that (A) the system has a high efficiency filter with reliable back-up filter; and (B) controls to monitor the concentration of lead in the return air and to bypass the recirculation system automatically if it fails are installed, operating, and maintained.

(e) Administrative controls. If administrative controls are used as a means of reducing employees TWA exposure to lead, the employer shall establish and implement a job rotation schedule which includes:

(i) Name or identification number of each affected employee;

(ii) Duration and exposure levels at each job or work station where each affected employee is located; and

(iii) Any other information which may be useful in assessing the reliability of administrative controls to reduce exposure to lead.

(7) Respiratory protection.

(a) General. Where the use of respirators is required under this section, the employer shall provide, at no cost to the employee, and assure the use of respirators which comply with the requirements of this subsection. Respirators shall be used in the following circumstances:

(i) During the time period necessary to install or implement engineering or work practice controls; and

(ii) In work situations in which engineering and work practice controls are not sufficient to reduce exposures to or below the permissible exposure limit; and

(iii) Whenever an employee requests a respirator.

(b) Respirator selection.

(i) Where respirators are required under this section the employer shall select the appropriate respirator or combination of respirators from Table II.

TABLE II

RESPIRATORY PROTECTION FOR LEAD AEROSOLS

Airborne Concentration of Lead or Condition of Use	Required Respirator ¹
Not in excess of 0.5 mg/m ³ (10X PEL).	Half-mask, air-purifying respirator equipped with high efficiency filters. ^{2,3}
Not in excess of 2.5 mg/m ³ (50X PEL).	Full facepiece, air-purifying respirator with high efficiency filters. ³
Not in excess of 50 mg/m ³ (1000X PEL).	(1) Any powered, air-purifying respirator with high efficiency filters ³ ; or (2) Half-mask supplied-air respirator operated in positive-pressure mode. ²
Not in excess of 100 mg/m ³ (2000X PEL).	Supplied-air respirators with full facepiece, hood, helmet, or suit, operated in positive pressure mode.
Greater than 100 mg/m ³ , unknown concentration or fire fighting.	Full facepiece, self-contained breathing apparatus operated in positive-pressure mode.

Note: ¹ Respirators specified for high concentrations can be used at lower concentrations of lead.

² Full facepiece is required if the lead aerosols cause eye or skin irritation at the use concentrations.

³ A high efficiency particulate filter means 99.97 percent efficient against 0.3 micron size particles.

(ii) The employer shall provide a powered, air-purifying respirator in lieu of the respirator specified, in Table II whenever:

(A) An employee chooses to use this type of respirator; and

(B) This respirator will provide adequate protection to the employee.

(iii) The employer shall select respirators from among those approved for protection against lead dust, fume, and mist by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(c) Respirator usage.

(i) The employer shall assure that the respirator issued to the employee exhibits minimum facepiece leakage and that the respirator is fitted properly.

(ii) Employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter for each employee wearing negative pressure respirators. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with Appendix D. The tests shall be used to select facepieces that provide the required protection as prescribed in Table II.

(iii) If an employee exhibits difficulty in breathing during the fitting test or during use, the employer shall make available to the employee an examination in accordance with subitem (11)(c)(i)(C) of this section to determine whether the

employee can wear a respirator while performing the required duty.

(d) Respirator program.

(i) The employer shall institute a respiratory protection program in accordance with WAC 296-62-071.

(ii) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(iii) Employees who wear respirators shall be permitted to leave work areas to wash their face and respirator facepiece whenever necessary to prevent skin irritation associated with respirator use.

(8) Protective work clothing and equipment.

(a) Provision and use. If an employee is exposed to lead above the PEL, without regard to the use of respirators or where the possibility of skin or eye irritation exists, the employer shall provide at no cost to the employee and assure that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(i) Coveralls or similar full-body work clothing;

(ii) Gloves, hats, and shoes or disposable shoe coverlets; and

(iii) Face shields, vented goggles, or other appropriate protective equipment which complies with WAC 296-24-078.

(b) Cleaning and replacement.

(i) The employer shall provide the protective clothing required in subdivision (8)(a) of this section in a clean and dry condition at least weekly, and daily to employees whose exposure levels without regard to a respirator are over 200 µg/m³ of lead as an eight-hour TWA.

(ii) The employer shall provide for the cleaning, laundering, or disposal of protective clothing and equipment required by subdivision (8)(a) of this section.

(iii) The employer shall repair or replace required protective clothing and equipment as needed to maintain their effectiveness.

(iv) The employer shall assure that all protective clothing is removed at the completion of a work shift only in change rooms provided for that purpose as prescribed in subdivision (10)(b) of this section.

(v) The employer shall assure that contaminated protective clothing which is to be cleaned, laundered, or disposed of, is placed in a closed container in the change-room which prevents dispersion of lead outside the container.

(vi) The employer shall inform in writing any person who cleans or launders protective clothing or equipment of the potentially harmful effects of exposure to lead.

(vii) The employer shall assure that the containers of contaminated protective clothing and equipment required by subdivision (8)(b)(v) are labeled as follows:

CAUTION: CLOTHING CONTAMINATED WITH LEAD.
DO NOT REMOVE DUST BY BLOWING OR SHAKING.
DISPOSE OF LEAD CONTAMINATED WASH WATER
IN ACCORDANCE WITH APPLICABLE LOCAL,
STATE, OR FEDERAL REGULATIONS.

(viii) The employer shall prohibit the removal of lead from protective clothing or equipment by blowing, shaking, or any other means which disperses lead into the air.

(9) Housekeeping.

(a) Surfaces. All surfaces shall be maintained as free as practicable of accumulations of lead.

(b) Cleaning floors.

(i) Floors and other surfaces where lead accumulates may not be cleaned by the use of compressed air.

(ii) Shoveling, dry or wet sweeping, and brushing may be used only where vacuuming or other equally effective methods have been tried and found not to be effective.

(c) Vacuuming. Where vacuuming methods are selected, the vacuums shall be used and emptied in a manner which minimizes the reentry of lead into the workplace.

(10) Hygiene facilities and practices.

(a) The employer shall assure that in areas where employees are exposed to lead above the PEL, without regard to the use of respirators, food or beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, except in change rooms, lunchrooms, and showers required under subdivision (10)(b) through (10)(d) of this section.

(b) Change rooms.

(i) The employer shall provide clean change rooms for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that change rooms are equipped with separate storage facilities for protective work clothing and equipment and for street clothes which prevent cross-contamination.

(c) Showers.

(i) The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators, shower at the end of the work shift.

(ii) The employer shall provide shower facilities in accordance with WAC 296-24-12009.

(iii) The employer shall assure that employees who are required to shower pursuant to item (10)(c)(i) do not leave the workplace wearing any clothing or equipment worn during the work shift.

(d) Lunchrooms.

(i) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure to lead is above the PEL, without regard to the use of respirators.

(ii) The employer shall assure that lunchroom facilities have a temperature controlled, positive pressure, filtered air supply, and are readily accessible to employees.

(iii) The employer shall assure that employees who work in areas where their airborne exposure to lead is above the PEL without regard to the use of a respirator wash their hands and face prior to eating, drinking, smoking or applying cosmetics.

(iv) The employer shall assure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface lead dust has been removed by vacuuming, downdraft booth, or other cleaning method.

(e) Lavatories. The employer shall provide an adequate number of lavatory facilities which comply with WAC 296-24-12009 (1) and (2).

(11) Medical surveillance.

(a) General.

(i) The employer shall institute a medical surveillance program for all employees who are or may be exposed above the action level for more than thirty days per year.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician.

(iii) The employer shall provide the required medical surveillance including multiple physician review under item (11)(c)(iii) without cost to employees and at a reasonable time and place.

(b) Biological monitoring.

(i) Blood lead and ZPP level sampling and analysis. The employer shall make available biological monitoring in the form of blood sampling and analysis for lead and zinc protoporphyrin levels to each employee covered under item (11)(a)(i) of this section on the following schedule:

(A) At least every six months to each employee covered under item (11)(a)(i) of this section;

(B) At least every two months for each employee whose last blood sampling and analysis indicated a blood lead level at or above 40 µg/100 g of whole blood. This frequency shall continue until two consecutive blood samples and analyses indicate a blood lead level below 40 µg/100 g of whole blood; and

(C) At least monthly during the removal period of each employee removed from exposure to lead due to an elevated blood lead level.

(ii) Follow-up blood sampling tests. Whenever the results of a blood lead level test indicate that an employee's blood lead level exceeds the numerical criterion for medical removal under item (12)(a)(i)(A), the employer shall provide a second (follow-up) blood sampling test within two weeks after the employer receives the results of the first blood sampling test.

(iii) Accuracy of blood lead level sampling and analysis. Blood lead level sampling and analysis provided pursuant to this section shall have an accuracy (to a confidence level of ninety-five percent) within plus or minus fifteen percent or 6 µg/100 ml, whichever is greater, and shall be conducted by a laboratory licensed by the Center for Disease Control (CDC), United States Department of Health, Education and Welfare or which has received a satisfactory grade in blood lead proficiency testing from CDC in the prior twelve months.

(iv) Employee notification. Within five working days after the receipt of biological monitoring results, the employer shall notify in writing each employee whose blood lead level exceeds 40 µg/100 g: (A) of that employee's blood lead level and (B) that the standard requires temporary medical removal with medical removal protection benefits when an employee's blood lead level exceeds the numerical criterion for medical removal under item (12)(a)(i) of this section.

(c) Medical examinations and consultations.

(i) Frequency. The employer shall make available medical examinations and consultations to each employee covered

under item (11)(a)(i) of this section on the following schedule:

(A) At least annually for each employee for whom a blood sampling test conducted at any time during the preceding twelve months indicated a blood lead level at or above 40 µg/100 g;

(B) Prior to assignment for each employee being assigned for the first time to an area in which airborne concentrations of lead are at or above the action level;

(C) As soon as possible, upon notification by an employee either that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice concerning the effects of current or past exposure to lead on the employee's ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during use; and

(D) As medically appropriate for each employee either removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited pursuant to a final medical determination.

(ii) Content. Medical examinations made available pursuant to subitems (11)(c)(i)(A) through (B) of this section shall include the following elements:

(A) A detailed work history and a medical history, with particular attention to past lead exposure (occupational and nonoccupational), personal habits (smoking, hygiene), and past gastrointestinal, hematologic, renal, cardiovascular, reproductive and neurological problems;

(B) A thorough physical examination, with particular attention to teeth, gums, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems. Pulmonary status should be evaluated if respiratory protection will be used;

(C) A blood pressure measurement;

(D) A blood sample and analysis which determines:

(I) Blood lead level;

(II) Hemoglobin and hematocrit determinations, red cell indices, and examination of peripheral smear morphology;

(III) Zinc protoporphyrin;

(IV) Blood urea nitrogen; and

(V) Serum creatinine;

(E) A routine urinalysis with microscopic examination; and

(F) Any laboratory or other test which the examining physician deems necessary by sound medical practice.

The content of medical examinations made available pursuant to subitems (11)(c)(i)(C) through (D) of this section shall be determined by an examining physician and, if requested by an employee, shall include pregnancy testing or laboratory evaluation of male fertility.

(iii) Multiple physician review mechanism.

(A) If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee under this section, the employee may designate a second physician:

(I) To review any findings, determinations or recommendations of the initial physician; and

(II) To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(B) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to this section. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

(I) The employee informing the employer that he or she intends to seek a second medical opinion, and

(II) The employee initiating steps to make an appointment with a second physician.

(C) If the findings, determinations or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(D) If the two physicians have been unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

(I) To review any findings, determinations or recommendations of the prior physicians; and

(II) To conduct such examinations, consultations, laboratory tests and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(E) The employer shall act consistent with the findings, determinations and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(iv) Information provided to examining and consulting physicians.

(A) The employer shall provide an initial physician conducting a medical examination or consultation under this section with the following information:

(I) A copy of this regulation for lead including all appendices;

(II) A description of the affected employee's duties as they relate to the employee's exposure;

(III) The employee's exposure level or anticipated exposure level to lead and to any other toxic substance (if applicable);

(IV) A description of any personal protective equipment used or to be used;

(V) Prior blood lead determinations; and

(VI) All prior written medical opinions concerning the employee in the employer's possession or control.

(B) The employer shall provide the foregoing information to a second or third physician conducting a medical examination or consultation under this section upon request either by the second or third physician, or by the employee.

(v) Written medical opinions.

(A) The employer shall obtain and furnish the employee with a copy of a written medical opinion from each examining or consulting physician which contains the following information:

(I) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to lead;

(II) Any recommended special protective measures to be provided to the employee, or limitations to be placed upon the employee's exposure to lead;

(III) Any recommended limitation upon the employee's use of respirators, including a determination of whether the employee can wear a powered air purifying respirator if a physician determines that the employee cannot wear a negative pressure respirator; and

(IV) The results of the blood lead determinations.

(B) The employer shall instruct each examining and consulting physician to:

(I) Not reveal either in the written opinion, or in any other means of communication with the employer, findings, including laboratory results, or diagnoses unrelated to an employee's occupational exposure to lead; and

(II) Advise the employee of any medical condition, occupational or nonoccupational, which dictates further medical examination or treatment.

(vi) Alternate physician determination mechanisms. The employer and an employee or authorized employee representative may agree upon the use of any expeditious alternate physician determination mechanism in lieu of the multiple physician review mechanism provided by this subsection so long as the alternate mechanism otherwise satisfies the requirements contained in this subsection.

(d) Chelation.

(i) The employer shall assure that any person whom he retains, employs, supervises or controls does not engage in prophylactic chelation of any employee at any time.

(ii) If therapeutic or diagnostic chelation is to be performed by any person in item (11)(d)(i), the employer shall assure that it be done under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring and that the employee is notified in writing prior to its occurrence.

(12) Medical removal protection.

(a) Temporary medical removal and return of an employee.

(i) Temporary removal due to elevated blood lead levels.

(A) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a periodic and a follow-up blood sampling test conducted pursuant to this section indicate that the employee's blood lead level is at or above 60 $\mu\text{g}/100$ g of whole blood; and

(B) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that the average of the last three blood sampling tests conducted pursuant to this section (or the average of all blood sampling tests conducted over the previous six months, whichever is longer) indicates that the employee's blood lead level is at or above 50 $\mu\text{g}/100$ g of whole blood; provided, however, that an employee need not be removed if the last blood sampling test indicates a blood lead level at or below 40 $\mu\text{g}/100$ g of whole blood.

(ii) Temporary removal due to a final medical determination.

(A) The employer shall remove an employee from work having an exposure to lead at or above the action level on each occasion that a final medical determination results in a medical finding, determination, or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(B) For the purposes of this section, the phrase "final medical determination" shall mean the outcome of the multiple physician review mechanism or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section.

(C) Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to lead, the employer shall implement and act consistent with the recommendation.

(iii) Return of the employee to former job status.

(A) The employer shall return an employee to his or her former job status:

(I) For an employee removed due to a blood lead level at or above 60 $\mu\text{g}/100$ g, or due to an average blood lead level at or above 50 $\mu\text{g}/100$ g, when two consecutive blood sampling tests indicate that the employee's blood lead level is at or below 40 $\mu\text{g}/100$ g of whole blood;

(II) For an employee removed due to a final medical determination, when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to lead.

(B) For the purposes of this section, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(iv) Removal of other employee special protective measure or limitations. The employer shall remove any limitations placed on an employee or end any special protective measures provided to an employee pursuant to a final medical determination when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(v) Employer options pending a final medical determination. Where the multiple physician review mechanism, or alternate medical determination mechanism used pursuant to the medical surveillance provisions of this section, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

(A) Removal. The employer may remove the employee from exposure to lead, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status.

(B) Return. The employer may return the employee to his or her former job status, end any special protective mea-

asures provided to the employee, and remove any limitations placed upon the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions. If:

(I) The initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician; or

(II) The employee has been on removal status for the preceding eighteen months due to an elevated blood lead level, then the employer shall await a final medical determination.

(b) Medical removal protection benefits.

(i) Provision of medical removal protection benefits. The employer shall provide to an employee up to eighteen months of medical removal protection benefits on each occasion that an employee is removed from exposure to lead or otherwise limited pursuant to this section.

(ii) Definition of medical removal protection benefits. For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the earnings, seniority and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to lead or otherwise limited.

(iii) Follow-up medical surveillance during the period of employee removal or limitation. During the period of time that an employee is removed from normal exposure to lead or otherwise limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to this section.

(iv) Workers' compensation claims. If a removed employee files a claim for workers' compensation payments for a lead-related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment related expenses.

(v) Other credits. The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or receives income from employment with another employer made possible by virtue of the employee's removal.

(vi) Employees whose blood lead levels do not adequately decline within eighteen months of removal. The employer shall take the following measures with respect to any employee removed from exposure to lead due to an elevated blood lead level whose blood lead level has not declined within the past eighteen months of removal so that the employee has been returned to his or her former job status:

(A) The employer shall make available to the employee a medical examination pursuant to this section to obtain a final medical determination with respect to the employee;

(B) The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and if not, what steps should be taken to protect the employee's health;

(C) Where the final medical determination has not yet been obtained, or once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status.

(D) Where the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status despite what would otherwise be an unacceptable blood lead level, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the blood lead level removal criteria provided by this section.

(vii) Voluntary removal or restriction of an employee. Where an employer, although not required by this section to do so, removes an employee from exposure to lead or otherwise places limitations on an employee due to the effects of lead exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by item (12)(b)(i) of this section.

(13) Employee information and training.

(a) Training program.

(i) Each employer who has a workplace in which there is a potential exposure to airborne lead at any level shall inform employees of the content of Appendices A and B of this regulation.

(ii) The employer shall institute a training program for and assure the participation of all employees who are subject to exposure to lead at or above the action level or for whom the possibility of skin or eye irritation exists.

(iii) The employer shall provide initial training by one hundred eighty days from the effective date for those employees covered by item (13)(a)(ii) on the standard's effective date and prior to the time of initial job assignment for those employees subsequently covered by this subsection.

(iv) The training program shall be repeated at least annually for each employee.

(v) The employer shall assure that each employee is informed of the following:

(A) The content of this standard and its appendices;

(B) The specific nature of the operations which could result in exposure to lead above the action level;

(C) The purpose, proper selection, fitting, use, and limitations of respirators;

(D) The purpose and a description of the medical surveillance program, and the medical removal protection program including information concerning the adverse health effects associated with excessive exposure to lead (with particular

attention to the adverse reproductive effects on both males and females);

(E) The engineering controls and work practices associated with the employee's job assignment;

(F) The contents of any compliance plan in effect; and

(G) Instructions to employees that chelating agents should not routinely be used to remove lead from their bodies and should not be used at all except under the direction of a licensed physician.

(b) Access to information and training materials.

(i) The employer shall make readily available to all affected employees a copy of this standard and its appendices.

(ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(iii) In addition to the information required by item (13)(a)(v), the employer shall include as part of the training program, and shall distribute to employees, any materials pertaining to the Occupational Safety and Health Act, the regulations issued pursuant to the act, and this lead standard, which are made available to the employer by the director.

(14) Signs.

(a) General.

(i) The employer may use signs required by other statutes, regulations or ordinances in addition to, or in combination with, signs required by this subsection.

(ii) The employer shall assure that no statement appears on or near any sign required by this subsection which contradicts or detracts from the meaning of the required sign.

(b) Signs.

(i) The employer shall post the following warning signs in each work area where the PEL is exceeded:

WARNING
LEAD WORK AREA
POISON
NO SMOKING OR EATING

(ii) The employer shall assure that signs required by this subsection are illuminated and cleaned as necessary so that the legend is readily visible.

(15) Recordkeeping.

(a) Exposure monitoring.

(i) The employer shall establish and maintain an accurate record of all monitoring required in subsection (5) of this section.

(ii) This record shall include:

(A) The date(s), number, duration, location and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure where applicable;

(B) A description of the sampling and analytical methods used and evidence of their accuracy;

(C) The type of respiratory protective devices worn, if any;

(D) Name, social security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent; and

(E) The environmental variables that could affect the measurement of employee exposure.

(iii) The employer shall maintain these monitoring records for at least forty years or for the duration of employment plus twenty years, whichever is longer.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance as required by subsection (11) of this section.

(ii) This record shall include:

(A) The name, social security number, and description of the duties of the employee;

(B) A copy of the physician's written opinions;

(C) Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(D) Any employee medical complaints related to exposure to lead.

(iii) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(A) A copy of the medical examination results including medical and work history required under subsection (11) of this section;

(B) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to that information; and

(C) A copy of the results of biological monitoring.

(iv) The employer shall maintain or assure that the physician maintains those medical records for at least forty years, or for the duration of employment plus twenty years, whichever is longer.

(c) Medical removals.

(i) The employer shall establish and maintain an accurate record for each employee removed from current exposure to lead pursuant to subsection (12) of this section.

(ii) Each record shall include:

(A) The name and social security number of the employee;

(B) The date on each occasion that the employee was removed from current exposure to lead as well as the corresponding date on which the employee was returned to his or her former job status;

(C) A brief explanation of how each removal was or is being accomplished; and

(D) A statement with respect to each removal indicating whether or not the reason for the removal was an elevated blood lead level.

(iii) The employer shall maintain each medical removal record for at least the duration of an employee's employment.

(d) Availability.

(i) The employer shall make available upon request all records required to be maintained by subsection (15) of this section to the director for examination and copying.

(ii) Environmental monitoring, medical removal, and medical records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217. Medical removal records shall be provided in the same manner as environmental monitoring records.

(iii) Upon request, the employer shall make an employee's medical records required to be maintained by this

section available to the affected employee or former employee or to a physician or other individual designated by such affected employee or former employees for examination and copying.

(e) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subsection (15) of this section.

(ii) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records required to be maintained by this section for the prescribed period, these records shall be transmitted to the director.

(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the director at least three months prior to the disposal of such records and shall transmit those records to the director if requested within the period.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in WAC 296-62-05215.

(16) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to lead conducted pursuant to subsection (5) of this section.

(b) Observation procedures.

(i) Whenever observation of the monitoring of employee exposure to lead requires entry into an area where the use of respirators, protective clothing or equipment is required, the employer shall provide the observer with and assure the use of such respirators, clothing and such equipment, and shall require the observer to comply with all other applicable safety and health procedures.

(ii) Without interfering with the monitoring, observers shall be entitled to:

(A) Receive an explanation of the measurement procedures;

(B) Observe all steps related to the monitoring of lead performed at the place of exposure; and

(C) Record the results obtained or receive copies of the results when returned by the laboratory.

(17) Effective date. The effective date of this standard is September 6, 1980.

(18) Startup dates. All obligations of this standard commence on the effective date except as follows:

(a) The initial determination under subdivision (5)(b) shall be made as soon as possible but no later than thirty days from the effective date.

(b) Initial monitoring under subdivision (5)(d) shall be completed as soon as possible but no later than ninety days from the effective date.

(c) Initial biological monitoring and medical examinations under subsection (11) shall be completed as soon as possible but no later than one hundred eighty days from the effective date. Priority for biological monitoring and medical examinations shall be given to employees whom the employer believes to be at greatest risk from continued exposure.

(d) Initial training and education shall be completed as soon as possible but no later than one hundred eighty days from the effective date.

(e) Hygiene and lunchroom facilities under subsection (10) shall be in operation as soon as possible but no later than one year from the effective year.

(f) Respiratory protection required by subsection (7) shall be provided as soon as possible but no later than the following schedule:

(i) Employees whose eight-hour TWA exposure exceeds $200 \mu\text{g}/\text{m}^3$ - on the effective date.

(ii) Employees whose eight-hour TWA exposure exceeds the PEL but is less than $200 \mu\text{g}/\text{m}^3$ - one hundred fifty days from the effective date.

(iii) Powered, air-purifying respirators provided under (7)(b)(ii) - two hundred ten days from the effective date.

(iv) Quantitative fit testing required under item (7)(c)(ii) - one year from effective date. Qualitative fit testing is required in the interim.

(g) Written compliance plans required by subdivision (6)(c) shall be completed and available for inspection and copying as soon as possible but no later than the following schedule:

(i) Employers for whom compliance with the PEL or interim level is required within one year from the effective date - six months from the effective date.

(ii) Employers in secondary lead smelting and refining and in lead storage battery manufacturing—one year from the effective date.

(iii) Employers in primary smelting and refining industry - one year from the effective date from the interim level; five years from the effective date for PEL.

(iv) Plans for construction of hygiene facilities, if required - six months from the effective date.

(v) All other industries—one year from the date on which the court lifts the stay on the implementation of paragraph (6)(a) for the particular industry.

(h) The permissible exposure limit in subsection (4) shall become effective one hundred fifty days from the effective date.

(19) Appendices. The information contained in the appendices to this section is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation.

(a) Appendix A. Substance Data Sheet for Occupational Exposure to Lead.

(i) Substance identification.

(A) Substance. Pure lead (Pb) is a heavy metal at room temperature and pressure and is a basic chemical element. It can combine with various other substances to form numerous lead compounds.

(B) Compounds covered by the standard. The word "lead" when used in this standard means elemental lead, all inorganic lead compounds (except those which are not biologically available due to either solubility or specific chemical interaction), and a class of organic lead compounds called lead soaps. This standard does not apply to other organic lead compounds.

(C) Uses. Exposure to lead occurs in at least 120 different occupations, including primary and secondary lead smelt-

ing, lead storage battery manufacturing, lead pigment manufacturing and use, solder manufacturing and use, shipbuilding and ship repairing, auto manufacturing, and printing.

(D) Permissible exposure. The Permissible Exposure Limit (PEL) set by the standard is 50 micrograms of lead per cubic meter of air ($50 \mu\text{g}/\text{m}^3$), averaged over an eight-hour work day.

(E) Action level. The standard establishes an action level of 30 micrograms per cubic meter of air ($30 \mu\text{g}/\text{m}^3$) time weighted average, based on an eight-hour work day. The action level initiates several requirements of the standard, such as exposure monitoring, medical surveillance, and training and education.

(ii) Health hazard data.

(A) Ways in which lead enters your body.

(I) When absorbed into your body in certain doses lead is a toxic substance. The object of the lead standard is to prevent absorption of harmful quantities of lead. The standard is intended to protect you not only from the immediate toxic effects of lead, but also from the serious toxic effects that may not become apparent until years of exposure have passed.

(II) Lead can be absorbed into your body by inhalation (breathing) and ingestion (eating). Lead (except for certain organic lead compounds not covered by the standard, such as tetraethyl lead) is not absorbed through your skin. When lead is scattered in the air as a dust, fume or mist, it can be inhaled and absorbed through your lungs and upper respiratory tract. Inhalation of airborne lead is generally the most important source of occupational lead absorption. You can also absorb lead through your digestive system if lead gets into your mouth and is swallowed. If you handle food, cigarettes, chewing tobacco, or make-up which have lead on them or handle them with hands contaminated with lead, this will contribute to ingestion.

(III) A significant portion of the lead that you inhale or ingest gets into your blood stream. Once in your blood stream lead is circulated throughout your body and stored in various organs and body tissues. Some of this lead is quickly filtered out of your body and excreted, but some remains in your blood and other tissue. As exposure to lead continues, the amount stored in your body will increase if you are absorbing more lead than your body is excreting. Even though you may not be aware of any immediate symptoms of disease, this lead stored in your tissues can be slowly causing irreversible damage, first to individual cells, then to your organs and whole body systems.

(B) Effects of overexposure to lead.

(I) Short-term (acute) overexposure. Lead is a potent, systemic poison that serves no known useful function once absorbed by your body. Taken in large enough doses, lead can kill you in a matter of days. A condition affecting the brain called acute encephalopathy may arise which develops quickly to seizures, coma, and death from cardiorespiratory arrest. A short-term dose of lead can lead to acute encephalopathy. Short-term occupational exposures of this magnitude are highly unusual, but not impossible. Similar forms of encephalopathy may, however arise from extended, chronic exposure to lower doses of lead. There is no sharp dividing line between rapidly developing acute effects of lead, and

chronic effects which take longer to acquire. Lead adversely affects numerous body systems, and causes forms of health impairment and disease which arise after periods of exposure as short as days or as long as several years.

(II) Long-term (chronic) overexposure.

a) Chronic overexposure to lead may result in severe damage to your blood-forming, nervous, urinary and reproductive systems. Some common symptoms of chronic overexposure include loss of appetite, metallic taste in the mouth, anxiety, constipation, nausea, pallor, excessive tiredness, weakness, insomnia, headache, nervous irritability, muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity and colic. In lead colic there may be severe abdominal pain.

b) Damage to the central nervous system in general and the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma, and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

c) Chronic overexposure to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression of kidney dialysis or death is possible.

d) Chronic overexposure to lead impairs the reproductive systems of both men and women. Overexposure to lead may result in decreased sex drive, impotence and sterility in men. Lead can alter the structure of sperm cells raising the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

e) Overexposure to lead also disrupts the blood-forming system resulting in decreased hemoglobin (the substance in the blood that carries oxygen to the cells) and ultimately anemia. Anemia is characterized by weakness, pallor and fatigability as a result of decreased oxygen carrying capacity in the blood.

(III) Health protection goals of the standard.

a) Prevention of adverse health effects for most workers from exposure to lead throughout a working lifetime requires that worker blood lead (PbB) levels be maintained at or below forty micrograms per one hundred grams of whole

blood (40 $\mu\text{g}/100\text{g}$). The blood lead levels of workers (both male and female workers) who intend to have children should be maintained below 30 $\mu\text{g}/100\text{g}$ to minimize adverse reproductive health effects to the parents and to the developing fetus.

b) The measurement of your blood lead level is the most useful indicator of the amount of lead absorbed by your body. Blood lead levels (PbB) are most often reported in units of milligrams (mg) or micrograms (μg) of lead (1 mg=1000 μg) per 100 grams (100g), 100 milliliters (100 ml) or deciliter (dl) of blood. These three units are essentially the same. Sometimes PbB's are expressed in the form of mg% or $\mu\text{g}\%$. This is a shorthand notation for 100g, 100ml, or dl.

c) PbB measurements show the amount of lead circulating in your blood stream, but do not give any information about the amount of lead stored in your various tissues. PbB measurements merely show current absorption of lead, not the effect that lead is having on your body or the effects that past lead exposure may have already caused. Past research into lead-related diseases, however, has focused heavily on associations between PbBs and various diseases. As a result, your PbB is an important indicator of the likelihood that you will gradually acquire a lead-related health impairment or disease.

d) Once your blood lead level climbs above 40 $\mu\text{g}/100\text{g}$, your risk of disease increases. There is a wide variability of individual response to lead, thus it is difficult to say that a particular PbB in a given person will cause a particular effect. Studies have associated fatal encephalopathy with PbBs as low as 150 $\mu\text{g}/100\text{g}$. Other studies have shown other forms of disease in some workers with PbBs well below 80 $\mu\text{g}/100\text{g}$. Your PbB is a crucial indicator of the risks to your health, but one other factor is extremely important. This factor is the length of time you have had elevated PbBs. The longer you have an elevated PbB, the greater the risk that large quantities of lead are being gradually stored in your organs and tissues (body burden). The greater your overall body burden, the greater the chances of substantial permanent damage.

e) The best way to prevent all forms of lead-related impairments and diseases—both short-term and long-term—is to maintain your PbB below 40 $\mu\text{g}/100\text{g}$. The provisions of the standard are designed with this end in mind. Your employer has prime responsibility to assure that the provisions of the standard are complied with both by the company and by individual workers. You as a worker, however, also have a responsibility to assist your employer in complying with the standard. You can play a key role in protecting your own health by learning about the lead hazards and their control, learning what the standard requires, following the standard where it governs your own action, and seeing that your employer complies with the provisions governing his actions.

(IV) Reporting signs and symptoms of health problems. You should immediately notify your employer if you develop signs or symptoms associated with lead poisoning or if you desire medical advice concerning the effects of current or past exposure to lead on your ability to have a healthy child. You should also notify your employer if you have difficulty breathing during a respirator fit test or while wearing a respirator. In each of these cases your employer must make avail-

able to you appropriate medical examinations or consultations. These must be provided at no cost to you and at a reasonable time and place.

(b) Appendix B. Employee Standard Summary. This appendix summarizes key provisions of the standard that you as a worker should become familiar with. The appendix discusses the entire standard.

(i) Permissible exposure limit (PEL). The standard sets a permissible exposure limit (PEL) of fifty micrograms of lead per cubic meter of air (50 $\mu\text{g}/\text{m}^3$), averaged over an eight-hour workday. This is the highest level of lead in air to which you may be permissibly exposed over an eight-hour workday. Since it is an eight-hour average it permits short exposures above the PEL so long as for each eight-hour workday your average exposure does not exceed the PEL.

(ii) Exposure monitoring.

(A) If lead is present in the work place where you work in any quantity, your employer is required to make an initial determination of whether the action level is exceeded for any employee. The initial determination must include instrument monitoring of the air for the presence of lead and must cover the exposure of a representative number of employees who are reasonably believed to have the highest exposure levels. If your employer has conducted appropriate air sampling for lead in the past year he may use these results. If there have been any employee complaints of symptoms which may be attributable to exposure to lead or if there is any other information or observations which would indicate employee exposure to lead, this must also be considered as part of the initial determination. If this initial determination shows that a reasonable possibility exists that any employee may be exposed, without regard to respirators, over the action level (30 $\mu\text{g}/\text{m}^3$) your employer must set up an air monitoring program to determine the exposure level of every employee exposed to lead at your work place.

(B) In carrying out this air monitoring program, your employer is not required to monitor the exposure of every employee, but he or she must monitor a representative number of employees and job types. Enough sampling must be done to enable each employee's exposure level to be reasonably represented by at least one full shift (at least seven hours) air sample. In addition, these air samples must be taken under conditions which represent each employee's regular, daily exposure to lead.

(C) If you are exposed to lead and air sampling is performed, your employer is required to quickly notify you in writing of air monitoring results which represent your exposure. If the results indicate your exposure exceeds the PEL (without regard to your use of respirators), then your employer must also notify you of this in writing, and provide you with a description of the corrective action that will be taken to reduce your exposure.

(D) Your exposure must be rechecked by monitoring every six months if your exposure is over the action level but below the PEL. Air monitoring must be repeated every three months if you are exposed over the PEL. Your employer may discontinue monitoring for you if two consecutive measurements, taken at least two weeks apart, are below the action level. However, whenever there is a production, process, control, or personnel change at your work place which may result

in new or additional exposure to lead, or whenever there is any other reason to suspect a change which may result in new or additional exposure to lead, your employer must perform additional monitoring.

(iii) Methods of compliance. Your employer is required to assure that no employee is exposed to lead in excess of the PEL. The standard establishes a priority of methods to be used to meet the PEL.

(iv) Respiratory protection.

(A) Your employer is required to provide and assure your use of respirators when your exposure to lead is not controlled below the PEL by other means. The employer must pay the cost of the respirator. Whenever you request one, your employer is also required to provide you a respirator even if your air exposure level does not exceed the PEL. You might desire a respirator when, for example, you have received medical advice that your lead absorption should be decreased. Or, you may intend to have children in the near future, and want to reduce the level of lead in your body to minimize adverse reproductive effects. While respirators are the least satisfactory means of controlling your exposure, they are capable of providing significant protection if properly chosen, fitted, worn, cleaned, maintained, and replaced when they stop providing adequate protection.

(B) Your employer is required to select respirators from the seven types listed in Table II of the respiratory protection section of chapter 296-62 WAC. Any respirator chosen must be approved by the Mine Safety and Health Administration (MSHA) or the National Institute for Occupational Safety and Health (NIOSH). This respirator selection table will enable your employer to choose a type of respirator which will give you a proper amount of protection based on your airborne lead exposure. Your employer may select a type of respirator that provides greater protection than that required by the standard; that is, one recommended for a higher concentration of lead than is present in your work place. For example, a powered air purifying respirator (PAPR) is much more protective than a typical negative-pressure respirator, and may also be more comfortable to wear. A PAPR has a filter, cartridge or canister to clean the air, and a power source which continuously blows filtered air into your breathing zone. Your employer might make a PAPR available to you to ease the burden of having to wear a respirator for long periods of time.

(C) Your employer must also start a respiratory protection program. This program must include written procedures for the proper selection, use, cleaning, storage, and maintenance of respirators.

(D) Your employer must assure that your respirator facepiece fits properly. Proper fit of a respirator facepiece is critical. Obtaining a proper fit on each employee may require your employer to make available two or three different mask types. Any respirator which has a filter, cartridge or canister which cleans the work room air before you breathe it and which requires the force of your inhalation to draw air through the filtering element is a negative pressure respirator. A positive pressure respirator supplies air to you directly. A quantitative fit test uses a sophisticated machine to measure the amount, if any, of test material that leaks into the face-

piece of your respirator. Appendix D describes "qualitative" procedures which are acceptable under certain conditions.

(E) You must also receive from your employer proper training in the use of respirators. Your employer is required to teach you how to wear a respirator, to know why it is needed, and to understand its limitations.

(F) The standard provides that if your respirator uses filter elements, you must be given an opportunity to change the filter elements whenever an increase in breathing resistance is detected. You also must be permitted to periodically leave your work area to wash your face and respirator facepiece whenever necessary to prevent skin irritation. If you ever have difficulty breathing during a fit test or while using a respirator, your employer must make a medical examination available to you to determine whether you can safely wear a respirator. The result of this examination may be to give you a positive pressure respirator (which reduces breathing resistance) or to provide alternative means of protection.

(v) Protective work clothing and equipment. If you are exposed to lead above the PEL, or if you are exposed to lead compounds such as lead arsenate or lead azide which can cause skin and eye irritation, your employer must provide you with protective work clothing and equipment appropriate for the hazard. If work clothing is provided, it must be provided in a clean and dry condition at least weekly, and daily if your airborne exposure to lead is greater than 200 $\mu\text{g}/\text{m}^3$. Appropriate protective work clothing and equipment can include coveralls or similar full-body work clothing, gloves, hats, shoes or disposable shoe coverlets, and face shields or vented goggles. Your employer is required to provide all such equipment at no cost to you. He or she is responsible for providing repairs and replacement as necessary and also is responsible for the cleaning, laundering or disposal of protective clothing and equipment. Contaminated work clothing or equipment must be removed in change rooms and not worn home or you will extend your exposure and expose your family since lead from your clothing can accumulate in your house, car, etc. Contaminated clothing which is to be cleaned, laundered or disposed of must be placed in closed containers in the change room. At no time may lead be removed from protective clothing or equipment by any means which disperses lead into the work room air.

(vi) Housekeeping. Your employer must establish a housekeeping program sufficient to maintain all surfaces as free as practicable of accumulations of lead dust. Vacuuming is the preferred method of meeting this requirement, and the use of compressed air to clean floors and other surfaces is absolutely prohibited. Dry or wet sweeping, shoveling, or brushing may not be used except where vacuuming or other equally effective methods have been tried and do not work. Vacuums must be used and emptied in a manner which minimizes the reentry of lead into the work place.

(vii) Hygiene facilities and practices.

(A) The standard requires that change rooms, showers and filtered air lunchrooms be constructed and made available to workers exposed to lead above the PEL. When the PEL is exceeded, the employer must assure that food and beverage is not present or consumed, tobacco products are not present or used, and cosmetics are not applied, except in these facilities. Change rooms, showers and lunchrooms,

must be used by workers exposed in excess of the PEL. After showering, no clothing or equipment worn during the shift may be worn home and this includes shoes and underwear. Your own clothing worn during the shift should be carried home and cleaned carefully so that it does not contaminate your home. Lunchrooms may not be entered with protective clothing or equipment unless surface dust has been removed by vacuuming, downdraft booth or other cleaning methods. Finally, workers exposed above the PEL must wash both their hands and faces prior to eating, drinking, smoking or applying cosmetics.

(B) All of the facilities and hygiene practices just discussed are essential to minimize additional sources of lead absorption from inhalation or ingestion of lead that may accumulate on you, your clothes or your possessions. Strict compliance with these provisions can virtually eliminate several sources of lead exposure which significantly contribute to excessive lead absorption.

(viii) Medical surveillance.

(A) The medical surveillance program is part of the standard's comprehensive approach to the prevention of lead-related disease. Its purpose is to supplement the main thrust of the standard which is aimed at minimizing airborne concentrations of lead and sources of ingestion. Only medical surveillance can determine if the other provisions of the standard have effectively protected you as an individual. Compliance with the standard's provision will protect most workers from the adverse effects of lead exposure, but may not be satisfactory to protect individual workers (I) who have high body burdens of lead acquired over past years, (II) who have additional uncontrolled sources of nonoccupational lead exposure, (III) who exhibit unusual variations in lead absorption rates, or (IV) who have specific nonwork related medical conditions which could be aggravated by lead exposure (e.g., renal disease, anemia). In addition, control systems may fail, or hygiene and respirator programs may be inadequate. Periodic medical surveillance of individual workers will help detect those failures. Medical surveillance will also be important to protect your reproductive ability - regardless of whether you are a man or a woman.

(B) All medical surveillance required by the standard must be performed by or under the supervision of a licensed physician. The employer must provide required medical surveillance without cost to employees and at a reasonable time and place. The standard's medical surveillance program has two parts - periodic biological monitoring, and medical examinations.

(C) Your employer's obligation to offer medical surveillance is triggered by the results of the air monitoring program. Medical surveillance must be made available to all employees who are exposed in excess of the action level for more than 30 days a year. The initial phase of the medical surveillance program, which included blood lead level tests and medical examinations, must be completed for all covered employees no later than 180 days from the effective date of this standard. Priority within this first round of medical surveillance must be given to employees whom the employer believes to be at greatest risk from continued exposure (for example, those with the longest prior exposure to lead, or those with the highest current exposure). Thereafter, the

employer must periodically make medical surveillance - both biological monitoring and medical examinations - available to all covered employees.

(D) Biological monitoring under the standard consists of blood lead level (PbB) and zinc protoporphyrin tests at least every six months after the initial PbB test. A zinc protoporphyrin (ZPP) test is a very useful blood test which measures an effect of lead on your body. If a worker's PbB exceeds 40 $\mu\text{g}/100\text{g}$, the monitoring frequency must be increased from every six months to at least every two months and not reduced until two consecutive PbBs indicate a blood lead level below 40 $\mu\text{g}/100\text{g}$. Each time your PbB is determined to be over 40 $\mu\text{g}/100\text{g}$, your employer must notify you of this in writing within five working days of the receipt of the test results. The employer must also inform you that the standard requires temporary medical removal with economic protection when your PbB exceeds certain criteria (see Discussion of Medical Removal Protection - subsection (12)). During the first year of the standard, this removal criterion is 80 $\mu\text{g}/100\text{g}$. Anytime your PbB exceeds 80 $\mu\text{g}/100\text{g}$ your employer must make available to you a prompt follow-up PbB test to ascertain your PbB. If the two tests both exceed 80 $\mu\text{g}/100\text{g}$ and you are temporarily removed, then your employer must make successive PbB tests available to you on a monthly basis during the period of your removal.

(E) Medical examinations beyond the initial one must be made available on an annual basis if your blood lead levels exceeds 40 $\mu\text{g}/100\text{g}$ at any time during the preceding year. The initial examination will provide information to establish a baseline to which subsequent data can be compared. An initial medical examination must also be made available (prior to assignment) for each employee being assigned for the first time to an area where the airborne concentration of lead equals or exceeds the action level. In addition, a medical examination or consultation must be made available as soon as possible if you notify your employer that you are experiencing signs or symptoms commonly associated with lead poisoning or that you have difficulty breathing while wearing a respirator or during a respirator fit test. You must also be provided a medical examination or consultation if you notify your employer that you desire medical advice concerning the effects of current or past exposure to lead on your ability to procreate a healthy child.

(F) Finally, appropriate follow-up medical examinations or consultations may also be provided for employees who have been temporarily removed from exposure under the medical removal protection provisions of the standard (see item (ix) below).

(G) The standard specifies the minimum content of pre-assignment and annual medical examinations. The content of other types of medical examinations and consultations is left up to the sound discretion of the examining physician. Pre-assignment and annual medical examinations must include (I) a detailed work history and medical history, (II) a thorough physical examination, and (III) a series of laboratory tests designed to check your blood chemistry and your kidney function. In addition, at any time upon your request, a laboratory evaluation of male fertility will be made (microscopic

examination of a sperm sample), or a pregnancy test will be given.

(H) The standard does not require that you participate in any of the medical procedures, tests, etc., which your employer is required to make available to you. Medical surveillance can, however, play a very important role in protecting your health. You are strongly encouraged, therefore, to participate in a meaningful fashion. Generally, your employer will choose the physician who conducts medical surveillance under the lead standard - unless you and your employer can agree on the choice of a physician or physicians. Some companies and unions have agreed in advance, for example, to use certain independent medical laboratories or panels of physicians. Any of these arrangements are acceptable so long as required medical surveillance is made available to workers.

(I) The standard requires your employer to provide certain information to a physician to aid in his or her examination of you. This information includes (I) the standard and its appendices, (II) a description of your duties as they relate to lead exposure, (III) your exposure level, (IV) a description of personal protective equipment you wear, (V) prior blood level results, and (VI) prior written medical opinions concerning you that the employer has. After a medical examination or consultation the physician must prepare a written report which must contain (I) the physician's opinion as to whether you have any medical conditions which places you at increased risk of material impairment to health from exposure to lead, (II) any recommended special protective measures to be provided to you, (III) any blood lead level determinations, and (IV) any recommended limitation on your use of respirators. This last element must include a determination of whether you can wear a powered air purifying respirator (PAPR) if you are found unable to wear a negative pressure respirator.

(J) The medical surveillance program of the lead standard may at some point in time serve to notify certain workers that they have acquired a disease or other adverse medical condition as a result of occupational lead exposure. If this is true these workers might have legal rights to compensation from public agencies, their employers, firms that supply hazardous products to their employers, or other persons. Some states have laws, including worker compensation laws, that disallow a worker to learn of a job-related health impairment to sue, unless the worker sues within a short period of time after learning of the impairment. (This period of time may be a matter of months or years.) An attorney can be consulted about these possibilities. It should be stressed that WISHA is in no way trying to either encourage or discourage claims or lawsuits. However, since results of the standard's medical surveillance program can significantly affect the legal remedies of a worker who has acquired a job-related disease or impairment, it is proper for WISHA to make you aware of this.

(K) The medical surveillance section of the standard also contains provisions dealing with chelation. Chelation is the use of certain drugs (administered in pill form or injected into the body) to reduce the amount of lead absorbed in body tissues. Experience accumulated by the medical and scientific communities has largely confirmed the effectiveness of this

type of therapy for the treatment of very severe lead poisoning. On the other hand it has also been established that there can be a long list of extremely harmful side effects associated with the use of chelating agents. The medical community has balanced the advantages and disadvantages resulting from the use of chelating agents in various circumstances and has established when the use of these agents is acceptable. The standard includes these accepted limitations due to a history of abuse of chelation therapy by some lead companies. The most widely used chelating agents are calcium disodium EDTA, (Ca Na₂EDTA), Calcium Disodium Versenate (Versenate), and d-penicillamine (penicillamine or Cupramine).

(L) The standard prohibits "prophylactic chelation" of any employee by any person the employer retains, supervises or controls. "Prophylactic chelation" is the routine use of chelating or similarly acting drugs to prevent elevated blood levels in workers who are occupationally exposed to lead, or the use of these drugs to routinely lower blood lead levels to predesignated concentrations believed to be safe. It should be emphasized that where an employer takes a worker who has no symptoms of lead poisoning and has chelation carried out by a physician (either inside or outside of a hospital) solely to reduce the worker's blood lead level, that will generally be considered prophylactic chelation. The use of a hospital and a physician does not mean that prophylactic chelation is not being performed. Routine chelation to prevent increased or reduce current blood lead levels is unacceptable whatever the setting.

(M) The standard allows the use of "therapeutic" or "diagnostic" chelation if administered under the supervision of a licensed physician in a clinical setting with thorough and appropriate medical monitoring. Therapeutic chelation responds to severe lead poisoning where there are marked symptoms. Diagnostic chelation, involves giving a patient a dose of the drug then collecting all urine excreted for some period of time as an aid to the diagnosis of lead poisoning.

(N) In cases where the examining physician determines that chelation is appropriate, you must be notified in writing of this fact before such treatment. This will inform you of a potentially harmful treatment, and allow you to obtain a second opinion.

(ix) Medical removal protection.

(A) Excessive lead absorption subjects you to increased risk of disease. Medical removal protection (MRP) is a means of protecting you when for whatever reasons, other methods, such as engineering controls, work practices, and respirators, have failed to provide the protection you need. MRP involves the temporary removal of a worker from his or her regular job to a place of significantly lower exposure without any loss of earnings, seniority, or other employment rights of benefits. The purpose of this program is to cease further lead absorption and allow your body to naturally excrete lead which has previously been absorbed. Temporary medical removal can result from an elevated blood lead level, or a medical opinion. Up to eighteen months of protection is provided as a result of either form of removal. The vast majority of removed workers, however, will return to their former jobs long before this eighteen month period expires. The standard contains special provisions to deal with the extraordinary but possible case

where a long-term worker's blood lead level does not adequately decline during eighteen months of removal.

(B) During the first year of the standard, if your blood lead level is 80 $\mu\text{g}/100\text{g}$ or above you must be removed from any exposure where your air lead level without a respirator would be 100 $\mu\text{g}/\text{m}^3$ or above. If you are removed from your normal job you may not be returned until your blood lead level declines to at least 60 $\mu\text{g}/100\text{g}$. These criteria for removal and return will change according to the following schedule:

TABLE 1

Effective Date	Removal Blood Level ($\mu\text{g}/100\text{g}$)	Air Lead ($\mu\text{g}/\text{m}^3$)	Return Blood Lead ($\mu\text{g}/100\text{g}$)
9/6/81	At or above 70	50 or above	At or below 50
9/6/82	At or above 60	30 or above	At or below 40
9/6/84	At or above 50 averaged over six months	30 or above	At or below 40

(C) You may also be removed from exposure even if your blood lead levels are below these criteria if a final medical determination indicates that you temporarily need reduced lead exposure for medical reasons. If the physician who is implementing your employer's medical program makes a final written opinion recommending your removal or other special protective measures, your employer must implement the physician's recommendation. If you are removed in this manner, you may only be returned when the physician indicates it is safe for you to do so.

(D) The standard does not give specific instructions dealing with what an employer must do with a removed worker. Your job assignment upon removal is a matter for you, your employer and your union (if any) to work out consistent with existing procedures for job assignments. Each removal must be accomplished in a manner consistent with existing collective bargaining relationships. Your employer is given broad discretion to implement temporary removals so long as no attempt is made to override existing agreements. Similarly, a removed worker is provided no right to veto an employer's choice which satisfies the standard.

(E) In most cases, employers will likely transfer removed employees to other jobs with sufficiently low lead exposure. Alternatively, a worker's hours may be reduced so that the time weighted average exposure is reduced, or he or she may be temporarily laid off if no other alternative is feasible.

(F) In all of these situations, MRP benefits must be provided during the period of removal - i.e., you continue to receive the same earnings, seniority, and other rights and benefits you would have had if you had not been removed. Earnings include more than just your base wage; it includes overtime, shift differentials, incentives, and other compensation you would have earned if you had not been removed. During the period of removal you must also be provided with appropriate follow-up medical surveillance. If you were removed because your blood lead level was too high, you must be provided with a monthly blood test. If a medical opinion caused your removal, you must be provided medical tests or examinations that the physician believes to be appro-

priate. If you do not participate in this follow-up medical surveillance, you may lose your eligibility for MRP benefits.

(G) When you are medically eligible to return to your former job, your employer must return you to your "former job status." This means that you are entitled to the position, wages, benefits, etc., you would have had if you had not been removed. If you would still be in your old job if no removal had occurred, that is where you go back. If not, you are returned consistent with whatever job assignment discretion your employer would have had if no removal had occurred. MRP only seeks to maintain your rights, not expand them or diminish them.

(H) If you are removed under MRP and you are also eligible for worker compensation or other compensation for lost wages, your employer's MRP benefits obligation is reduced by the amount that you actually receive from these other sources. This is also true if you obtain other employment during the time you are laid off with MRP benefits.

(I) The standard also covers situations where an employer voluntarily removes a worker from exposure to lead due to the effects of lead on the employee's medical condition, even though the standard does not require removal. In these situations MRP benefits must still be provided as though the standard required removal. Finally, it is important to note that in all cases where removal is required, respirators cannot be used as a substitute. Respirators may be used before removal becomes necessary, but not as an alternative to a transfer to a low exposure job, or to a lay-off with MRP benefits.

(x) Employee information and training.

(A) Your employer is required to provide an information and training program for all employees exposed to lead above the action level or who may suffer skin or eye irritation from lead. This program must inform these employees of the specific hazards associated with their work environment, protective measures which can be taken, the danger of lead to their bodies (including their reproductive systems), and their rights under the standard. In addition, your employer must make readily available to all employees, including those exposed below the action level, a copy of the standard and its appendices and must distribute to all employees any materials provided to the employer under the Washington Industrial Safety and Health Act (WISHA).

(B) Your employer is required to complete this training for all employees by March 4, 1981. After this date, all new employees must be trained prior to initial assignment to areas where there is possibility of exposure over the action level. This training program must also be provided at least annually thereafter.

(xi) Signs. The standard requires that the following warning sign be posted in work areas where the exposure to lead exceeds the PEL:

WARNING
LEAD WORK AREA
NO SMOKING OR EATING

(xii) Recordkeeping.

(A) Your employer is required to keep all records of exposure monitoring for airborne lead. These records must include the name and job classification of employees mea-

sured, details of the sampling and analytic techniques, the results of this sampling and the type of respiratory protection being worn by the person sampled. Your employer is also required to keep all records of biological monitoring and medical examination results. These must include the names of the employees, the physician's written opinion and a copy of the results of the examination. All of the above kinds of records must be kept for 40 years, or for at least 20 years after your termination of employment, whichever is longer.

(B) Recordkeeping is also required if you are temporarily removed from your job under the MRP program. This record must include your name and social security number, the date of your removal and return, how the removal was or is being accomplished, and whether or not the reason for the removal was an elevated blood lead level. Your employer is required to keep each medical removal record only for as long as the duration of an employee's employment.

(C) The standard requires that if you request to see or copy environmental monitoring, blood lead level monitoring, or medical removal records, they must be made available to you or to a representative that you authorize. Your union also has access to these records. Medical records other than PbBs must also be provided to you upon request, to your physician or to any other person whom you may specifically designate. Your union does not have access to your personal medical records unless you authorize their access.

(xiii) Observations of monitoring. When air monitoring for lead is performed at your work place as required by this standard, your employer must allow you or someone you designate to act as an observer of the monitoring. Observers are entitled to an explanation of the measurement procedure, and to record the results obtained. Since results will not normally be available at the time of the monitoring, observers are entitled to record or receive the results of the monitoring when returned by the laboratory. Your employer is required to provide the observer with any personal protective devices required to be worn by employees working in the areas that is being monitored. The employer must require the observer to wear all such equipment and to comply with all other applicable safety and health procedures.

(xiv) Effective date. The standard's effective date is September 6, 1980, and the employer's obligation under the standard begin to come into effect as of that date. The standard was originally adopted as WAC 296-62-07349 and later recodified to WAC 296-62-07521.

(c) Appendix C. Medical Surveillance Guidelines.

(i) Introduction.

(A) The primary purpose of the Washington Industrial Safety and Health Act of 1973 is to assure, so far as possible, safe and healthful working conditions for every working man and woman. The occupational health standard for inorganic lead* was promulgated to protect workers exposed to inorganic lead including metallic lead, all inorganic lead compounds and organic lead soaps.

*The term inorganic lead used throughout the medical surveillance appendices is meant to be synonymous with the definition of lead set forth in the standard.

(B) Under this final standard in effect as of September 6, 1980, occupational exposure to inorganic lead is to be limited to 50 $\mu\text{g}/\text{m}^3$ (micrograms per cubic meter) based on an eight-

hour time-weighted average (TWA). This level of exposure eventually must be achieved through a combination of engineering, work practice and other administrative controls. Periods of time ranging from one to ten years are provided for different industries to implement these controls which are based on individual industry considerations. Until these controls are in place, respirators must be used to meet the 50 $\mu\text{g}/\text{m}^3$ exposure limit.

(C) The standard also provides for a program of biological monitoring and medical surveillance for all employees exposed to levels of inorganic lead above the action level of 30 $\mu\text{g}/\text{m}^3$ for more than thirty days per year.

(D) The purpose of this document is to outline the medical surveillance provisions of the standard for inorganic lead, and to provide further information to the physician regarding the examination and evaluation of workers exposed to inorganic lead.

(E) Item (ii) provides a detailed description of the monitoring procedure including the required frequency of blood testing for exposed workers, provisions for medical removal protection (MRP), the recommended right of the employee to a second medical opinion, and notification and recordkeeping requirements of the employer. A discussion of the requirements for respirator use and respirator monitoring and WISHA's position on prophylactic chelation therapy are also included in this section.

(F) Item (iii) discusses the toxic effects and clinical manifestations of lead poisoning and effects of lead intoxication on enzymatic pathways in heme synthesis. The adverse effects on both male and female reproductive capacity and on the fetus are also discussed.

(G) Item (iv) outlines the recommended medical evaluation of the worker exposed to inorganic lead including details of the medical history, physical examination, and recommended laboratory tests, which are based on the toxic effects of lead as discussed in item (ii).

(H) Item (v) provides detailed information concerning the laboratory tests available for the monitoring of exposed workers. Included also is a discussion of the relative value of each test and the limitations and precautions which are necessary in the interpretation of the laboratory results.

(I) Airborne levels to be achieved without reliance on respirator protection through a combination of engineering and work practice or other administrative controls are illustrated in the following table:

Industry	Permissible Lead Level/Compliance Date		
	200 $\mu\text{g}/\text{m}^3$	100 $\mu\text{g}/\text{m}^3$	50 $\mu\text{g}/\text{m}^3$
Primary Lead Production	1973	06/29/84	06/29/91
Secondary Lead Production	1973	06/29/84	06/29/91
Lead Acid Battery Manufacturing	1973	06/29/83	06/29/91
Automobile Mfg./Solder, Grinding	1973	N/A	03/08/97
Electronics, Gray Iron Foundries, Ink Mfg., Paints and Coatings Mfg., Can Mfg., Wallpaper Mfg., and Printing.	1973	N/A	06/29/91

Industry	Permissible Lead Level/Compliance Date		
	200µg/m ³	100µg/m ³	50µg/m ³
Lead Chemical Mfg., Non-ferrous Foundries, Leaded Steel Mfg., Battery Breaking in the Collection and Processing of Scrap (when not a part of secondary lead smelter) Secondary Copper Smelter, Brass and Bronze Ingot Production.	1973	N/A	N/A ^{1*}
All Other Industries	1973	N/A	09/08/92

* Feasibility of achieving the PEL by engineering and work practice controls for these industries has yet to be resolved in court, therefore no date has been scheduled.

(ii) Medical surveillance and monitoring requirements for workers exposed to inorganic lead.

(A) Under the occupational health standard for inorganic lead, a program of biological monitoring and medical surveillance is to be made available to all employees exposed to lead above the action level of 30 µg/m³ TWA for more than thirty days each year. This program consists of periodic blood sampling and medical evaluation to be performed on a schedule which is defined by previous laboratory results, worker complaints or concerns, and the clinical assessment of the examining physician.

(B) Under this program, the blood lead level of all employees who are exposed to lead above the action level of 30 µg/m³ is to be determined at least every six months. The frequency is increased to every two months for employees whose last blood lead level was between 40µg/100g whole blood and the level requiring employee medical removal to be discussed below. For employees who are removed from exposure to lead due to an elevated blood lead, a new blood lead level must be measured monthly. Zinc protoporphyrin

(ZPP) measurement is required on each occasion that a blood lead level measurement is made.

(C) An annual medical examination and consultation performed under the guidelines discussed in item (iv) is to be made available to each employee for whom a blood test conducted at any time during the preceding twelve months indicated a blood lead level at or above 40µg/100g. Also, an examination is to be given to all employees prior to their assignment to an area in which airborne lead concentrations reach or exceed the action level. In addition, a medical examination must be provided as soon as possible after notification by an employee that the employee has developed signs or symptoms commonly associated with lead intoxication, that the employee desires medical advice regarding lead exposure and the ability to procreate a healthy child, or that the employee has demonstrated difficulty in breathing during a respirator fitting test or during respirator use. An examination is also to be made available to each employee removed from exposure to lead due to a risk of sustaining material impairment to health, or otherwise limited or specially protected pursuant to medical recommendations.

(D) Results of biological monitoring or the recommendations of an examining physician may necessitate removal of an employee from further lead exposure pursuant to the standard's medical removal program (MRP). The object of the MRP program is to provide temporary medical removals to workers either with substantially elevated blood lead levels or otherwise at risk of sustaining material health impairment from continued substantial exposure to lead. The following guidelines which are summarized in Table 10 were created under the standard for the temporary removal of an exposed employee and his or her subsequent return to work in an exposure area.

TABLE 10

		EFFECTIVE DATE				
		Sept. 6, 1980	Sept. 6, 1981	Sept. 6, 1982	Sept. 6, 1983	Sept. 6, 1984
A.	Blood lead level requiring employee medical removal (level must be confirmed with second follow-up blood lead level within two weeks of first report).	>80 µg/100g.	>70 µg/100g.	>60 µg/100g.	>60 µg/100g.	>60 µg/100g or average of last three blood samples or all blood samples over previous 6 months (whichever is over a longer time period) is 50 µg/100g. or greater unless last sample is 40 µg/100g or less.
B.	Frequency which employees exposed is action level of lead (30 µg/m ³ TWA) must have blood lead level checked. (ZPP is also required in each occasion that a blood test is obtained):					
1.	Last blood lead level less than 40 µg/100g	Every 6 months.	Every 6 months.	Every 6 months.	Every 6 months.	Every 6 months.

TABLE 10
EFFECTIVE DATE

	Sept. 6, 1980	Sept. 6, 1981	Sept. 6, 1982	Sept. 6, 1983	Sept. 6, 1984
2. Last blood lead level between 40 µg/100g and level requiring medical removal (see A above)	Every 2 months.	Every 2 months.	Every 2 months.	Every 2 months.	Every 2 months.
3. Employees removed from exposure to lead because of an elevated blood lead level	Every 1 month.	Every 1 month.	Every 1 month.	Every 1 month.	Every 1 month.
C. Permissible airborne exposure limit for workers removed from work due to an elevated blood lead level (without regard to respirator protection).	100 µg/m ³ 8 hr TWA	50 µg/m ³ 8 hr TWA	30 µg/m ³ 8 hr TWA	30 µg/m ³ 8 hr TWA	30 µg/m ³ 8 hr TWA
D. Blood lead level confirmed with a second blood analysis, at which employee may return to work. Permissible exposure without regard to respirator protection is listed by industry in Table 1.	60 µg/100g	50 µg/100g	40 µg/100g	40 µg/100g	40 µg/100g

Note: Where medical opinion indicates that an employee is at risk of material impairment from exposure to lead, the physician can remove an employee from exposure exceeding the action level (or less) or recommend special protective measures as deemed appropriate and necessary. Medical monitoring during the medical removal period can be more stringent than noted in the table above if the physician so specifies. Return to work or removal of limitations and special protections is permitted when the physician indicates that the worker is no longer at risk of material impairment.

(E) Under the standard's ultimate worker removal criteria, a worker is to be removed from any work having any eight-hour TWA exposure to lead of 30 µg/m³ or more whenever either of the following circumstances apply. (I) a blood lead level of 60 µg/100g or greater is obtained and confirmed by a second follow-up blood lead level performed within two weeks after the employer receives the results of the first blood sample test, or (II) the average of the previous three blood lead determinations or the average of all blood lead determinations conducted during the previous six months, whichever encompasses the longest time period, equals or exceeds 50 µg/100g, unless the last blood sample indicates a blood lead level at or below 40 µg/100g, in which case the employee need not be removed. Medical removal is to continue until two consecutive blood lead levels are 40 µg/100g or less.

(F) During the first two years that the ultimate removal criteria are being phased in, the return criteria have been set to assure that a worker's blood lead level has substantially declined during the period of removal. From March 1, 1979, to March 1, 1980, the blood lead level requiring employee medical removal is 80 µg/100g. Workers found to have a confirmed blood lead at this level or greater need only be removed from work having a daily eight hour TWA exposure to lead at or above 100 µg/m³. Workers so removed are to be returned to work when their blood lead levels are at or below 60 µg/100g of whole blood. From March 1, 1980, to March 1, 1981, the blood lead level requiring medical removal is 70 µg/100g. During this period workers need only be removed from jobs having a daily eight hour TWA exposure to lead at or above 50 µg/m³ and are to be returned to work when a level of 50 µg/100g is achieved. Beginning March 1, 1981, return depends on the worker's blood lead level declining to 40 µg/100g of whole blood.

(G) As part of the standard, the employer is required to notify in writing each employee whose whole blood lead level exceeds 40 µg/100g. In addition, each such employee is

to be informed that the standard requires medical removal with MRP benefits, discussed below, when an employee's blood lead level exceeds the above defined limits.

(H) In addition to the above blood lead level criteria, temporary worker removal may also take place as a result of medical determinations and recommendations. Written medical opinions must be prepared after each examination pursuant to the standard. If the examining physician includes medical finding, determination or opinion that the employee has a medical condition which places the employee at increased risk of material health impairment from exposure to lead, then the employee must be removed from exposure to lead at or above the action level. Alternatively, if the examining physician recommends special protective measures for an employee (e.g., use of a powered air purifying respirator) or recommends limitations on an employee's exposure to lead, then the employer must implement these recommendations. Recommendations may be more stringent than the specific provisions of the standard. The examining physician, therefore, is given broad flexibility to tailor special protective procedures to the needs of individual employees. This flexibility extends to the evaluation and management of pregnant workers and male and female workers who are planning to conceive children. Based on the history, physical examination, and laboratory studies, the physician might recommend special protective measures or medical removal for an employee who is pregnant or who is planning to conceive a child when, in the physician's judgment, continued exposure to lead at the current job would pose a significant risk. The return of the employee to his or her former job status, or the removal of special protections or limitations, depends upon the examining physician determining that the employee is no longer at increased risk of material impairment or that the special measures are no longer needed.

(I) During the period of any form of special protection or removal, the employer must maintain the worker's earnings, seniority, and other employment rights and benefits (as though the worker has not been removed) for a period of up to eighteen months. This economic protection will maximize meaningful worker participation in the medical surveillance program, and is appropriate as part of the employer's overall obligation to provide a safe and healthful work place. The provisions of MRP benefits during the employee's removal period may, however, be conditioned upon participation in medical surveillance.

(J) On rare occasions, an employee's blood lead level may not acceptably decline within eighteen months of removal. This situation will arise only in unusual circumstances, thus the standard relies on an individual medical examination to determine how to protect such an employee. This medical determination is to be based on both laboratory values, including lead levels, zinc protoporphyrin levels, blood counts, and other tests felt to be warranted, as well as the physician's judgment that any symptoms or findings on physical examination are a result of lead toxicity. The medical determination may be that the employee is incapable of ever safely returning to his or her former job status. The medical determination may provide additional removal time past eighteen months for some employees or specify special protective measures to be implemented.

(K) The lead standard provides for a multiple physician review in cases where the employee wishes a second opinion concerning potential lead poisoning or toxicity. If an employee wishes a second opinion, he or she can make an appointment with a physician of his or her choice. This second physician will review the findings, recommendations or determinations of the first physician and conduct any examinations, consultations or tests deemed necessary in an attempt to make a final medical determination. If the first and second physicians do not agree in their assessment they must try to resolve their differences. If they cannot reach an agreement then they must designate a third physician to resolve the dispute.

(L) The employer must provide examining and consulting physicians with the following specific information: A copy of the lead regulations and all appendices, a description of the employee's duties as related to exposure, the exposure level to lead and any other toxic substances (if applicable), a description of personal protective equipment used, blood lead levels, and all prior written medical opinions regarding the employee in the employer's possession or control. The employer must also obtain from the physician and provide the employee with a written medical opinion containing blood lead levels, the physician's opinion as to whether the employee is at risk of material impairment to health, any recommended protective measures for the employee if further exposure is permitted, as well as any recommended limitations upon an employee's use of respirators.

(M) Employers must instruct each physician not to reveal to the employer in writing or in any other way his or her findings, laboratory results, or diagnoses which are felt to be unrelated to occupational lead exposure. They must also instruct each physician to advise the employee of any occupationally or nonoccupationally related medical condition requiring further treatment or evaluation.

(N) The standard provides for the use of respirators when engineering and other primary controls have not been fully implemented. However, the use of respirator protection shall not be used in lieu of temporary medical removal due to elevated blood lead levels or findings that an employee is at risk of material health impairment. This is based on the numerous inadequacies of respirators including skin rash where the facepiece makes contact with the skin, unacceptable stress to breathing in some workers with underlying cardiopulmonary impairment, difficulty in providing adequate fit, the tendency

for respirators to create additional hazards by interfering with vision, hearing, and mobility, and the difficulties of assuring the maximum effectiveness of a complicated work practice program involving respirators. Respirators do, however, serve a useful function where engineering and work practice are inadequate by providing interim or short-term protection, provided they are properly selected for the environment in which the employee will be working, properly fitted to the employee, maintained and cleaned periodically, and worn by the employee when required.

(O) In its final standard on occupational exposure to inorganic lead, WISHA has prohibited prophylactic chelation. Diagnostic and therapeutic chelation are permitted only under the supervision of a licensed physician with appropriate medical monitoring in an acceptable clinical setting. The decision to initiate chelation therapy must be made on an individual basis and take into account the severity of symptoms felt to be a result of lead toxicity along with blood lead levels, ZPP levels and other laboratory tests as appropriate. EDTA and penicillamine, which are the primary chelating agents used in the therapy of occupational lead poisoning, have significant potential side effects and their use must be justified on the basis of expected benefits to the worker.

(P) Unless frank and severe symptoms are present, therapeutic chelation is not recommended given the opportunity to remove a worker from exposure and allow the body to naturally excrete accumulated lead. As a diagnostic aid, the chelation mobilization test using CA-EDTA has limited applicability. According to some investigators, the tests can differentiate between lead-induced and other nephropathies. The test may also provide an estimation of the mobile fraction of the total body lead burden.

(Q) Employers are required to assure that accurate records are maintained on exposure monitoring, medical surveillance, and medical removal for each employee. Exposure monitoring and medical surveillance records must be kept for forty years or the duration of employment plus twenty years, whichever is longer, while medical removal records must be maintained for the duration of employment. All records required under the standard must be made available upon request to representatives of the director of the department of labor and industries. Employers must also make environmental and biological monitoring and medical removal records available to affected employees and to former employees or their authorized employee representatives. Employees or their specifically designated representatives have access to their entire medical surveillance records.

(R) In addition, the standard requires that the employer inform all workers exposed to lead at or above the action level of the provisions of the standard and all its appendices, the purpose and description of medical surveillance and provisions for medical removal protection if temporary removal is required. An understanding of the potential health effects of lead exposure by all exposed employees along with full understanding of their rights under the lead standard is essential for an effective monitoring program.

(iii) Adverse health effects of inorganic lead.

(A) Although the toxicity of lead has been known for 2,000 years, the knowledge of the complex relationship between lead exposure and human response is still being

refined. Significant research into the toxic properties of lead continues throughout the world, and it should be anticipated that our understanding of thresholds of effects and margins of safety will be improved in future years. The provisions of the lead standard are founded on two prime medical judgments; first, the prevention of adverse health effects from exposure to lead throughout a working lifetime requires that worker blood lead levels be maintained at or below 40 $\mu\text{g}/100\text{g}$, and second, the blood lead levels of workers, male or female, who intend to parent in the near future should be maintained below 30 $\mu\text{g}/100\text{g}$ to minimize adverse reproduction health effects to the parent and developing fetus. The adverse effects of lead on reproduction are being actively researched and WISHA encourages the physician to remain abreast of recent developments in the area to best advise pregnant workers or workers planning to conceive children.

(B) The spectrum of health effects caused by lead exposure can be sub-divided into five developmental states; normal, physiological changes of uncertain significance, pathophysiological changes, overt symptoms (morbidity), and mortality. Within this process there are no sharp distinctions, but rather a continuum of effects. Boundaries between categories overlap due to the wide variation of individual responses [responses] and exposures in the working population. WISHA's development of the lead standard focused on pathophysiological changes as well as later stages of disease.

(I) Heme synthesis inhibition.

a) The earliest demonstrated effect of lead involves its ability to inhibit at least two enzymes [enzymes] of the heme synthesis pathway at very low blood levels. Inhibition of delta aminolevulinic acid dehydrase (ALA-D) which catalyzes the conversion of delta-aminolevulinic acid (ALA) to protoporphyrin is observed at a blood lead level below 20 $\mu\text{g}/100\text{g}$ whole blood. At a blood lead level of 40 $\mu\text{g}/100\text{g}$, more than twenty percent of the population would have seventy percent inhibition of ALA-D. There is an exponential increase in ALA excretion at blood lead levels greater than 40 $\mu\text{g}/100\text{g}$.

b) Another enzyme, ferrochelatase, is also inhibited at low blood lead levels. Inhibition of ferrochelatase leads to increased free erythrocyte protoporphyrin (FEP) in the blood which can then bind to zinc to yield zinc protoporphyrin. At a blood lead level of 50 $\mu\text{g}/100\text{g}$ or greater, nearly 100 percent of the population will have an increase FEP. There is also an exponential relationship between blood lead levels greater than 40 $\mu\text{g}/100\text{g}$ and the associated ZPP level, which has led to the development of the ZPP screening test for lead exposure.

c) While the significance of these effects is subject to debate, it is WISHA's position that these enzyme disturbances are early stages of a disease process which may eventually result in the clinical symptoms of lead poisoning. Whether or not the effects do progress to the later stages of clinical disease, disruption of these enzyme processes over a working lifetime is considered to be a material impairment of health.

d) One of the eventual results of lead-induced inhibition of enzymes in the heme synthesis pathway is anemia which can be asymptomatic if mild but associated with a wide array

of symptoms including dizziness, fatigue, and tachycardia when more severe. Studies have indicated that lead levels as low as 50 $\mu\text{g}/100\text{g}$ can be associated with a definite decreased hemoglobin, although most cases of lead-induced anemia, as well as shortened red-cell survival times, occur at lead levels exceeding 80 $\mu\text{g}/100\text{g}$. Inhibited hemoglobin synthesis is more common in chronic cases whereas shortened erythrocyte life span is more common in acute cases.

e) In lead-induced anemias, there is usually a reticulocytosis along with the presence of basophilic stippling, and ringed sideroblasts, although none of the above are pathognomonic for lead-induced anemia.

(II) Neurological effects.

a) Inorganic lead had been found to have toxic effects on both the central and peripheral nervous systems. The earliest stage of lead-induced central nervous system effects first manifest themselves in the form of behavioral disturbances and central nervous system symptoms including irritability, restlessness, insomnia and other sleep disturbances, fatigue, vertigo, headache, poor memory, tremor, depression, and apathy. With more severe exposure, symptoms can progress to drowsiness, stupor, hallucinations, delirium, convulsions and coma.

b) The most severe and acute form of lead poisoning which usually follows ingestion or inhalation of large amounts of lead is acute encephalopathy which may arise precipitously with the onset of intractable seizures, coma, cardiorespiratory arrest, and death within 48 hours.

c) While there is disagreement about what exposure levels are needed to produce the earliest symptoms, most experts agree that symptoms definitely can occur at blood lead levels of 60 $\mu\text{g}/100\text{g}$ whole blood and therefore recommend a 40 $\mu\text{g}/100\text{g}$ maximum. The central nervous system effects frequently are not reversible following discontinued exposure or chelation therapy and when improvement does occur, it is almost always only partial.

d) The peripheral neuropathy resulting from lead exposure characteristically involves only motor function with minimal sensory damage and has a marked predilection for the extensor muscles of the most active extremity. The peripheral neuropathy can occur with varying degrees of severity. The earliest and mildest form which can be detected in workers with blood lead levels as low as 50 $\mu\text{g}/100\text{g}$ is manifested by slowing or motor nerve conduction velocity often without clinical symptoms. With progression of the neuropathy there is development of painless extensor muscle weakness usually involving the extensor muscles of the fingers and hand in the most active upper extremity, followed in severe cases by wrist drop, much less commonly, foot drop.

e) In addition to slowing of nerve conduction, electromyographical studies in patients with blood lead levels greater than 50 $\mu\text{g}/100\text{g}$ have demonstrated a decrease in the number of acting motor unit potentials, an increase in the duration of motor unit potentials, and spontaneous pathological activity including fibrillations and fasciculation. Whether these effects occur at levels of 40 $\mu\text{g}/100\text{g}$ is undetermined.

f) While the peripheral neuropathies can occasionally be reversed with therapy, again such recovery is not assured particularly in the more severe neuropathies and often improve-

ment is only partial. The lack of reversibility is felt to be due in part to segmental demyelination.

(III) Gastrointestinal. Lead may also effect the gastrointestinal system producing abdominal colic or diffuse abdominal pain, constipation, obstipation, diarrhea, anorexia, nausea and vomiting. Lead colic rarely develops at blood lead levels below 80 $\mu\text{g}/100\text{g}$.

(IV) Renal.

a) Renal toxicity represents one of the most serious health effects of lead poisoning. In the early stages of disease nuclear inclusion bodies can frequently be identified in proximal renal tubular cells. Renal functions remain normal and the changes in this stage are probably reversible. With more advanced disease there is progressive interstitial fibrosis and impaired renal function. Eventually extensive interstitial fibrosis ensues with sclerotic glomeruli and dilated and atrophied proximal tubules; all represent end stage kidney disease. Azotemia can be progressive, eventually resulting in frank uremia necessitating dialysis. There is occasionally associated hypertension and hyperuricemia with or without gout.

b) Early kidney disease is difficult to detect. The urinalysis is normal in early lead nephropathy and the blood urea nitrogen and serum creatinine increase only when two-thirds of kidney function is lost. Measurement of creatinine clearance can often detect earlier disease as can other methods of measurement of glomerular filtration rate. An abnormal Ca-EDTA mobilization test has been used to differentiate between lead-induced and other nephropathies, but this procedure is not widely accepted. A form of Fanconi syndrome with aminoaciduria, glycosuria, and hyperphosphaturia indicating severe injury to the proximal renal tubules is occasionally seen in children.

(V) Reproductive effects.

a) Exposure to lead can have serious effects on reproductive function in both males and females. In male workers exposed to lead there can be a decrease in sexual drive, impotence, decreased ability to produce healthy sperm, and sterility. Malformed sperm (teratospermia), decreased number of sperm (hypospermia), and sperm with decreased motility (asthenospermia) can occur. Teratospermia has been noted at mean blood lead levels of 53 $\mu\text{g}/100\text{g}$ and hypospermia and asthenospermia at 41 $\mu\text{g}/100\text{g}$. Furthermore, there appears to be a dose-response relationship for teratospermia in lead exposed workers.

b) Women exposed to lead may experience menstrual disturbances including dysmenorrhea, menorrhagia and amenorrhea. Following exposure to lead, women have a higher frequency of sterility, premature births, spontaneous miscarriages, and stillbirths.

c) Germ cells can be affected by lead and cause genetic damage in the egg or sperm cells before conception and result in failure to implant, miscarriage, stillbirth, or birth defects.

d) Infants of mothers with lead poisoning have a higher mortality during the first year and suffer from lowered birth weights, slower growth, and nervous system disorders.

e) Lead can pass through the placental barrier and lead levels in the mother's blood are comparable to concentrations of lead in the umbilical cord at birth. Transplacental passage

becomes detectable at 12-14 weeks of gestation and increases until birth.

f) There is little direct data on damage to the fetus from exposure to lead but it is generally assumed that the fetus and newborn would be at least as susceptible to neurological damage as young children. Blood lead levels of 50-60 $\mu\text{g}/100\text{g}$ in children can cause significant neurobehavioral impairments, and there is evidence of hyperactivity at blood levels as low as 25 $\mu\text{g}/100\text{g}$. Given the overall body of literature concerning the adverse health effects of lead in children, WISHA feels that the blood lead level in children should be maintained below 30 $\mu\text{g}/100\text{g}$ with a population mean of 15 $\mu\text{g}/100\text{g}$. Blood lead levels in the fetus and newborn likewise should not exceed 30 $\mu\text{g}/100\text{g}$.

g) Because of lead's ability to pass through the placental barrier and also because of the demonstrated adverse effects of lead on reproductive function in both males and females as well as the risk of genetic damage of lead on both the ovum and sperm, WISHA recommends a 30 $\mu\text{g}/100\text{g}$ maximum permissible blood lead level in both males and females who wish to bear children.

(IV) Other toxic effects.

a) Debate and research continue on the effects of lead on the human body. Hypertension has frequently been noted in occupationally exposed individuals although it is difficult to assess whether this is due to lead's adverse effects on the kidneys or if some other mechanism is involved.

b) Vascular and electrocardiographic changes have been detected but have not been well characterized. Lead is thought to impair thyroid function and interfere with the pituitary-adrenal axis, but again these effects have not been well defined.

(iv) Medical evaluation.

(A) The most important principle in evaluating a worker for any occupational disease including lead poisoning is a high index of suspicion on the part of the examining physician. As discussed in Section (ii), lead can affect numerous organ systems and produce a wide array of signs and symptoms, most of which are nonspecific and subtle in nature at least in the early stages of disease. Unless serious concern for lead toxicity is present, many of the early clues to diagnosis may easily be overlooked.

(B) The crucial initial step in the medical evaluation is recognizing that a worker's employment can result in exposure to lead. The worker will frequently be able to define exposures to lead and lead-containing materials but often will not volunteer this information unless specifically asked. In other situations the worker may not know of any exposures to lead but the suspicion might be raised on the part of the physician because of the industry or occupation of the worker. Potential occupational exposure to lead and its compounds occur in at least 120 occupations, including lead smelting, the manufacture of lead storage batteries, the manufacture of lead pigments and products containing pigments, solder manufacture, shipbuilding and ship repair, auto manufacturing, construction, and painting.

(C) Once the possibility for lead exposure is raised, the focus can then be directed toward eliciting information from

the medical history, physical exam, and finally from laboratory data to evaluate the worker for potential lead toxicity.

(D) A complete and detailed work history is important in the initial evaluation. A listing of all previous employment with information on work processes, exposure to fumes or dust, known exposures to lead or other toxic substances, respiratory protection used, and previous medical surveillance should all be included in the worker's record. Where exposure to lead is suspected, information concerning on-the-job personal hygiene, smoking or eating habits in work areas, laundry procedures, and use of any protective clothing or respiratory protection equipment should be noted. A complete work history is essential in the medical evaluation of a worker with suspected lead toxicity, especially when long-term effects such as neurotoxicity and nephrotoxicity are considered.

(E) The medical history is also of fundamental importance and should include a listing of all past and current medical conditions, current medications including proprietary drug intake, previous surgeries and hospitalizations, allergies, smoking history, alcohol consumption, and also nonoccupational lead exposures such as hobbies (hunting, riflery). Also known childhood exposures should be elicited. Any previous history of hematological, neurological, gastrointestinal, renal, psychological, gynecological, genetic, or reproductive problems should be specifically noted.

(F) A careful and complete review of systems must be performed to assess both recognized complaints and subtle or slowly acquired symptoms which the worker might not appreciate as being significant. The review of symptoms should include the following:

General	- weight loss, fatigue, decreased appetite.
Head, Eyes, Ears, Nose, Throat (HEENT)	- headaches, visual disturbance or decreased visual acuity, hearing deficits or tinnitus, pigmentation of the oral mucosa, or metallic taste in mouth.
Cardio-pulmonary	- shortness of breath, cough, chest pains, palpitations, or orthopnea.
Gastrointestinal	- nausea, vomiting, heartburn, abdominal pain, constipation or diarrhea.
Neurologic	- irritability, insomnia, weakness (fatigue), dizziness, loss of memory, confusion, hallucinations, incoordination, ataxia, decreased strength in hands or feet, disturbance in gait, difficulty in climbing stairs, or seizures.
Hematologic	- pallor, easy fatigability, abnormal blood loss, melena.
Reproductive (male or female and spouse where relevant)	- history of infertility, impotence, loss of libido, abnormal menstrual periods, history of miscarriages, stillbirths, or children with birth defects.

Musculo-skeletal - muscle and joint pains.

(G) The physical examination should emphasize the neurological, gastrointestinal, and cardiovascular systems. The worker's weight and blood pressure should be recorded and the oral mucosa checked for pigmentation characteristic of a possible Burtonian or lead line on the gingiva. It should be noted, however, that the lead line may not be present even in severe lead poisoning if good oral hygiene is practiced.

(H) The presence of pallor on skin examination may indicate an anemia, which if severe might also be associated with a tachycardia. If an anemia is suspected, an active search for blood loss should be undertaken including potential blood loss through the gastrointestinal tract.

(I) A complete neurological examination should include an adequate mental status evaluation including a search for behavioral and psychological disturbances, memory testing, evaluation for irritability, insomnia, hallucinations, and mental clouding. Gait and coordination should be examined along with close observation for tremor. A detailed evaluation of peripheral nerve function including careful sensory and motor function testing is warranted. Strength testing particularly of extensor muscle groups of all extremities is of fundamental importance.

(J) Cranial nerve evaluation should also be included in the routine examination.

(K) The abdominal examination should include auscultation for bowel sounds and abnormal bruits and palpation for organomegaly, masses, and diffuse abdominal tenderness.

(L) Cardiovascular examination should evaluate possible early signs of congestive heart failure. Pulmonary status should be addressed particularly if respirator protection is contemplated.

(M) As part of the medical evaluation, the lead standard requires the following laboratory studies.

(I) Blood lead level.

(II) Hemoglobin and hematocrit determinations, red cell indices, and examination of the peripheral blood smear to evaluate red blood cell morphology.

(III) Blood urea nitrogen.

(IV) Serum creatinine.

(V) Routine urinalysis with microscopic examination.

(VI) A zinc protoporphyrin level.

(N) In addition to the above, the physician is authorized to order any further laboratory or other tests which he or she deems necessary in accordance with sound medical practice. The evaluation must also include pregnancy testing or laboratory evaluation of male fertility if requested by the employee.

(O) Additional tests which are probably not warranted on a routine basis but may be appropriate when blood lead and ZPP levels are equivocal include delta aminolevulinic acid and coproporphyrin concentrations in the urine, and dark-field illumination for detection of basophilic stippling in red blood cells.

(P) If an anemia is detected further studies including a careful examination of the peripheral smear, reticulocyte count, stool for occult blood, serum iron, total iron binding capacity, bilirubin, and, if appropriate vitamin B12 and folate may be of value in attempting to identify the cause of the anemia.

(Q) If a peripheral neuropathy is suspected, nerve conduction studies are warranted both for diagnosis and as a basis to monitor any therapy.

(R) If renal disease is questioned, a 24-hour urine collection for creatinine clearance, protein, and electrolytes may be indicated. Elevated uric acid levels may result from lead-induced renal disease and a serum uric acid level might be performed.

(S) An electrocardiogram and chest x-ray may be obtained as deemed appropriate.

(T) Sophisticated and highly specialized testing should not be done routinely and where indicated should be under the direction of a specialist.

(v) Laboratory evaluation.

(A) The blood level at present remains the single most important test to monitor lead exposure and is the test used in the medical surveillance program under the lead standard to guide employee medical removal. The ZPP has several advantages over the blood lead level. Because of its relatively recent development and the lack of extensive data concerning its interpretation, the ZPP currently remains an ancillary test.

(B) This section will discuss the blood lead level and ZPP in detail and will outline their relative advantages and disadvantages. Other blood tests currently available to evaluate lead exposure will also be reviewed.

(C) The blood lead level is a good index of current or recent lead absorption when there is no anemia present and when the worker has not taken any chelating agents. However, blood lead levels along with urinary lead levels do not necessarily indicate the total body burden of lead and are not adequate measures of past exposure. One reason for this is that lead has a high affinity for bone and up to 90 percent of the body's total lead is deposited there. A very important component of the total lead body burden is lead in soft tissue (liver, kidneys, and brain). This fraction of the lead body burden, the biologically active lead, is not entirely reflected by blood lead levels since it is a function of the dynamics of lead absorption, distribution, deposition in bone and excretion. Following discontinuation of exposure to lead, the excess body burden is only slowly mobilized from bone and other relatively stable stores and excreted. Consequently, a high blood lead level may only represent recent heavy exposure to lead without a significant total body excess and likewise a low blood lead level does not exclude an elevated total body burden of lead.

(D) Also due to its correlation with recent exposures, the blood lead level may vary considerably over short time intervals.

(E) To minimize laboratory error and erroneous results due to contamination, blood specimens must be carefully collected after thorough cleaning of the skin with appropriate methods using lead-free containers and analyzed by a reliable laboratory. Under the standard, samples must be analyzed in laboratories which are approved by the Center for Disease Control (CDC) or which have received satisfactory grades in proficiency testing by the CDC in the previous year. Analysis is to be made using atomic absorption spectrophotometry anodic stripping; voltammetry or any method which meets the accuracy requirements set forth by the standard.

(F) The determination of lead in urine is generally considered a less reliable monitoring technique than analysis of whole blood primarily due to individual variability in urinary excretion capacity as well as the technical difficulty of obtaining accurate 24 hour urine collections. In addition, workers with renal insufficiency, whether due to lead or some other cause, may have decreased lead clearance and consequently urine lead levels may underestimate the true lead burden. Therefore, urine lead levels should not be used as a routine test.

(G) The zinc protoporphyrin test, unlike the blood lead determination, measures an adverse metabolic effect of lead and as such is a better indicator of lead toxicity than the level of blood lead itself. The level of ZPP reflects lead absorption over the preceding three to four months, and therefore is a better indicator of lead body burden. The ZPP requires more time than the blood lead to read significantly elevated levels; the return to normal after discontinuing lead exposure is also slower. Furthermore, the ZPP test is simpler, faster, and less expensive to perform and no contamination is possible. Many investigators believe it is the most reliable means of monitoring chronic lead absorption.

(H) Zinc protoporphyrin results from the inhibition of the enzyme ferrochelatase which catalyzes the insertion of an iron molecule into the protoporphyrin molecule, which then becomes heme. If iron is not inserted into the molecule then zinc, having a greater affinity for protoporphyrin, takes place in the iron, forming ZPP.

(I) An elevation in the level of circulating ZPP may occur at blood lead levels as low as 20-30 $\mu\text{g}/100\text{g}$ in some workers. Once the blood lead level has reached 40 $\mu\text{g}/100\text{g}$ there is more marked rise in the ZPP value from its normal range of less than 100 $\mu\text{g}/100\text{ml}$. Increases in blood lead levels beyond 40 $\mu\text{g}/100\text{g}$ are associated with exponential increases in ZPP.

(J) Whereas blood lead levels fluctuate over short time spans, ZPP levels remain relatively stable. ZPP is measured directly in red blood cells and is present for the cell's entire 120 day lifespan. Therefore, the ZPP level in blood reflects the average ZPP production over the previous three to four months and consequently the average lead exposure during that time interval.

(K) It is recommended that a hematocrit be determined whenever a confirmed ZPP of 50 $\mu\text{g}/100\text{ml}$ whole blood is obtained to rule out a significant underlying anemia. If the ZPP is in excess of 100 $\mu\text{g}/100\text{ml}$ and not associated with abnormal elevations in blood lead levels, the laboratory should be checked to be sure the blood leads were determined using atomic absorption spectrophotometry, anodic stripping voltammetry or any method which meets the accuracy requirements set forth by the standard, by a CDC approved laboratory which is experienced in lead level determinations. Repeat periodic blood lead studies should be obtained in all individuals with elevated ZPP levels to be certain that an associated elevated blood lead level has not been missed due to transient fluctuations in blood leads.

(L) ZPP has characteristic fluorescence spectrum with a peak at 594nm which is detectable with a hematofluorimeter. The hematofluorimeter is accurate and portable and can pro-

vide on-site, instantaneous results for workers who can be frequently tested via a finger prick.

(M) However, careful attention must be given to calibration and quality control procedures. Limited data on blood lead - ZPP correlations and the ZPP levels which are associated with the adverse health effects discussed in item (ii) are the major limitations of the test. Also it is difficult to correlate ZPP levels with environmental exposure and there is some variation of response with age and sex. Nevertheless, the ZPP promises to be an important diagnostic test for the early detection of lead toxicity and its value will increase as more data is collected regarding its relationship to other manifestations of lead poisoning.

(N) Levels of delta-aminolevulinic acid (ALA) in the urine are also used as a measure of lead exposure. Increasing concentrations of ALA are believed to result from the inhibition of the enzyme delta-aminolevulinic acid dehydrase (ALA-D). Although the test is relatively easy to perform, inexpensive, and rapid, the disadvantages include variability in results, the necessity to collect a complete 24 hour urine sample which has a specific gravity greater than 1.010, and also the fact that ALA decomposes in the presence of light.

(O) The pattern of porphyrin excretion in the urine can also be helpful in identifying lead intoxication. With lead poisoning, the urine concentrations of coproporphyrins I and II, porphobilinogen and uroporphyrin I rise. The most important increase, however, is that of coproporphyrin III; levels may exceed 5,000 µg/l in the urine in lead poisoned individuals, but its correlation with blood lead levels and ZPP are not as good as those of ALA. Increases in urinary porphyrins are not diagnostic of lead toxicity and may be seen in porphyria, some liver diseases, and in patients with high reticulocyte counts.

(vi) Summary.

(A) The WISHA standard for inorganic lead places significant emphasis on the medical surveillance of all workers exposed to levels of inorganic lead above the action level of 30 µg/m³ TWA. The physician has a fundamental role in this surveillance program, and in the operation of the medical removal protection program.

(B) Even with adequate worker education on the adverse health effects of lead and appropriate training in work practices, personal hygiene and other control measures, the physician has a primary responsibility for evaluating potential lead toxicity in the worker. It is only through a careful and detailed medical and work history, a complete physical examination and appropriate laboratory testing that an accurate assessment can be made. Many of the adverse health effects of lead toxicity are either irreversible or only partially reversible and therefore early detection of disease is very important.

(C) This document outlines the medical monitoring program as defined by the occupational safety and health standard for inorganic lead. It reviews the adverse health effects of lead poisoning and describes the important elements of the history and physical examinations as they relate to these adverse effects.

(D) It is hoped that this review and discussion will give the physician a better understanding of the WISHA standard with the ultimate goal of protecting the health and well-being of the worker exposed to lead under his or her care.

(d) Appendix D. Qualitative Fit Test Protocols. This appendix specifies the only allowable qualitative fit test (QLFT) protocols permissible for compliance with WAC 296-62-07521 (7)(c)(ii).

(i) Isoamyl acetate protocol.

(A) Odor threshold screening.

(I) Three 1-liter glass jars with metal lids (e.g., Mason or Ball jars) are required.

(II) Odor-free water (e.g., distilled or spring water) at approximately 25° C shall be used for the solutions.

(III) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor-free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

(IV) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but may not be connected to the same recirculating ventilation system.

(V) The odor test solution is prepared in a second jar by placing .4 cc of the stock solution into 500 cc of odor-free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

(VI) A test blank is prepared in a third jar by adding 500 cc of odor-free water.

(VII) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. If the labels are put on the lids they can be periodically dried off and switched to avoid people thinking the same jars always has the IAA.

(VIII) The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2); "The purpose of this test is to determine if you can smell banana oil at low concentrations. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(IX) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(X) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA QLFT may not be used.

(XI) If the test subject correctly identifies the jar containing the odor test solution he or she may proceed to respirator selection and fit testing.

(B) Respirator selection.

(I) The test subject shall be allowed to select the most comfortable respirator from a large array of various sizes and manufacturers that includes at least three sizes of elastomeric half facepieces and units of at least two manufacturers.

(II) The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to assess a "comfortable" respirator. A mirror shall be available to assist the sub-

ject in evaluating the fit and positioning of the respirator. This may not constitute formal training on respirator use, only a review.

(III) The test subject should understand that he or she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly, will provide adequate protection.

(IV) The test subject holds each facepiece up to his or her face and eliminates those which are obviously not giving a comfortable fit. Normally, selection will begin with a half-mask and if a fit cannot be found here, the subject will be asked to go to the full facepiece respirators. (A small percentage of users will not be able to wear any half-masks.)

(V) The more comfortable facepieces are recorded; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in (VI) below. If the test subject is not familiar with using a particular respirator, he or she shall be directed to don the mask several times and to adjust the straps each time, so that he or she becomes adept at setting proper tension on the straps.

(VI) Assessment of comfort shall include reviewing the following points with the test subject:

- Chin properly placed.
- Positioning of mask on nose.
- Strap tension.
- Fit across nose bridge.
- Room for safety glasses.
- Distance from nose to chin.
- Room to talk.
- Tendency to slip.
- Checks filled out.
- Self-observation/in mirror.
- Adequate time for assessment.

(VII) The test subject shall conduct the conventional negative and positive-pressure fit checks (e.g., see ANSI Z88.2-1980). Before conducting the negative or positive-pressure checks, the subject shall be told to "seat" his or her mask by rapidly moving the head side-to-side and up and down, taking a few deep breaths.

(VIII) The test subject is now ready for fit testing.

(IX) After passing the fit test, the test subjects shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

(X) The employee shall be given the opportunity to select a different facepiece and be retested if during the first two weeks of on-the-job wear, the chosen facepiece becomes unacceptably uncomfortable.

(C) Fit test.

(I) The fit test chamber shall be substantially similar to a clear 55 gallon drum liner suspended inverted over a two foot diameter frame, so that the top of the chamber is about six inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(II) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

(III) After selecting, donning, and properly adjusting a respirator himself or herself, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hook, to prevent general room contamination.

(IV) A copy of the following test exercises and rainbow (or equally effective) passage shall be taped to the inside of the test chamber:

- a) Normal breathing.
- b) Deep breathing. Be certain breaths are deep and regular.
- c) Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his or her head is at either side.
- d) Nodding head up-and-down. Be sure certain motions are complete and made about every second. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his or her head is in the fully up position.

e) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage. When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

f) Normal breathing.

(V) Each test subject shall wear his or her respirator for at least ten minutes before starting the fit test.

(VI) Upon entering the test chamber, the test subject shall be given a six inch by five inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject will hang the wet towel on the hook at the top of the chamber.

(VII) Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of his or her cooperation, the purpose of the head exercises, or to demonstrate some of the exercises.

(VIII) Each exercise described in segment (IV) above shall be performed for at least one minute.

(IX) If at any time during the test, the subject detects the banana-like odor of IAA, he or she shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(X) Upon returning to the selection room, the subject shall remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, etc. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the

subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(XI) If a person cannot be fitted with the selection of half-mask respirators, include full facepiece models in the selection process. When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having him break the face seal and take a breath before exiting the chamber.

(XII) When the test subject leaves the chamber he or she shall remove the saturated towel, returning it to the test conductor. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag. There is no significant IAA concentration buildup in the test chamber from subsequent tests.

(XIII) Persons who have successfully passed this fit test may be assigned the use of the tested respirator in atmospheres with up to ten times the PEL of airborne lead. In other words this IAA protocol may be used to assign a protection factor no higher than ten.

(ii) Saccharin solution aerosol protocol.

(A) Taste threshold screening.

(I) Threshold screening as well as fit testing employees shall use an enclosure about the head and shoulders that is approximately twelve inches in diameter by fourteen inches tall with at least the front portion clear and that allows free movement of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly of part #FT 14 and FT 15 combined is adequate.

(II) The test closure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(III) The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(IV) The test subject shall don the test enclosure. For the threshold screening test, he or she shall breathe through his or her open mouth with tongue extended.

(V) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(VI) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the test solution (see (C)(VI) below) in 100 cc of water.

(VII) To produce the aerosol the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

(VIII) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(IX) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(X) If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(XI) The test conductor will take note of the number of squeezes required to elicit a taste response.

(XII) If the saccharin is not tasted after thirty squeezes (Step (A)(IX)) the test subject may not perform the saccharin fit test.

(XIII) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(XIV) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

(XV) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(B) Respirator selection. Respirators shall be selected as described in Section (i)(B) above, except that each respirator shall be equipped with a particulate filter cartridge.

(C) Fit test.

(I) The fit test uses the same enclosure described in (i)(B)(I) and (II) above.

(II) Each test subject shall wear his or her respirator for at least ten minutes before starting the fit test.

(III) The test subject shall don the enclosure while wearing the respirator selected on Section (A) above. The respirator shall be properly adjusted and equipped with a particulate filter cartridge.

(IV) The test subject may not eat, drink (except plain water), or chew gum for fifteen minutes before the test.

(V) A second DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(VI) The first test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

(VII) As before, the test subject shall breathe through the open mouth with tongue extended.

(VIII) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See (A)(X) above.)

(IX) After generation of the aerosol the test subject shall be instructed to perform the following exercises for one minute each.

a) Normal breathing.

b) Deep breathing. Be certain breaths are deep and regular.

c) Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his or her head is at either side.

d) Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his or her head is in the fully up position.

e) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage. When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch with its path high above,

and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(X) Every thirty seconds, the aerosol concentration shall be replenished using one-half the number of squeezes as initially (C)(VIII).

(XI) The test subject shall so indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(XII) If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

(XIII) Successful completion of the test protocol shall allow the use of the tested respirator in contaminated atmospheres up to ten times the PEL. In other words this protocol may be used to assign protection factors no higher than ten.

(iii) Irritant fume protocol.

(A) Respirator Selection. Respirators shall be selected as described in Section (i)(B) above, except that each respirator shall be equipped with high efficiency cartridges.

(B) Fit Test.

(I) The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize him or her with its characteristic odor.

(II) The test subject shall properly don the respirator selected as above, and wear it for at least ten [ten] minutes before starting the fit test.

(III) The test conductor shall review this protocol with the test subject before testing.

(IV) The test subject shall perform the conventional positive pressure and negative pressure fit checks. Failure of either check shall be cause to select an alternate respirator.

(V) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

(VI) Advise the subject that the smoke can be irritating to the eyes and instruct him or her to keep his or her eyes closed while the test is performed.

(VII) The test conductor shall direct the stream of irritant smoke from the tube toward the faceseal area of the test subject. The conductor shall begin at least twelve inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(VIII) The following exercises shall be performed while the respirator seal is being challenged by the smoke. Each shall be performed for one minute.

a) Normal breathing.

b) Deep breathing. Be certain breaths are deep and regular.

c) Turning head from side-to-side. Be certain movement is complete. Alert the test subject not to bump the respirator on the shoulders. Have the test subject inhale when his or her head is at either side.

d) Nodding head up-and-down. Be certain motions are complete. Alert the test subject not to bump the respirator on the chest. Have the test subject inhale when his or her head is in the fully up position.

e) Talking—slowly and distinctly, count backwards from 100.

f) Normal breathing.

(IX) If the irritant smoke produces an involuntary reaction (cough) by the test subject, the test conductor shall stop the test. In this case the tested respirator is rejected and another respirator shall be selected.

(X) Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube to determine whether he or she reacts to the smoke. Failure to evoke a response shall void the test.

(XI) Steps (B)(IV), (VII), and (VIII) of this protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the irritant smoke.

(XII) Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL. In other words this protocol may be used to assign protection factors not exceeding ten.

(e) Appendix E: Recommendations to employers concerning high-risk tasks (nonmandatory).

The department advises employers that the following tasks have a high risk for lead overexposure (this list is not complete; other tasks also can result in lead over-exposure):

- Any open flame operation involving lead-containing solder in a manner producing molten solder, including the manufacture or repair of motor vehicle radiators;
- Sanding, cutting or grinding of lead-containing solder;
- Breaking, recycling or manufacture of lead-containing batteries;
- Casting objects using lead, brass, or lead-containing alloys;
- Where lead-containing coatings or paints are present:
 - abrasive blasting
 - welding
 - cutting
 - torch burning
 - manual demolition of structures
 - manual scraping
 - manual sanding
 - heat gun applications
 - power tool cleaning
 - rivet busting
 - clean-up activities where dry expendable abrasives are used
 - abrasive blasting enclosure movement and removal;
- Spray-painting with lead-containing paint;
- Using lead-containing mortar;
- Lead burning;
- Operation or cleaning of shooting facilities where lead bullets are used;
- Formulation or processing of lead-containing pigments or paints;
- Cutting, burning, or melting of lead-containing materials.

The department recommends that annual blood lead testing be offered to all employees potentially overexposed to lead, including those performing the tasks listed above, regardless of air lead levels. Research has shown that air lead levels often do not accurately predict workers' lead overexpo-

sure. The blood lead testing will provide the most information if performed during a period of peak lead exposure.

Employers should be aware that the United States Public Health Service has set a goal of eliminating occupational exposures which result in whole blood lead levels of 25 µg/dl or greater. This goal should guide whether employees' blood lead levels indicate lead overexposure.

If blood lead levels are elevated in an employee performing a task associated with lead overexposure, employers should assess the maintenance and effectiveness of exposure controls, hygiene facilities, respiratory protection program, the employee's work practices and personal hygiene, and the employee's respirator use, if any. If a deficiency exists in any of these areas, the employer should correct the problem.

[Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-62-07521, filed 4/10/96, effective 6/1/96; 95-04-078, § 296-62-07521, filed 1/30/95, effective 3/2/95; 91-24-017 (Order 91-07), § 296-62-07521, filed 11/22/91, effective 12/24/91; 90-17-051 (Order 90-10), § 296-62-07521, filed 8/13/90, effective 9/24/90; 90-03-029 (Order 89-20), § 296-62-07521, filed 1/11/90, effective 2/26/90; 88-14-108 (Order 88-11), § 296-62-07521, filed 7/6/88. Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-07521, filed 11/30/83; 82-13-045 (Order 82-22), § 296-62-07521, filed 6/11/82. Formerly WAC 296-62-07349.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 296-62-07523 Benzene. (1) Scope and application.

(a) This section applies to all occupational exposures to benzene. Chemical Abstracts Service Registry No. 71-43-2, except as provided in (b) and (c) of this subsection.

(b) This section does not apply to:

(i) The storage, transportation, distribution, dispensing, sale or use of gasoline, motor fuels, or other fuels containing benzene subsequent to its final discharge from bulk wholesale storage facilities, except that operations where gasoline or motor fuels are dispensed for more than four hours per day in an indoor location are covered by this section.

(ii) Loading and unloading operations at bulk wholesale storage facilities which use vapor control systems for all loading and unloading operations, except for the provisions of WAC 296-62-054 as incorporated into this section and the emergency provisions of subsections (7) and (9)(d) of this section.

(iii) The storage, transportation, distribution, or sale of benzene or liquid mixtures containing more than 0.1 percent benzene in intact containers or in transportation pipelines while sealed in such a manner as to contain benzene vapors or liquid, except for the provisions of WAC 296-62-054 as incorporated into this section and the emergency provisions of subsections (7) and (9)(d) of this section.

(iv) Containers and pipelines carrying mixtures with less than 0.1 percent benzene and natural gas processing plants processing gas with less than 0.1 percent benzene.

(v) Work operations where the only exposure to benzene is from liquid mixtures containing 0.5 percent or less of benzene by volume, or the vapors released from such liquids until September 12, 1988; work operations where the only exposure to benzene is from liquid mixtures containing 0.3 percent or less of benzene by volume or the vapors released from such liquids from September 12, 1988, to September 12,

1989; and work operations where the only exposure to benzene is from liquid mixtures containing 0.1 percent or less of benzene by volume or the vapors released from such liquids after September 12, 1989; except that tire building machine operators using solvents with more than 0.1 percent benzene are covered by subsection (9) of this section.

(vi) Oil and gas drilling, production, and servicing operations.

(vii) Coke oven batteries.

(c) The cleaning and repair of barges and tankers which have contained benzene are excluded from subsection (6) of this section (Methods of compliance), subsection (5)(a) of this section (General), and subsection (5)(f) of this section (Accuracy of monitoring). Engineering and work practice controls shall be used to keep exposures below 10 ppm unless it is proven to be not feasible.

(2) Definitions.

(a) "Action level" means an airborne concentration of benzene of 0.5 ppm calculated as an 8-hour time-weighted average.

(b) "Authorized person" means any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees for the purpose of exercising the right to observe monitoring and measuring procedures under subsection (5) of this section, or any other person authorized by the Washington Industrial Safety and Health Act (WISHA) or regulations issued under WISHA.

(c) "Benzene" (C₆H₆) (CAS Registry No. 71-43-2) means liquefied or gaseous benzene. It includes benzene contained in liquid mixtures and the benzene vapors released by these liquids. It does not include trace amounts of unreacted benzene contained in solid materials.

(d) "Bulk wholesale storage facility" means a bulk terminal or bulk plant where fuel is stored prior to its delivery to wholesale customers.

(e) "Container" means any barrel, bottle, can, cylinder, drum, reaction vessel, storage tank, or the like, but does not include piping systems.

(f) "Day" means any part of a calendar day.

(g) "Director" means the director of the department of labor and industries, or his/her designated representative.

(h) "Emergency" means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which may or does result in an unexpected significant release of benzene.

(i) "Employee exposure" means exposure to airborne benzene which would occur if the employee were not using respiratory protective equipment.

(j) "Regulated area" means any area where airborne concentrations of benzene exceed or can reasonably be expected to exceed, the permissible exposure limits, either the 8-hour time-weighted average exposure of 1 ppm or the short-term exposure limit of 5 ppm for fifteen minutes.

(k) "Vapor control system" means any equipment used for containing the total vapors displaced during the loading of gasoline, motor fuel, or other fuel tank trucks and the displacing of these vapors through a vapor processing system or balancing the vapor with the storage tank. This equipment also includes systems containing the vapors displaced from the

storage tank during the unloading of the tank truck which balance the vapors back to the tank truck.

(3) Permissible exposure limits (PELs).

(a) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration of benzene in excess of one part of benzene per million parts of air (1 ppm) as an 8-hour time-weighted average.

(b) Short-term exposure limit (STEL). The employer shall assure that no employee is exposed to an airborne concentration of benzene in excess of 5 ppm as averaged over any fifteen minute period.

(4) Regulated areas.

(a) The employer shall establish a regulated area wherever the airborne concentration of benzene exceeds or can reasonably be expected to exceed the permissible exposure limits, either the 8-hour time-weighted average exposure of 1 ppm or the short-term exposure limit of 5 ppm for fifteen minutes.

(b) Access to regulated areas shall be limited to authorized persons.

(c) Regulated areas shall be determined from the rest of the workplace in any manner that minimizes the number of employees exposed to benzene within the regulated area.

(5) Exposure monitoring.

(a) General.

(i) Determinations of employee exposure shall be made from breathing zone air samples that are representative of each employee's average exposure to airborne benzene.

(ii) Representative 8-hour TWA employee exposures shall be determined on the basis of one sample or samples representing the full shift exposure for each job classification in each work area.

(iii) Determinations of compliance with the STEL shall be made from fifteen minute employee breathing zone samples measured at operations where there is reason to believe exposures are high, such as where tanks are opened, filled, unloaded, or gauged; where containers or process equipment are opened and where benzene is used for cleaning or as a solvent in an uncontrolled situation. The employer may use objective data, such as measurements from brief period measuring devices, to determine where STEL monitoring is needed.

(iv) Except for initial monitoring as required under (b) of this subsection, where the employer can document that one shift will consistently have higher employee exposures for an operation, the employer shall only be required to determine representative employee exposure for that operation during the shift on which the highest exposure is expected.

(b) Initial monitoring.

(i) Each employer who has a place of employment covered under subsection (1)(a) of this section shall monitor each of these workplaces and work operations to determine accurately the airborne concentrations of benzene to which employees may be exposed.

(ii) The initial monitoring required under (b)(i) of this subsection shall be completed by sixty days after the effective date of this standard or within thirty days of the introduction of benzene into the workplace. Where the employer has monitored within one year prior to the effective date of this

standard and the monitoring satisfies all other requirements of this section, the employer may rely on such earlier monitoring results to satisfy the requirements of (b)(i) of this subsection.

(c) Periodic monitoring and monitoring frequency.

(i) If the monitoring required by (b)(i) of this subsection reveals employee exposure at or above the action level but at or below the TWA, the employer shall repeat such monitoring for each such employee at least every year.

(ii) If the monitoring required by (b)(i) of this subsection reveals employee exposure above the TWA, the employer shall repeat such monitoring for each such employee at least every six months.

(iii) The employer may alter the monitoring schedule from every six months to annually for any employee for whom two consecutive measurements taken at least seven days apart indicate that the employee exposure has decreased to the TWA or below, but is at or above the action level.

(iv) Monitoring for the STEL shall be repeated as necessary to evaluate exposures of employees subject to short term exposures.

(d) Termination of monitoring.

(i) If the initial monitoring required by (b)(i) of this subsection reveals employee exposure to be below the action level the employer may discontinue the monitoring for that employee, except as otherwise required by (e) of this subsection.

(ii) If the periodic monitoring required by (c) of this subsection reveals that employee exposures, as indicated by at least two consecutive measurements taken at least seven days apart, are below the action level the employer may discontinue the monitoring for that employee, except as otherwise required by (e) of this subsection.

(e) Additional monitoring.

(i) The employer shall institute the exposure monitoring required under (b) and (c) of this subsection when there has been a change in the production, process, control equipment, personnel, or work practices which may result in new or additional exposures to benzene, or when the employer has any reason to suspect a change which may result in new or additional exposures.

(ii) Whenever spills, leaks, ruptures, or other breakdowns occur that may lead to employee exposure, the employer shall monitor (using area or personal sampling) after the cleanup of the spill or repair of the leak, rupture or other breakdown to ensure that exposures have returned to the level that existed prior to the incident.

(f) Accuracy of monitoring. Monitoring shall be accurate, to a confidence level of ninety-five percent, to within plus or minus twenty-five percent for airborne concentrations of benzene.

(g) Employee notification of monitoring results.

(i) The employer shall, within fifteen working days after the receipt of the results of any monitoring performed under this standard, notify each employee of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(ii) Whenever the PELs are exceeded, the written notification required by (g)(i) of this subsection shall contain the corrective action being taken by the employer to reduce the

employee exposure to or below the PEL, or shall refer to a document available to the employee which states the corrective actions to be taken.

(6) Methods of compliance.

(a) Engineering controls and work practices.

(i) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to benzene at or below the permissible exposure limits, except to the extent that the employer can establish that these controls are not feasible or where the provisions of (a)(iii) of this subsection or subsection (7)(a) of this section apply.

(ii) Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the PELs, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection which complies with the requirements of subsection (7) of this section.

(iii) Where the employer can document that benzene is used in a workplace less than a total of thirty days per year, the employer shall use engineering controls, work practice controls or respiratory protection or any combination of these controls to reduce employee exposure to benzene to or below the PELs, except that employers shall use engineering and work practice controls, if feasible, to reduce exposure to or below 10 ppm as an 8-hour TWA.

(b) Compliance program.

(i) When any exposures are over the PEL, the employer shall establish and implement a written program to reduce employee exposure to or below the PEL primarily by means of engineering and work practice controls, as required by (a) of this subsection.

(ii) The written program shall include a schedule for development and implementation of the engineering and work practice controls. These plans shall be reviewed and revised as appropriate based on the most recent exposure monitoring data, to reflect the current status of the program.

(iii) Written compliance programs shall be furnished upon request for examination and copying to the director, affected employees, and designated employee representatives.

(7) Respiratory protection.

(a) General. The employer shall provide respirators, and assure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(i) During the time period necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations for which the employer establishes that compliance with either the TWA or STEL through the use of engineering and work practice controls is not feasible, such as some maintenance and repair activities, vessel cleaning, or other operations where engineering and work practice controls are infeasible because exposures are intermittent in nature and limited in duration;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient or are not required under subsection (6)(a)(iii) of this section to reduce exposure to or below the PELs; and

(iv) In emergencies.

(b) Respirator selection.

(i) Where respirators are required or allowed under this section, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1 of this section, and shall assure that the employee uses the respirator provided.

(ii) The employer shall select respirators from among those jointly approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11. Negative pressure respirators shall have filter elements approved by MSHA/NIOSH for organic vapors or benzene.

(iii) Any employee who cannot wear a negative pressure respirator shall be given the option of wearing a respirator with less breathing resistance such as a powered air-purifying respirator or supplied air respirator.

(c) Respirator program. The employer shall institute a respiratory protection program in accordance with Part E, Respiratory protection, WAC 296-62-071 through 296-62-07121.

(d) Respirator use.

(i) Where air-purifying respirators are used, the employer shall replace the air-purifying element at the expiration of service life or at the beginning of each shift in which they will be used, whichever comes first.

(ii) If an air-purifying element becomes available with an end of useful life indicator for benzene approved by MSHA/NIOSH, the element may be used until such time as the indicator shows no further useful life.

(iii) The employer shall permit employees who wear respirators to leave the regulated area to wash their faces and respirator facepieces as necessary in order to prevent skin irritation associated with respirator use or to change the filter elements of air-purifying respirators whenever they detect a change in breathing resistance or chemical vapor breakthrough.

(e) Respirator fit testing.

(i) The employer shall perform, and certify the results of, either quantitative or qualitative fit tests at the time of initial fitting and at least annually thereafter for each employee wearing a negative pressure respirator. The test shall be used to select a respirator facepiece which exhibits minimum leakage and provides the required protection as prescribed in Table 1 of this section. The employer shall provide and assure that the employee wears a respirator demonstrated by the fit test to provide the required protection.

(ii) The employer shall follow the test protocols outlined in Appendix E of this standard for whichever type of fit testing the employer chooses.

TABLE 1. - RESPIRATORY PROTECTION FOR BENZENE

Airborne concentration of benzene or condition of use		Respirator type	
(a)	Less than or equal to 10 ppm.	(1)	Half-mask air-purifying respirator with organic vapor cartridge.
(b)	Less than or equal to 50 ppm.	(1)	Full facepiece respirator with organic vapor cartridges.
		(1)	Full facepiece gas mask with chin style canister. ¹

TABLE 1. - RESPIRATORY PROTECTION FOR BENZENE

Airborne concentration of benzene or condition of use	Respirator type
(c) Less than or equal to 100 ppm.	(1) Full facepiece powered air-purifying respirator with organic vapor canister. ¹
(d) Less than or equal to 1,000 ppm.	(1) Supplied air respirator with full facepiece in positive-pressure mode.
(e) Greater than 1,000 ppm or unknown concentration.	(1) Self-contained breathing apparatus with full facepiece in positive-pressure mode. (2) Full facepiece positive-pressure supplied-air respirator with auxiliary self-contained air supply.
(f) Escape	(1) Any organic vapor gas mask; or (2) Any self-contained breathing apparatus with full facepiece.
(g) Firefighting	(1) Full facepiece self-contained breathing apparatus in positive pressure mode.

¹Canisters must have a minimum service life of four (4) hours when tested at 150 ppm benzene, at a flow rate of 64 LPM, 25° C, and 85% relative humidity for non-powered air purifying respirators. The flow rate shall be 115 LPM and 170 LPM respectively for tight fitting and loose fitting powered air-purifying respirators.

(8) Protective clothing and equipment. Personal protective clothing and equipment shall be worn where appropriate to prevent eye contact and limit dermal exposure to liquid benzene. Protective clothing and equipment shall be provided by the employer at no cost to the employee and the employer shall assure its use where appropriate. Eye and face protection shall meet the requirements of WAC 296-24-07801.

(9) Medical surveillance.

(a) General.

(i) The employer shall make available a medical surveillance program for employees who are or may be exposed to benzene at or above the action level thirty or more days per year; for employees who are or may be exposed to benzene at or above the PELs ten or more days per year; for employees who have been exposed to more than 10 ppm of benzene for thirty or more days in a year prior to the effective date of the standard when employed by their current employer; and for employees involved in the tire building operations called tire building machine operators, who use solvents containing greater than 0.1 percent benzene.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician and that all laboratory tests are conducted by an accredited laboratory.

(iii) The employer shall assure that persons other than licensed physicians who administer the pulmonary function testing required by this section shall complete a training course in spirometry sponsored by an appropriate governmental, academic, or professional institution.

(iv) The employer shall assure that all examinations and procedures are provided without cost to the employee and at a reasonable time and place.

(b) Initial examination.

(i) Within sixty days of the effective date of this standard, or before the time of initial assignment, the employer shall provide each employee covered by (a)(i) of this subsection with a medical examination including the following elements:

(A) A detailed occupational history which includes:

(I) Past work exposure to benzene or any other hematological toxins;

(II) A family history of blood dyscrasias including hematological neoplasms;

(III) A history of blood dyscrasias including genetic hemoglobin abnormalities, bleeding abnormalities, abnormal function of formed blood elements;

(IV) A history of renal or liver dysfunction;

(V) A history of medicinal drugs routinely taken;

(VI) A history of previous exposure to ionizing radiation; and

(VII) Exposure to marrow toxins outside of the current work situation.

(B) A complete physical examination.

(C) Laboratory tests. A complete blood count including a leukocyte count with differential, a quantitative thrombocyte count, hematocrit, hemoglobin, erythrocyte count and erythrocyte indices (MCV, MCH, MCHC). The results of these tests shall be reviewed by the examining physician.

(D) Additional tests as necessary in the opinion of the examining physician, based on alterations to the components of the blood or other signs which may be related to benzene exposure.

(E) For all workers required to wear respirators for at least thirty days a year, the physical examination shall pay special attention to the cardiopulmonary system and shall include a pulmonary function test.

(ii) No initial medical examination is required to satisfy the requirements of (b)(i) of this subsection if adequate records show that the employee has been examined in accordance with the procedures of (b)(i) of this subsection within the twelve months prior to the effective date of this standard.

(c) Periodic examinations.

(i) The employer shall provide each employee covered under (a)(i) of this subsection with a medical examination annually following the previous examination. These periodic examinations shall include at least the following elements:

(A) A brief history regarding any new exposure to potential marrow toxins, changes in medicinal drug use, and the appearance of physical signs relating to blood disorders;

(B) A complete blood count including a leukocyte count with differential, quantitative thrombocyte count, hemoglobin, hematocrit, erythrocyte count and erythrocyte indices (MCV, MCH, MCHC); and

(C) Appropriate additional tests as necessary, in the opinion of the examining physician, in consequence of alterations in the components of the blood or other signs which may be related to benzene exposure.

(ii) Where the employee develops signs and symptoms commonly associated with toxic exposure to benzene, the employer shall provide the employee with an additional medical examination which shall include those elements considered appropriate by the examining physician.

(iii) For persons required to use respirators for at least thirty days a year, a pulmonary function test shall be performed every three years. A specific evaluation of the cardiopulmonary system shall be made at the time of the pulmonary function test.

(d) Emergency examinations.

(i) In addition to the surveillance required by (a)(i) of this subsection, if an employee is exposed to benzene in an emergency situation, the employer shall have the employee provide a urine sample at the end of the employee's shift and have a urinary phenol test performed on the sample within seventy-two hours. The urine specific gravity shall be corrected to 1.024.

(ii) If the result of the urinary phenol test is below 75 mg phenol/L of urine, no further testing is required.

(iii) If the result of the urinary phenol test is equal to or greater than 75 mg phenol/L of urine, the employer shall provide the employee with a complete blood count including an erythrocyte count, leukocyte count with differential and thrombocyte count at monthly intervals for a duration of three months following the emergency exposure.

(iv) If any of the conditions specified in (e)(i) of this subsection exists, then the further requirements of (e) of this subsection shall be met and the employer shall, in addition, provide the employees with periodic examinations if directed by the physician.

(e) Additional examinations and referrals.

(i) Where the results of the complete blood count required for the initial and periodic examinations indicate any of the following abnormal conditions exist, then the blood count shall be repeated within two weeks.

(A) The hemoglobin level or the hematocrit falls below the normal limit (outside the ninety-five percent confidence interval (C.I.)) as determined by the laboratory for the particular geographic area and/or these indices show a persistent downward trend from the individual's preexposure norms; provided these findings cannot be explained by other medical reasons.

(B) The thrombocyte (platelet) count varies more than twenty percent below the employee's most recent values or falls outside the normal limit (ninety-five percent C.I.) as determined by the laboratory.

(C) The leukocyte count is below 4,000 per mm³ or there is an abnormal differential count.

(ii) If the abnormality persists, the examining physician shall refer the employee to a hematologist or an internist for further evaluation unless the physician has good reason to believe such referral is unnecessary. (See Appendix C for examples of conditions where a referral may be unnecessary.)

(iii) The employer shall provide the hematologist or internist with the information required to be provided to the physician under this subsection and the medical record required to be maintained by subsection (11)(b)(ii) of this section.

(iv) The hematologist's or internist's evaluation shall include a determination as to the need for additional tests, and the employer shall assure that these tests are provided.

(f) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this regulation and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's actual or representative exposure level;

(iv) A description of any personal protective equipment used or to be used; and

(v) Information from previous employment-related medical examinations of the affected employee which is not otherwise available to the examining physician.

(g) Physician's written opinions.

(i) For each examination under this section, the employer shall obtain and provide the employee with a copy of the examining physician's written opinion within fifteen days of the examination. The written opinion shall be limited to the following information:

(A) The occupationally pertinent results of the medical examination and tests;

(B) The physician's opinion concerning whether the employee has any detected medical conditions which would place the employee's health at greater than normal risk of material impairment from exposure to benzene;

(C) The physician's recommended limitations upon the employee's exposure to benzene or upon the employee's use of protective clothing or equipment and respirators.

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions resulting from benzene exposure which require further explanation or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific records, findings, and diagnoses that have no bearing on the employee's ability to work in a benzene-exposed workplace.

(h) Medical removal plan.

(i) When a physician makes a referral to a hematologist/internist as required under (e)(ii) of this subsection, the employee shall be removed from areas where exposures may exceed the action level until such time as the physician makes a determination under (h)(ii) of this subsection.

(ii) Following the examination and evaluation by the hematologist/internist, a decision to remove an employee from areas where benzene exposure is above the action level or to allow the employee to return to areas where benzene exposure is above the action level shall be made by the physician in consultation with the hematologist/internist. This decision shall be communicated in writing to the employer and employee. In the case of removal, the physician shall state the required probable duration of removal from occupational exposure to benzene above the action level and the requirements for future medical examinations to review the decision.

(iii) For any employee who is removed pursuant to (h)(ii) of this subsection, the employer shall provide a follow-up examination. The physician, in consultation with the hematologist/internist, shall make a decision within six months of the date the employee was removed as to whether the employee shall be returned to the usual job or whether the employee should be removed permanently.

(iv) Whenever an employee is temporarily removed from benzene exposure pursuant to (h)(i) or (ii) of this sub-

section, the employer shall transfer the employee to a comparable job for which the employee is qualified (or can be trained for in a short period) and where benzene exposures are as low as possible, but in no event higher than the action level. The employer shall maintain the employee's current wage rate, seniority, and other benefits. If there is no such job available, the employer shall provide medical removal protection benefits until such a job becomes available or for six months, whichever comes first.

(v) Whenever an employee is removed permanently from benzene exposure based on a physician's recommendation pursuant to (h)(iii) of this subsection, the employee shall be given the opportunity to transfer to another position which is available or later becomes available for which the employee is qualified (or can be trained for in a short period) and where benzene exposures are as low as possible but in no event higher than the action level. The employer shall assure that such employee suffers no reduction in current wage rate, seniority, or other benefits as a result of the transfer.

(i) Medical removal protection benefits.

(i) The employer shall provide to an employee six months of medical removal protection benefits immediately following each occasion an employee is removed from exposure to benzene because of hematological findings pursuant to (h)(i) and (ii) of this subsection, unless the employee has been transferred to a comparable job where benzene exposures are below the action level.

(ii) For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the current wage rate, seniority, and other benefits of an employee as though the employee had not been removed.

(iii) The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or from employment with another employer made possible by virtue of the employee's removal.

(10) Communication of benzene hazards to employees.

(a) Signs and labels.

(i) The employer shall post signs at entrances to regulated areas. The signs shall bear the following legend:

DANGER
BENZENE
CANCER HAZARD
FLAMMABLE-NO SMOKING
AUTHORIZED PERSONNEL ONLY
RESPIRATOR REQUIRED

(ii) The employer shall ensure that labels or other appropriate forms of warning are provided for containers of benzene within the workplace. There is no requirement to label pipes. The labels shall comply with the requirements of WAC 296-62-05411 and in addition shall include the following legend:

DANGER
CONTAINS BENZENE
CANCER HAZARD

(b) Material safety data sheets.

(i) Employers shall obtain or develop, and shall provide access to their employees, to a material safety data sheet (MSDS) which addresses benzene and complies with WAC 296-62-054.

(ii) Employers who are manufacturers or importers shall:

(A) Comply with subsection (1) of this section; and

(B) Comply with the requirement in WISHA's hazard communication standard, WAC 296-62-054 (Hazard communication purpose), that they deliver to downstream employers an MSDS which addresses benzene.

(c) Information and training.

(i) The employer shall provide employees with information and training at the time of their initial assignment to a work area where benzene is present. If exposures are above the action level, employees shall be provided with information and training at least annually thereafter.

(ii) The training program shall be in accordance with the requirements of WAC 296-62-05415 (1) and (2), and shall include specific information on benzene for each category of information included in that section.

(iii) In addition to the information required under WAC 296-62-054, the employer shall:

(A) Provide employees with an explanation of the contents of this section, including Appendices A and B, and indicate to them where the standard is available; and

(B) Describe the medical surveillance program required under subsection (9) of this section, and explain the information contained in Appendix C.

(11) Recordkeeping.

(a) Exposure measurements.

(i) The employer shall establish and maintain an accurate record of all measurements required by subsection (5) of this section, in accordance with WAC 296-62-052.

(ii) This record shall include:

(A) The dates, number, duration, and results of each of the samples taken, including a description of the procedure used to determine representative employee exposures;

(B) A description of the sampling and analytical methods used;

(C) A description of the type of respiratory protective devices worn, if any; and

(D) The name, Social Security number, job classification, and exposure levels of the employee monitored and all other employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least the duration of employment plus thirty years, in accordance with Part B, Access to records, WAC 296-62-052 through 296-62-05223.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by subsection (9) of this section, in accordance with WAC 296-62-052.

(ii) This record shall include:

(A) The name and Social Security number of the employee;

(B) The employer's copy of the physician's written opinion on the initial, periodic, and special examinations, includ-

ing results of medical examinations and all tests, opinions, and recommendations;

(C) Any employee medical complaints related to exposure to benzene;

(D) A copy of the information provided to the physician as required by subsection (9)(f)(ii) through (v) of this section; and

(E) A copy of the employee's medical and work history related to exposure to benzene or any other hematologic toxins.

(iii) The employer shall maintain this record for at least the duration of employment plus thirty years, in accordance with Part B, Access to records, WAC 296-62-052 through 296-62-05223.

(c) Availability.

(i) The employer shall assure that all records required to be maintained by this section shall be made available upon request to the director for examination and copying.

(ii) Employee exposure monitoring records required by this subsection shall be provided upon request for examination and copying to employees, employee representatives, and the director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(iii) Employee medical records required by this subsection shall be provided upon request for examination and copying, to the subject employee, to anyone having the specific written consent of the subject employee, and to the director in accordance with WAC 296-62-052.

(d) Transfer of records.

(i) The employer shall comply with the requirements involving transfer of records set forth in WAC 296-62-05205.

(ii) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director, at least three months prior to disposal, and transmit them to the director if required by the director within that period.

(12) Observation of monitoring.

(a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe the measuring or monitoring of employee exposure to benzene conducted pursuant to subsection (5) of this section.

(b) Observation procedures. When observation of the measuring or monitoring of employee exposure to benzene requires entry into areas where the use of protective clothing and equipment or respirators is required, the employer shall provide the observer with personal protective clothing and equipment or respirators required to be worn by employees working in the area, assure the use of such clothing and equipment or respirators, and require the observer to comply with all other applicable safety and health procedures.

(13) Dates.

(a) Engineering and work practice controls required by subsection (6)(a) of this section shall be implemented no later than December 10, 1989.

(b) Coke and coal chemical operations may comply with (b)(ii) of this subsection or alternately include within the compliance program required by subsection (6)(b) of this section, a requirement to phase in engineering controls as

equipment is repaired and replaced. For coke and coal chemical operations choosing the latter alternative, compliance with the engineering controls requirements of subsection (6)(a) of this section shall be achieved no later than December 10, 1992. Substantial compliance with the engineering control requirements shall be achieved no later than December 10, 1990.

(14) Appendices. The information contained in WAC 296-62-07525, Appendices A, B, C, and D is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligations. The protocols on respiratory fit testing in Appendix E are mandatory.

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07523, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07525 Appendix A substance safety data sheet—Benzene. (1) Substance identification.

(a) Substance: Benzene.

(b) Permissible exposure: Except as to the use of gasoline, motor fuels, and other fuels subsequent to discharge from bulk terminals and other exemptions specified in WAC 296-62-07523 (1)(b):

(i) Airborne: The maximum time-weighted average (TWA) exposure limit is one part of benzene vapor per million parts of air (1 ppm) for an eight-hour workday and the maximum short-term exposure limit (STEL) is 5 ppm for any fifteen-minute period.

(ii) Dermal: Eye contact shall be prevented and skin contact with liquid benzene shall be limited.

(c) Appearance and odor: Benzene is a clear, colorless liquid with a pleasant, sweet odor. The odor of benzene does not provide adequate warning of its hazard.

(2) Health hazard data.

(a) Ways in which benzene affects your health. Benzene can affect your health if you inhale it, or if it comes in contact with your skin or eyes. Benzene is also harmful if you happen to swallow it.

(b) Effects of overexposure.

(i) Short-term (acute) overexposure: If you are overexposed to high concentrations of benzene, well above the levels where its odor is first recognizable, you may feel breathless, irritable, euphoric, or giddy; you may experience irritation in eyes, nose, and respiratory tract. You may develop a headache, feel dizzy, nauseated, or intoxicated. Severe exposures may lead to convulsions and loss of consciousness.

(ii) Long-term (chronic) exposure. Repeated or prolonged exposure to benzene, even at relatively low concentrations, may result in various blood disorders, ranging from anemia to leukemia, an irreversible, fatal disease. Many blood disorders associated with benzene exposure may occur without symptoms.

(3) Protective clothing and equipment.

(a) Respirators. Respirators are required for those operations in which engineering controls or work practice controls are not feasible to reduce exposure to the permissible level. However, where employers can document that benzene is present in the workplace less than thirty days a year, respirators may be used in lieu of engineering controls. If respirators are worn, they must have joint Mine Safety and Health Administration and the National Institute for Occupational

Safety and Health (NIOSH) seal of approval, and cartridge or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. If you experience difficulty breathing while wearing a respirator, you may request a positive pressure respirator from your employer. You must be thoroughly trained to use the assigned respirator, and the training will be provided by your employer.

(b) Protective clothing. You must wear appropriate protective clothing (such as boots, gloves, sleeves, aprons, etc.,) over any parts of your body that could be exposed to liquid benzene.

(c) Eye and face protection. You must wear splash-proof safety goggles if it is possible that benzene may get into your eyes. In addition, you must wear a face shield if your face could be splashed with benzene liquid.

(4) Emergency and first aid procedures.

(a) Eye and face exposure. If benzene is splashed in your eyes, wash it out immediately with large amounts of water. If irritation persists or vision appears to be affected see a doctor as soon as possible.

(b) Skin exposure. If benzene is spilled on your clothing or skin, remove the contaminated clothing and wash the exposed skin with large amounts of water and soap immediately. Wash contaminated clothing before you wear it again.

(c) Breathing. If you or any other person breathes in large amounts of benzene, get the exposed person to fresh air at once. Apply artificial respiration if breathing has stopped. Call for medical assistance or a doctor as soon as possible. Never enter any vessel or confined space where the benzene concentration might be high without proper safety equipment and at least one other person present who will stay outside. A life line should be used.

(d) Swallowing. If benzene has been swallowed and the patient is conscious, do not induce vomiting. Call for medical assistance or a doctor immediately.

(5) Medical requirements. If you are exposed to benzene at a concentration at or above 0.5 ppm as an 8-hour time-weighted average, or have been exposed at or above 10 ppm in the past while employed by your current employer, your employer is required to provide a medical examination and history and laboratory tests within sixty days of the effective date of this standard and annually thereafter. These tests shall be provided without cost to you. In addition, if you are accidentally exposed to benzene (either by ingestion, inhalation, or skin/eye contact) under emergency conditions known or suspected to constitute toxic exposure to benzene, your employer is required to make special laboratory tests available to you.

(6) Observation of monitoring. Your employer is required to perform measurements that are representative of your exposure to benzene and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you or your representative must also be provided with, and must wear the protective clothing and equipment.

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(7) Access to records. You or your representative are entitled to see the records of measurements of your exposure to benzene upon written request to your employer. Your medical examination records can be furnished to yourself, your physician, or designated representative upon request by you to your employer.

(8) Precautions for safe use, handling, and storage. Benzene liquid is highly flammable. It should be stored in tightly closed containers in a cool, well ventilated area. Benzene vapor may form explosive mixtures in air. All sources of ignition must be controlled. Use nonsparking tools when opening or closing benzene containers. Fire extinguishers, where provided, must be readily available. Know where they are located and how to operate them. Smoking is prohibited in areas where benzene is used or stored. Ask your supervisor where benzene is used in your area and for additional plant safety rules.

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07525, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07527 Appendix B substance technical guidelines—Benzene. (1) Physical and chemical data.

(a) Substance identification.

(i) Synonyms: Benzol, benzole, coal naphtha, cyclohexatriene, phene, phenyl hydride, pyrobenzol. (Benzin, petroleum benzin and Benzine do not contain benzene.)

(ii) Formula: C₆H₆ (CAS Registry Number: 71-43-2).

(b) Physical data.

(i) Boiling point (760 mm Hg); 80.1 C (176 F).

(ii) Specific gravity (water=1): 0.879.

(iii) Vapor density (air=1): 2.7.

(iv) Melting point: 5.5 C (42 F).

(v) Vapor pressure at 20 C (68 F): 75 mm Hg.

(vi) Solubility in water: .06%.

(vii) Evaporation rate (ether=1): 2.8.

(viii) Appearance and odor: Clear, colorless liquid with a distinctive sweet odor.

(2) Fire, explosion, and reactivity hazard data.

(a) Fire.

(i) Flash point (closed cup): -11 C (12 F).

(ii) Autoignition temperature: 580 C (1076 F).

(iii) Flammable limits in Air. % by volume: Lower: 1.3%, Upper: 7.5%.

(iv) Extinguishing media: Carbon dioxide, dry chemical, or foam.

(v) Special fire-fighting procedures: Do not use solid stream of water, since stream will scatter and spread fire. Fine water spray can be used to keep fire-exposed containers cool.

(vi) Unusual fire and explosion hazards: Benzene is a flammable liquid. Its vapors can form explosive mixtures. All ignition sources must be controlled when benzene is used, handled, or stored. Where liquid or vapor may be released, such areas shall be considered as hazardous locations. Benzene vapors are heavier than air; thus the vapors may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which benzene is handled.

(vii) Benzene is classified as a 1 B flammable liquid for the purpose of conforming to the requirements of WAC 296-24-330. A concentration exceeding 3,250 ppm is considered a potential fire explosion hazard. Locations where benzene

may be present in quantities sufficient to produce explosive or ignitable mixtures are considered Class I Group D for the purposes of conforming to the requirements of WAC 296-24-95613.

(b) Reactivity.

(i) Conditions contributing to instability: Heat.

(ii) Incompatibility: Heat and oxidizing materials.

(iii) Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide).

(3) Spill and leak procedures.

(a) Steps to be taken if the material is released or spilled.

As much benzene as possible should be absorbed with suitable materials, such as dry sand or earth; benzene remaining must be flushed with large amounts of water. Do not flush benzene into a confined space, such as a sewer, because of explosion danger. Remove all ignition sources. Ventilate enclosed places.

(b) Waste disposal method. Disposal methods must conform to other jurisdictional regulations. If allowed, benzene may be disposed of:

(i) By absorbing it in dry sand or earth and disposing in a sanitary landfill;

(ii) If small quantities, by removing it to a safe location from buildings or other combustible sources, pouring it in dry sand or earth and cautiously igniting it; and

(iii) If large quantities, by atomizing it in a suitable combustion chamber.

(4) Miscellaneous precautions.

(a) High exposure to benzene can occur when transferring the liquid from one container to another. Such operations should be well ventilated and good work practices must be established to avoid spills.

(b) Use nonsparking tools to open benzene containers which are effectively grounded and bonded prior to opening and pouring.

(c) Employers must advise employees of all plant areas and operations where exposure to benzene could occur. Common operations in which high exposures to benzene may be encountered are: The primary production and utilization of benzene, and transfer of benzene.

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07527, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07529 Appendix C medical surveillance guidelines for benzene. (1) Route of entry.

Inhalation; skin absorption.

(2) Toxicology. Benzene is primarily an inhalation hazard. Systemic absorption may cause depression of the hematopoietic system, pancytopenia, aplastic anemia, and leukemia. Inhalation of high concentrations can affect central nervous system function. Aspiration of small amounts of liquid benzene immediately causes pulmonary edema and hemorrhage of pulmonary tissue. There is some absorption through the skin. Absorption may be more rapid in the case of abraded skin, and benzene may be more readily absorbed if it is present in a mixture or as a contaminant in solvents which are readily absorbed. The defatting action of benzene may produce primary irritation due to repeated or prolonged contact with the skin. High concentrations are irritating to the

eyes and the mucous membranes of the nose, and respiratory tract.

(3) Signs and symptoms. Direct skin contact with benzene may cause erythema. Repeated or prolonged contact may result in drying, scaling dermatitis, or development of secondary skin infections. In addition, there is benzene absorption through the skin. Local effects of benzene vapor or liquid on the eye are slight. Only at very high concentrations is there any smarting sensation in the eye. Inhalation of high concentrations of benzene may have an initial stimulatory effect on the central nervous system characterized by exhilaration, nervous excitation, and/or giddiness, followed by a period of depression, drowsiness, or fatigue. A sensation of tightness in the chest accompanied by breathlessness may occur and ultimately the victim may lose consciousness. Tremors, convulsions, and death may follow from respiratory paralysis or circulatory collapse in a few minutes to several hours following severe exposures.

The detrimental effect on the blood-forming system of prolonged exposure to small quantities of benzene vapor is of extreme importance. The hematopoietic system is the chief target for benzene's toxic effects which are manifested by alterations in the levels of formed elements in the peripheral blood. These effects have occurred at concentrations of benzene which may not cause irritation of mucous membranes, or any unpleasant sensory effects. Early signs and symptoms of benzene morbidity are varied, often not readily noticed and nonspecific. Subjective complaints of headache, dizziness, and loss of appetite may precede or follow clinical signs. Rapid pulse and low blood pressure, in addition to a physical appearance of anemia, may accompany a subjective complaint of shortness of breath and excessive tiredness. Bleeding from the nose, gums, or mucous membranes, and the development of purpuric spots (small bruises) may occur as the condition progresses. Clinical evidence of leukopenia, anemia, and thrombocytopenia, singly or in combination, has been frequently reported among the first signs.

Bone marrow may appear normal, aplastic, or hyperplastic, and may not, in all situations, correlate with peripheral blood forming tissues. Because of variations in the susceptibility to benzene morbidity, there is no "typical" blood picture. The onset of effects of prolonged benzene exposure may be delayed for many months or years after the actual exposure has ceased and identification or correlation with benzene exposure must be sought out in the occupational history.

(4) Treatment of acute toxic effects. Remove from exposure immediately. Make sure you are adequately protected and do not risk being overcome by fumes. Give oxygen or artificial resuscitation if indicated. Flush eyes, wash skin if contaminated and remove all contaminated clothing. Symptoms of intoxication may persist following severe exposures. Recovery from mild exposures is usually rapid and complete.

(5) Surveillance and preventive considerations.

(a) General. The principal effects of benzene exposure which form the basis for this regulation are pathological changes in the hematopoietic system, reflected by changes in the peripheral blood and manifesting clinically as pancytopenia, aplastic anemia, and leukemia. Consequently, the medical surveillance program is designed to observe, on a regular basis, blood indices for early signs of these effects, and

although early signs of leukemia are not usually available, emerging diagnostic technology and innovative regimes make consistent surveillance for leukemia, as well as other hematopoietic effects, essential.

Initial examinations are to be provided within sixty days of the effective date of this standard, or at the time of initial assignment, and periodic examinations annually thereafter.

There are special provisions for medical tests in the event of hematologic abnormalities or for emergency situations.

The blood values which require referral to a hematologist or internist are noted in (b)(i) of this subsection. The standard specifies that blood abnormalities that persist must be referred "unless the physician has good reason to believe such referral is unnecessary" ((b)(i) of this subsection). Examples of conditions that could make a referral unnecessary despite abnormal blood limits are iron or folate deficiency, menorrhagia, or blood loss due to some unrelated medical abnormality.

Symptoms and signs of benzene toxicity can be nonspecific. Only a detailed history and appropriate investigative procedure will enable a physician to rule out or confirm conditions that place the employee at increased risk. To assist the examining physician with regard to which laboratory tests are necessary and when to refer an employee to the specialist, OSHA has established the following guidelines.

(b) Hematology guidelines. A minimum battery of tests is to be performed by strictly standardized methods.

(i) Red cell, white cell, platelet counts, white blood cell differential, hematocrit and red cell indices must be performed by an accredited laboratory. The normal ranges for the red cell and white cell counts are influenced by altitude, race, and sex, and therefore should be determined by the accredited laboratory in the specific area where the tests are performed.

Either a decline from an absolute normal or an individual's baseline to a subnormal value or a rise to a supra-normal value, are indicative of potential toxicity, particularly if all blood parameters decline. The normal total white blood count is approximately 7,200/mm³ plus or minus 3,000. For cigarette smokers the white count may be higher and the upper range may be 2,000 cells higher than normal for the laboratory. In addition, infection, allergies and some drugs may raise the white cell count. The normal platelet count is approximately 250,000 with a range of 140,000 to 400,000. Counts outside this range should be regarded as possible evidence of benzene toxicity.

Certain abnormalities found through routine screening are of greater significance in the benzene-exposed worker and require prompt consultation with a specialist, namely:

(A) Thrombocytopenia.

(B) A trend of decreasing white cell, red cell, or platelet indices in an individual over time is more worrisome than an isolated abnormal finding at one test time. The importance of trend highlights the need to compare an individual's test results to baseline and/or previous periodic tests.

(C) A constellation or pattern of abnormalities in the different blood indices is of more significance than a single abnormality. A low white count not associated with any abnormalities in other cell indices may be a normal statistical

variation, whereas if the low white count is accompanied by decreases in the platelet and/or red cell indices, such a pattern is more likely to be associated with benzene toxicity and merits thorough investigation.

Anemia, leukopenia, macrocytosis or an abnormal differential white blood cell count should alert the physician to further investigate and/or refer the patient if repeat tests confirm the abnormalities. If routine screening detects an abnormality, follow-up tests which may be helpful in establishing the etiology of the abnormality are the peripheral blood smear and the reticulocyte count.

The extreme range of normal for reticulocytes is 0.4 to 2.5 percent of the red cells, the usual range being 0.5 to 1.2 percent of the red cells, but the typical value is in the range of 0.8 to 1.0 percent. A decline in reticulocytes to levels of less than 0.4 percent is to be regarded as possible evidence (unless another specific cause is found) of benzene toxicity requiring accelerated surveillance. An increase in reticulocyte levels to about 2.5 percent may also be consistent with (but is not as characteristic of) benzene toxicity.

(ii) An important diagnostic test is a careful examination of the peripheral blood smear. As with reticulocyte count the smear should be with fresh uncoagulated blood obtained from a needle tip following venipuncture or from a drop of earlobe blood (capillary blood). If necessary, the smear may, under certain limited conditions, be made from a blood sample anticoagulated with EDTA (but never with oxalate or heparin). When the smear is to be prepared from a specimen of venous blood which has been collected by a commercial Vacutainer type tube containing neutral EDTA, the smear should be made as soon as possible after the venesection. A delay of up to twelve hours is permissible between the drawing of the blood specimen into EDTA and the preparation of the smear if the blood is stored at refrigerator (not freezing) temperature.

(iii) The minimum mandatory observations to be made from the smear are:

(A) The differential white blood cell count;

(B) Description of abnormalities in the appearance of red cells; and

(C) Description of any abnormalities in the platelets.

(D) A careful search must be made throughout of every blood smear for immature white cells such as band forms (in more than normal proportion, i.e., over ten percent of the total differential count), any number of metamyelocytes, myelocytes, or myeloblasts. Any nucleate or multinucleated red blood cells should be reported. Large "giant" platelets or fragments of megakaryocytes must be recognized.

An increase in the proportion of band forms among the neutrophilic granulocytes is an abnormality deserving special mention, for it may represent a change which should be considered as an early warning of benzene toxicity in the absence of other causative factors (most commonly infection). Likewise, the appearance of metamyelocytes, in the absence of another probable cause, is to be considered a possible indication of benzene-induced toxicity.

An upward trend in the number of basophils, which normally do not exceed about 2.0 percent of the total white cells, is to be regarded as possible evidence of benzene toxicity. A rise in the eosinophil count is less specific but also may be

suspicious of toxicity if it rises above 6.0 percent of the total white count.

The normal range of monocytes is from 2.0 to 8.0 percent of the total white count with an average of about 5.0 percent. About twenty percent of individuals reported to have mild but persisting abnormalities caused by exposure to benzene show a persistent monocytosis. The findings of a monocyte count which persists at more than ten to twelve percent of the normal white cell count (when the total count is normal) or persistence of an absolute monocyte count in excess of 800/mm³ should be regarded as a possible sign of benzene-induced toxicity.

A less frequent but more serious indication of benzene toxicity is the finding in the peripheral blood of the so-called "pseudo" (or acquired) Pelger-Huet anomaly. In this anomaly many, or sometimes the majority, of the neutrophilic granulocytes possess two round nuclear segments—less often one or three round segments—rather than three normally elongated segments. When this anomaly is not hereditary, it is often but not invariably predictive of subsequent leukemia. However, only about two percent of patients who ultimately develop acute myelogenous leukemia show the acquired Pelger-Huet anomaly. Other tests that can be administered to investigate blood abnormalities are discussed below; however, such procedures should be undertaken by the hematologist.

An uncommon sign, which cannot be detected from the smear, but can be elicited by a "sucrose water test" of peripheral blood, is transient paroxysmal nocturnal hemoglobinuria (PNH), which may first occur insidiously during a period of established aplastic anemia, and may be followed within one to a few years by the appearance of rapidly fatal acute myelogenous leukemia. Clinical detection of PNH, which occurs in only one or two percent of those destined to have acute myelogenous leukemia, may be difficult; if the "sucrose water test" is positive, the somewhat more definitive Ham test, also known as the acid-serum hemolysis test, may provide confirmation.

(E) Individuals documented to have developed acute myelogenous leukemia years after initial exposure to benzene may have progressed through a preliminary phase of hematologic abnormality. In some instances pancytopenia (i.e., a lowering in the counts of all circulating blood cells of bone marrow origin, but not to the extent implied by the term "aplastic anemia") preceded leukemia for many years. Depression of a single blood cell type or platelets may represent a harbinger of aplasia or leukemia. The finding of two or more cytopenias, or pancytopenia in a benzene-exposed individual, must be regarded as highly suspicious of more advanced although still reversible, toxicity. "Pancytopenia" coupled with the appearance of immature cells (myelocytes, myeloblasts, erythroblasts, etc.), with abnormal cells (pseudo Pelger-Huet anomaly, atypical nuclear heterochromatin, etc.), or unexplained elevations of white blood cells must be regarded as evidence of benzene overexposure unless proved otherwise. Many severely aplastic patients manifested the ominous finding of five to ten percent myeloblasts in the marrow, occasional myeloblasts and myelocytes in the blood and twenty to thirty monocytes. It is evident that isolated cytopenias, pancytopenias, and even aplastic anemias induced by benzene may be reversible and complete recovery has been

reported on cessation of exposure. However, since any of these abnormalities is serious, the employee must immediately be removed from any possible exposure to benzene vapor. Certain tests may substantiate the employee's prospects for progression or regression. One such test would be an examination of the bone marrow, but the decision to perform a bone marrow aspiration or needle biopsy is made by the hematologist.

The findings of basophilic stippling in circulating red blood cells (usually found in one to five percent of red cells following marrow injury), and detection in the bone marrow of what are termed "ringed sideroblasts" must be taken seriously, as they have been noted in recent years to be premonitory signs of subsequent leukemia.

Recently peroxidase-staining of circulating or marrow neutrophil granulocytes, employing benzidine dihydrochloride, have revealed the disappearance of, or diminution in, peroxidase in a sizable proportion of the granulocytes, and this has been reported as an early sign of leukemia. However, relatively few patients have been studied to date. Granulocyte granules are normally strongly peroxidase positive. A steady decline in leukocyte alkaline phosphatase has also been reported as suggestive of early acute leukemia. Exposure to benzene may cause an early rise in serum iron, often but not always associated with a fall in the reticulocyte count. Thus, serial measurements of serum iron levels may provide a means of determining whether or not there is a trend representing sustained suppression of erythropoiesis.

Measurement of serum iron, determination of peroxidase and of alkaline phosphatase activity in peripheral granulocytes can be performed in most pathology laboratories. Peroxidase and alkaline phosphatase staining are usually undertaken when the index of suspicion for leukemia is high.

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07529, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07531 Appendix D sampling and analytical methods for benzene monitoring and measurement procedures. Measurements taken for the purpose of determining employee exposure to benzene are best taken so that the representative average eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Short-time interval samples (or grab samples) may also be used to determine average exposure level if a minimum of five measurements are taken in a random manner over the eight-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random samples taken on one work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analysis must be performed with procedures meeting the requirements of the standard.

There are a number of methods available for monitoring employee exposures to benzene. The sampling and analysis may be performed by collection of the benzene vapor on charcoal adsorption tubes, with subsequent chemical analysis by gas chromatography. Sampling and analysis may also be performed by portable direct reading instruments, real-time

continuous monitoring systems, passive dosimeters or other suitable methods. The employer has the obligation of selecting a monitoring method which meets the accuracy and precision requirements of the standard under his unique field conditions. The standard requires that the method of monitoring must have an accuracy, to a ninety-five percent confidence level, of not less than plus or minus twenty-five percent for concentrations of benzene greater than or equal to 0.5 ppm.

The WISHA laboratory uses NIOSH Method 1500 for evaluation of benzene air concentrations.

(1) WISHA method HYDCB for air samples.

Analyte: Benzene.

Matrix: Air.

Procedure: Adsorption on charcoal, desorption with carbon disulfide, analysis by GC.

Detection limit: 0.04 ppm.

Recommended air volume and sampling rate: 10L at 0.05 to 0.2 L/min.

(a) Principle of the method.

(i) A known volume of air is drawn through a charcoal tube to trap the organic vapors present.

(ii) The charcoal in the tube is transferred to a small, stoppered vial, and the analyte is desorbed with carbon disulfide.

(iii) An aliquot of the desorbed sample is injected into a gas chromatograph.

(iv) The area of the resulting peak is determined and compared with areas obtained from standards.

(b) Advantages and disadvantages of the method.

(i) The sampling device is small, portable, and involves no liquids. Interferences are minimal, and most of those which do occur can be eliminated by altering chromatographic conditions. The samples are analyzed by means of a quick, instrumental method.

(ii) The amount of sample which can be taken is limited by the number of milligrams that the tube will hold before overloading. When the sample value obtained for the backup section of the charcoal tube exceeds twenty-five percent of that found on the front section, the possibility of sample loss exists.

(c) Apparatus.

(i) A calibrated personal sampling pump whose flow can be determined within ± 5 percent at the recommended flow rate.

(ii) Charcoal tubes: Glass with both ends flame sealed, 7 cm long with a 6-mm O.D. and a 4-mm I.D., containing two sections of 20/40 mesh activated charcoal separated by a 2-mm portion of urethane foam. The activated charcoal is prepared from coconut shells and is obtained commercially. The adsorbing section contains 100 mg of charcoal, the back-up section 50 mg. A 3-mm portion of urethane foam is placed between the outlet end of the tube and the back-up section. A plug of silanized glass wool is placed in front of the adsorbing section. The pressure drop across the tube must be less than one inch of mercury at a flow rate of one liter per minute.

(iii) Gas chromatograph equipped with a flame ionization detector.

(iv) Column (10-ft 1/8-in stainless steel) packed with 80/100 Supelcoport coated with twenty percent SP 2100, 0.1 percent CW 1500.

(v) An electronic integrator or some other suitable method for measuring peak area.

(vi) Two-milliliter sample vials with Teflon-lined caps.

(vii) Microliter syringes: 10-microliter 10-uL syringe, and other convenient sizes for making standards, 1-uL syringe for sample injections.

(viii) Pipets: 1.0 mL delivery pipets.

(ix) Volumetric flasks: Convenient sizes for making standard solutions.

(d) Reagents.

(i) Chromatographic quality carbon disulfide (CS₂). Most commercially available carbon disulfide contains a trace of benzene which must be removed. It can be removed with the following procedure:

Heat under reflux for two to three hours, 500 mL of carbon disulfide, 10 mL concentrated sulfuric acid, and five drops of concentrated nitric acid. The benzene is converted to nitrobenzene. The carbon disulfide layer is removed, dried with anhydrous sodium sulfate, and distilled. The recovered carbon disulfide should be benzene free. (It has recently been determined that benzene can also be removed by passing the carbon disulfide through 13x molecular sieve.)

(ii) Benzene, reagent grade.

(iii) p-Cymene, reagent grade, (internal standard).

(iv) Desorbing reagent. The desorbing reagent is prepared by adding 0.05 mL of p-Cymene per milliliter of carbon disulfide. (The internal standard offers a convenient means correcting analytical response for slight inconsistencies in the size of sample injections. If the external standard technique is preferred, the internal standard can be eliminated.)

(v) Purified GC grade helium, hydrogen, and air.

(e) Procedure.

(i) Cleaning of equipment. All glassware used for the laboratory analysis should be properly cleaned and free of organics which could interfere in the analysis.

(ii) Calibration of personal pumps. Each pump must be calibrated with a representative charcoal tube in the line.

(iii) Collection and shipping of samples.

(A) Immediately before sampling, break the ends of the tube to provide an opening at least one-half the internal diameter of the tube (2 mm).

(B) The smaller section of the charcoal is used as the backup and should be placed nearest the sampling pump.

(C) The charcoal tube should be placed in a vertical position during sampling to minimize channeling through the charcoal.

(D) Air being sampled should not be passed through any hose or tubing before entering the charcoal tube.

(E) A sample size of ten liters is recommended. Sample at a flow rate of approximately 0.05 to 0.2 liters per minute. The flow rate should be known with an accuracy of at least ± 5 percent.

(F) The charcoal tubes should be capped with the supplied plastic caps immediately after sampling.

(G) Submit at least one blank tube (a charcoal tube subjected to the same handling procedures, without having any

air drawn through it) with each set of samples. Take necessary shipping and packing precautions to minimize breakage of samples.

(iv) Analysis of samples.

(A) Preparation of samples. In preparation for analysis, each charcoal tube is scored with a file in front of the first section of charcoal and broken open. The glass wool is removed and discarded. The charcoal in the first (larger) section is transferred to a 2-ml vial. The separating section of foam is removed and discarded; the second section is transferred to another capped vial. These two sections are analyzed separately.

(B) Desorption of samples. Prior to analysis, 1.0 mL of desorbing solution is pipetted into each sample container. The desorbing solution consists of 0.05 uL internal standard per mL of carbon disulfide. The sample vials are capped as soon as the solvent is added. Desorption should be done for thirty minutes with occasional shaking.

(C) GC conditions. Typical operating conditions for the gas chromatograph are:

- (I) 30 mL/min (60 psig) helium carrier gas flow.
- (II) 30 mL/min (40 psig) hydrogen gas flow to detector.
- (III) 240 mL/min (40 psig) air flow to detector.
- (IV) 150°C injector temperature.
- (V) 250°C detector temperature.
- (VI) 100°C column temperature.

(D) Injection size. 1 µL.

(E) Measurement of area. The peak areas are measured by an electronic integrator or some other suitable form of area measurement.

(F) An internal standard procedure is used. The integrator is calibrated to report results in ppm for a ten liter air sample after correction for desorption efficiency.

(v) Determination of desorption efficiency.

(A) Importance of determination. The desorption efficiency of a particular compound can vary from one laboratory to another and from one lot of chemical to another. Thus, it is necessary to determine, at least once, the percentage of the specific compound that is removed in the desorption process, provided the same batch of charcoal is used.

(B) Procedure for determining desorption efficiency. The reference portion of the charcoal tube is removed. To the remaining portion, amounts representing 0.5X, 1X, and 2X and (X represents target concentration) based on a 10 L air sample are injected into several tubes at each level. Dilutions of benzene with carbon disulfide are made to allow injection of measurable quantities. These tubes are then allowed to equilibrate at least overnight. Following equilibration they are analyzed following the same procedure as the samples. Desorption efficiency is determined by dividing the amount of benzene found by amount spiked on the tube.

(f) Calibration and standards. A series of standards varying in concentration over the range of interest is prepared and analyzed under the same GC conditions that will be used on the samples. A calibration curve is prepared by plotting concentration (mg/mL) versus peak area.

(g) Calculations. Benzene air concentration can be calculated from the following equation:

$$\text{mg/m}^3 = (A)(B)/(C)(D)$$

Where: A = µg/mL benzene, obtained from the calibration curve

B = desorption volume (1 mL)

C = Liters of air sampled

D = desorption efficiency

The concentration in mg/m³ can be converted to ppm (at 25° C and 760 mm) with the following equation:

$$\text{ppm} = (\text{mg/m}^3)(24.46)/(78.11)$$

Where: 24.46 = molar volume of an ideal gas

25° C and 760 mm

78.11 = molecular weight of benzene

(h) Backup data.

(i) Detection limit-air samples.

The detection limit for the analytical procedure is 1.28 mg with a coefficient of variation of 0.023 at this level. This would be equivalent to an air concentration of 0.04 ppm for a 10 L air sample. This amount provided a chromatographic peak that could be identifiable in the presence of possible interferences. The detection limit data were obtained by making 1 µL injections of a 1.283 µg/mL standard.

Injection	Area Count	
1	655.4	$\bar{X} = 640.2$ $SD = 14.9$ $CV = 0.023$
2	617.5	
3	652.0	
4	641.1	
5	636.4	
6	629.2	

(ii) Pooled coefficient of variation-Air Samples. The pooled coefficient of variation for the analytical procedure was determined by 1 uL replicate injections of analytical standards. The standards were 16.04, 32.08, and 64.16 µg/mL, which are equivalent to 0.5, 1.0, and 2.0 ppm for a 10 L air sample respectively.

Injection	Area Counts		
	0.5 ppm	1.0 ppm	2.0 ppm
1	3996.5	8130.2	16481
2	4059.4	8235.6	16493
3	4052.0	8307.9	16535
4	4027.2	8253.2	16509
5	4046.8	8291.1	16552
6	4137.9	8288.8	16518
\bar{X} =	4053.3	8254.0	16548.3
SD=	47.2	62.5	97.1
CV=	0.0116	0.0076	0.0034
CV= 0.008.....			

(iii) Storage data-air samples.

Samples were generated at 1.03 ppm benzene at eighty percent relative humidity, 22° C, and 643 mm. All samples were taken for fifty minutes at 0.2 L/min. Six samples were analyzed immediately and the rest of the samples were divided into two groups by fifteen samples each. One group was stored at refrigerated temperature of -25° C, and the other group was stored at ambient temperature (approximately 23° C). These samples were analyzed over a period of fifteen days. The results are tabulated below.

PERCENT RECOVERY

Day Analyzed	Refrigerated			Ambient		
0	97.4	98.7	98.9	97.4	98.7	98.9
0	97.1	100.6	100.9*	97.1	100.6	100.9
2	95.8	96.4	95.4	95.4	96.6	96.9
5	93.9	93.7	92.4	92.4	94.3	94.1
9	93.6	95.5	94.6	95.2	95.6	95.6
13	94.3	95.3	93.7	91.0	95.0	94.6
15	96.8	95.8	94.2	92.9	96.3	95.9

(iv) Desorption data.

Samples were prepared by injecting liquid benzene onto the A section of charcoal tubes. Samples were prepared that would be equivalent to 0.5, 1.0, and 2.0 ppm for a 10 L air sample.

Sample	ppm		
	0.5 ppm	1.0 ppm	2.0 ppm
1	99.4	98.8	99.5
2	99.5	98.7	99.7
3	99.2	98.6	99.8
4	99.4	99.1	100.0
5	99.2	99.0	99.7
6	99.8	99.1	99.9
\bar{x} =	99.4	98.9	99.8
SD =	0.22	0.21	0.18
CV =	0.0022	0.0021	0.0018
\bar{x} = 99.4			

(v) Carbon disulfide.

Carbon disulfide from a number of sources was analyzed for benzene contamination. The results are given in the following table. The benzene contaminant can be removed with the procedures given in (d)(i) of this subsection.

SAMPLE	ug Benzene/mL	ppm equivalent
		(for 10 L air sample)
Aldrich Lot 83017.....	4.20	0.13
Baker Lot 720364.....	1.0†	0.03
Baker Lot 822351.....	1.0†	0.03
Malinkrodt Lot WEMP.....	1.74	0.05
Malinkrodt Lot WHGA.....	5.65	0.18
Treated CS ₂	2.90	0.09

(2) WISHA laboratory method for bulk samples.

Analyte: Benzene.

Matrix: Bulk samples.

Procedure: Bulk samples are analyzed directly by high performance liquid chromatography (HPLC) or by capillary gas chromatography. See laboratory manual for GC procedure.

Detection limits: 0.01% by volume.

(a) Principle of the method.

(i) An aliquot of the bulk sample to be analyzed is injected into a liquid chromatograph or gas chromatograph.

(ii) The peak area for benzene is determined and compared to areas obtained from standards.

(b) Advantages and disadvantages of the method.

(i) The analytical procedure is quick, sensitive, and reproducible.

(ii) Reanalysis of samples is possible.

(iii) Interferences can be circumvented by proper selection of HPLC parameters or GC parameters.

(iv) Samples must be free of any particulates that may clog the capillary tubing in the liquid chromatograph. This

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may require distilling the sample or clarifying with a clarification kit.

(c) Apparatus.

(i) Liquid chromatograph equipped with a UV detector or capillary gas chromatograph with FID detector.

(ii) HPLC column that will separate benzene from other components in the bulk sample being analyzed. The column used for validation studies was a Waters uBondapak C18, 30 cm x 3.9 mm.

(iii) A clarification kit to remove any particulates in the bulk if necessary.

(iv) A micro-distillation apparatus to distill any samples if necessary.

(v) An electronic integrator or some other suitable method of measuring peak areas.

(vi) Microliter syringes-10 uL syringe and other convenient sizes for making standards. 10 uL syringe for sample injections.

(vii) Volumetric flasks, 5 mL and other convenient sizes for preparing standards and making dilutions.

(d) Reagents.

(i) Benzene, reagent grade.

(ii) HPLC grade water, methyl alcohol, and isopropyl alcohol.

(e) Collection and shipment of samples.

(i) Samples should be transported in glass containers with Teflon-lined caps.

(ii) Samples should not be put in the same container used for air samples.

(f) Analysis of samples.

(i) Sample preparation.

If necessary, the samples are distilled or clarified. Samples are analyzed undiluted. If the benzene concentration is out of the working range, suitable dilutions are made with isopropyl alcohol.

(ii) HPLC conditions.

The typical operating conditions for the high performance liquid chromatograph are:

(A) Mobile phase-Methyl alcohol/water, 50/50.

(B) Analytical wavelength-254 nm.

(C) Injection size-10 µL.

(iii) Measurement of peak area and calibration.

Peak areas are measured by an integrator or other suitable means. The integrator is calibrated to report results % in benzene by volume.

(g) Calculations.

Since the integrator is programmed to report results in % benzene by volume in an undiluted sample, the following equation is used:

$$\% \text{ Benzene by Volume} = A \times B$$

Where: A = % by volume on report

B = Dilution Factor

(B = 1 for undiluted sample)

(h) Backup data.

(i) Detection limit-bulk samples.

The detection limit for the analytical procedure for bulk samples is 0.88 ug, with a coefficient or variation of 0.019 at this level. This amount provided a chromatographic peak that could be identifiable in the presence of possible interferences.

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The detection limit data were obtained by making 10 uL injections of a 0.10% by volume standard.

1	45386	$\bar{X} = 44040.1$ $SD = 852.5$ $CV = 0.019$
2	44214	
3	43822	
4	44062	
5	42724	

(ii) Pooled coefficient of variation-bulk samples.

The pooled coefficient of variation for analytical procedure was determined by 50 uL replicate injections of analytical standards. The standards were 0.01, 0.02, 0.04, 0.10, 1.0, and 2.0% benzene by volume.

Injection No.	0.01	0.02	0.04	0.10	1.0	2.0
1	45386	84737	166097	448497	4395380	9319150
2	44241	84300	170832	441239	4590800	9484900
3	43822	83835	164160	443719	4593200	9557580
4	44062	84381	164445	444082	4642350	9677060
5	44006	83012	168398	442564	4646430	9766240
6	42724	81957	173002	443975	4646260	.....
\bar{X}	44040.1	83703.6	167872	446149	4585767	9564986
SD	852.5	1042.2	3589.8	2459.1	96839.3	166233
CV	0.0194	0.0125	0.0213	0.0055	0.0211	0.0174
CV_p	0.017					

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WAC 296-62-07533 Appendix E qualitative and quantitative fit testing procedures. Fit test protocols.

(1) The employer shall include the following provisions in the fit test procedures. These provisions apply to both qualitative fit testing (QLFT) and quantitative fit testing (QNFT).

(a) The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least three sizes of elastomeric facepieces of the type of respirator that is to be tested, i.e., three sizes of half mask; or three sizes of full facepiece; and units from at least two manufacturers.

(b) Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a comfortable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

(c) The test subject shall be informed that he/she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

(d) The test subject shall be instructed to hold each facepiece up to the face and eliminate those which obviously do not give a comfortable fit.

(e) The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in (f) of this subsection. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

(f) Assessment of comfort shall include reviewing the following points with the test subject and allowing the test

subject adequate time to determine the comfort of the respirator:

- (i) Position of the mask on the nose;
 - (ii) Room for eye protection;
 - (iii) Room to talk; and
 - (iv) Position of mask on face and cheeks.
- (g) The following criteria shall be used to help determine the adequacy of the respirator fit:
- (i) Chin properly placed;
 - (ii) Adequate strap tension, not overly tightened;
 - (iii) Fit across nose bridge;
 - (iv) Respirator of proper size to span distance from nose to chin;
 - (v) Tendency of respirator to slip; and
 - (vi) Self-observation in mirror to evaluate fit and respirator position.

(h) The test subject shall conduct the negative and positive pressure fit checks as described below or ANSI Z88.2-1980. Before conducting the negative or positive pressure test, the subject shall be told to seat the mask on the face by moving the head from side-to-side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the fit check tests.

(i) Positive pressure test. Close off the exhalation valve and exhale gently onto the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

(ii) Negative pressure test. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

(i) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, or long sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

(j) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory disease or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(k) The test subject shall be given the opportunity to wear the successfully fitted respirator for a period of two weeks. If at any time during this period the respirator becomes uncomfortable, the test subject shall be given the opportunity to select a different facepiece and to be retested.

(l) The employer shall certify that a successful fit test has been administered to the employee. The certification shall include the following information:

- (i) Name of employee;
- (ii) Type, brand, and size of respirator; and

(iii) Date of test.

Where QNFT is used, the fit factor, strip chart, or other recording of the results of the test, shall be retained with the certification. The certification shall be maintained until the next fit test is administered.

(m) Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure. The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least five minutes before the start of the fit test.

(n) Test exercises. The test subject shall perform exercises, in the test environment, in the manner described below:

(i) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(ii) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as to not hyperventilate.

(iii) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(iv) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(v) Talking. The subject shall talk out loud slowly and loud enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from one hundred, or recite a memorized poem or song.

(vi) Grimace. The test subject shall grimace by smiling or frowning.

(vii) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(viii) Normal breathing. Same as exercise in (n)(i) of this subsection.

Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for fifteen seconds.

The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

(2) Qualitative fit test (QLFT) protocols.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator qualitative fit test program.

(ii) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and assure that test equipment is in proper working order.

(iii) The employer shall assure that QLFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

(b) Isoamyl acetate protocol.

(i) Odor threshold screening.

The odor threshold screening test, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate.

(A) Three one-liter glass jars with metal lids are required.

(B) Odor free water (e.g., distilled or spring water) at approximately twenty-five degrees C shall be used for the solutions.

(C) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor free water in a one liter jar and shaking for thirty seconds. A new solution shall be prepared at least weekly.

(D) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

(E) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor free water using a clean dropper or pipette. The solution shall be shaken for thirty seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(F) A test blank shall be prepared in a third jar by adding 500 cc of odor free water.

(G) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. Labels shall be placed on the lids so they can be periodically peeled, dried off, and switched to maintain the integrity of the test.

(H) The following instruction shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(I) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(J) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(K) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(ii) Isoamyl acetate fit test.

(A) The fit test chamber shall be similar to a clear fifty-five gallon drum liner suspended inverted over a two-foot diameter frame so that the top of the chamber is about six inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(B) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

(C) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(D) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(E) Upon entering the test chamber, the test subject shall be given a six-inch by five-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half and wetted with 0.75 cc of pure IAA. The test subject shall hand the wet towel on the hook at the top of the chamber.

(F) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the head exercises; or to demonstrate some of the exercises.

(G) If at any time during the test, the subject detects the banana like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(H) If the test has failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber and again begin the procedure described in (b)(ii)(A) through (G) of this subsection. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about five minutes before retesting. Odor sensitivity will usually have returned by this time.

(I) When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having the subject break the face seal and take a breath before exiting the chamber.

(J) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the test area from becoming contaminated, the used towels shall be kept in a self sealing bag so there is no significant IAA concentration build-up in the test chamber during subsequent tests.

(c) Saccharin solution aerosol protocol. The saccharin solution aerosol QLFT protocol is the only currently available, validated test protocol for use with particulate disposable dust respirators not equipped with high-efficiency filters. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(i) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(A) Threshold screening as well as fit testing subjects shall wear an enclosure about the head and shoulders that is

approximately twelve inches in diameter by fourteen inches tall with at least the front portion clear and that allows free movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts NZ FT 14 and NZ FT 15 combined, is adequate.

(B) The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(C) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her wide open mouth with tongue extended.

(D) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(E) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the fit test solution (see (c)(ii)(E) of this subsection) in 100 cc of distilled water.

(F) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(G) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(H) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(I) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(J) The test conductor will take note of the number of squeezes required to solicit a taste response.

(K) If the saccharin is not tasted after thirty squeezes (subitem (J)), the test subject may not perform the saccharin fit test.

(L) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(M) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

(N) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(ii) Saccharin solution aerosol fit test procedure.

(A) The test subject may not eat, drink (except plain water), or chew gum for fifteen minutes before the test.

(B) The fit test uses the same enclosure described in (c)(i) of this subsection.

(C) The test subject shall don the enclosure while wearing the respirator selected in (c)(i) of this subsection. The respirator shall be properly adjusted and equipped with a particulate filter(s).

(D) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(E) The fit test solution is prepared by adding eighty-three grams of sodium saccharin to 100 cc of warm water.

(F) As before, the test subject shall breathe through the open mouth with tongue extended.

(G) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same number of squeezes required to elicit a taste response in the screening test.

(H) After generating the aerosol the test subject shall be instructed to perform the exercises in subsection (1)(h) of this section.

(I) Every thirty seconds the aerosol concentration shall be replenished using one-half the number of squeezes as initially.

(J) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(K) If the taste of saccharin is detected, the fit is deemed unsatisfactory and a different respirator shall be tried.

(d) Irritant fume protocol.

(i) The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) filters.

(ii) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its characteristic odor.

(iii) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach one end of the smoke tube to a low flow air pump set to deliver two hundred milliliters per minute.

(iv) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

(v) The test conductor shall direct the stream of irritant smoke from the smoke tube towards the face seal area of the test subject. He/she shall begin at least twelve inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(vi) The exercises identified in subsection (1)(n) of this section shall be performed by the test subject while the respirator seal is being challenged by the smoke.

(vii) Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to evoke a response shall void the fit test.

(viii) The fit test shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agent.

(3) Quantitative fit test (QNFT) protocol.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator quantitative fit test program.

(ii) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and assure that test equipment is in proper working order.

(iii) The employer shall assure that QNFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

(b) Definitions.

(i) "Quantitative fit test." The test is performed in a test chamber. The normal air-purifying element of the respirator is replaced by a high-efficiency particulate air (HEPA) filter

in the case of particulate QNFT aerosols or a sorbent offering contaminant penetration protection equivalent to high-efficiency filters where the QNFT test agent is a gas or vapor.

(ii) "Challenge agent" means the aerosol, gas, or vapor introduced into a test chamber so that its concentration inside and outside the respirator may be measured.

(iii) "Test subject" means the person wearing the respirator for quantitative fit testing.

(iv) "Normal standing position" means standing erect and straight with arms down along the sides and looking straight ahead.

(v) "Maximum peak penetration method" means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(vi) "Average peak penetration method" means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers which calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(vii) "Fit factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

(c) Apparatus.

(i) Instrumentation. Aerosol generation, dilution, and measurement systems using corn oil or sodium chloride as test aerosols shall be used for quantitative fit testing.

(ii) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(iii) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate filter supplied by the same manufacturer.

(iv) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of the challenge agent concentration with each inspiration and expiration at fit factors of at least two thousand. Integrators or computers which integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(v) The combination of substitute air-purifying elements, challenge agent and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of an established exposure limit for the challenge agent at any time during the testing process.

(vi) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times and so

that there is no interference with the fit or performance of the respirator.

(vii) The test chamber and test set up shall permit the person administering the test to observe the test subject inside the chamber during the test.

(viii) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent inside the test chamber constant to within a ten percent variation for the duration of the test.

(ix) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event inside the test chamber and its being recorded.

(x) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(xi) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release.

(xii) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed fifty percent.

(xiii) The limitations of instrument detection shall be taken into account when determining the fit factor.

(xiv) Test respirators shall be maintained in proper working order and inspected for deficiencies such as cracks, missing valves and gaskets, etc.

(d) Procedural requirements.

(i) When performing the initial positive or negative pressure test the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these tests.

(ii) An abbreviated screening isoamyl acetate test or irritant fume test may be utilized in order to quickly identify poor fitting respirators which passed the positive and/or negative pressure test and thus reduce the amount of QNFT time. When performing a screening isoamyl acetate test, combination high-efficiency organic vapor cartridges/canisters shall be used.

(iii) A reasonably stable challenge agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain type of test units the determination of the challenge agent stability may be established after the test subject has entered the test environment.

(iv) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed five percent for a half mask or one percent for a full facepiece respirator.

(v) A stable challenge concentration shall be obtained prior to the actual start of testing.

(vi) Respirator restraining straps shall not be overtightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonable comfortable fit typical of normal use.

(vii) The test shall be terminated whenever any single peak penetration exceeds five percent for half masks and one percent for full facepiece respirators. The test subject shall be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(viii) In order to successfully complete a QNFT, three successful fit tests are required. The results of each of the three independent fit tests must exceed the minimum fit factor needed for the class of respirator (e.g., half mask respirator, full facepiece respirator).

(ix) Calculation of fit factors.

(A) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration inside the respirator.

(B) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and at the end of the test.

(C) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(I) Average peak concentration;

(II) Maximum peak concentration; or

(III) Integration by calculation of the area under the individual peak for each exercise. This includes computerized integration.

(x) Interpretation of test results. The fit factor established by the quantitative fit testing shall be the lowest of the three fit factor values calculated from the three required fit tests.

(xi) The test subject shall not be permitted to wear a half mask, or full facepiece respirator unless a minimum fit factor equivalent to at least ten times the hazardous exposure level is obtained.

(xii) Filters used for quantitative fit testing shall be replaced at least weekly, or whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily (when used) or sooner if there is any indication of breakthrough by a test agent.

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WAC 296-62-07540 Formaldehyde. (1) Scope and application. This standard applies to all occupational exposures to formaldehyde, i.e., from formaldehyde gas, its solutions, and materials that release formaldehyde.

(2) Definitions. For purposes of this standard, the following definitions shall apply:

(a) "Action level" means a concentration of 0.5 part formaldehyde per million parts of air (0.5 ppm) calculated as an 8-hour time-weighted average (TWA) concentration.

(b) "Approved" means approved by the director of the department of labor and industries or his/her authorized representative: *Provided, however*, That should a provision of this chapter state that approval by an agency or organization other than the department of labor and industries is required, such as Underwriters' Laboratories or the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health, the provision of WAC 296-24-006 shall apply.

(c) "Authorized person" means any person required by work duties to be present in regulated work areas, or authorized to do so by the employer, by this section of the standard, or by the WISHA Act.

(d) "Director" means the director of the department of labor and industries, or his/her designated representative.

(e) "Emergency" is any occurrence, such as but not limited to equipment failure, rupture of containers, or failure of control equipment that results in an uncontrolled release of a significant amount of formaldehyde.

(f) "Employee exposure" means the exposure to airborne formaldehyde which would occur without corrections for protection provided by any respirator that is in use.

(g) "Formaldehyde" means the chemical substance, HCHO, Chemical Abstracts Service Registry No. 50-00-0.

(3) Permissible exposure limit (PEL).

(a) TWA: The employer shall assure that no employee is exposed to an airborne concentration of formaldehyde which exceeds 0.75 part formaldehyde per million parts of air as an 8-hour TWA.

(b) Short term exposure limit (STEL): The employer shall assure that no employee is exposed to an airborne concentration of formaldehyde which exceeds two parts formaldehyde per million parts of air (2 ppm) as a fifteen-minute STEL.

(4) Exposure monitoring.

(a) General.

(i) Each employer who has a workplace covered by this standard shall monitor employees to determine their exposure to formaldehyde.

(ii) Exception. Where the employer documents, using objective data, that the presence of formaldehyde or formaldehyde-releasing products in the workplace cannot result in airborne concentrations of formaldehyde that would cause any employee to be exposed at or above the action level or the STEL under foreseeable conditions of use, the employer will not be required to measure employee exposure to formaldehyde.

(iii) When an employee's exposure is determined from representative sampling, the measurements used shall be representative of the employee's full shift or short-term exposure to formaldehyde, as appropriate.

(iv) Representative samples for each job classification in each work area shall be taken for each shift unless the employer can document with objective data that exposure levels for a given job classification are equivalent for different workshifts.

(b) Initial monitoring. The employer shall identify all employees who may be exposed at or above the action level or at or above the STEL and accurately determine the exposure of each employee so identified.

(i) Unless the employer chooses to measure the exposure of each employee potentially exposed to formaldehyde, the employer shall develop a representative sampling strategy and measure sufficient exposures within each job classification for each workshift to correctly characterize and not underestimate the exposure of any employee within each exposure group.

(ii) The initial monitoring process shall be repeated each time there is a change in production, equipment, process, personnel, or control measures which may result in new or additional exposure to formaldehyde.

(iii) If the employer receives reports or signs or symptoms of respiratory or dermal conditions associated with

formaldehyde exposure, the employer shall promptly monitor the affected employee's exposure.

(c) Periodic monitoring.

(i) The employer shall periodically measure and accurately determine exposure to formaldehyde for employees shown by the initial monitoring to be exposed at or above the action level or at or above the STEL.

(ii) If the last monitoring results reveal employee exposure at or above the action level, the employer shall repeat monitoring of the employees at least every six months.

(iii) If the last monitoring results reveal employee exposure at or above the STEL, the employer shall repeat monitoring of the employees at least once a year under worst conditions.

(d) Termination of monitoring. The employer may discontinue periodic monitoring for employees if results from two consecutive sampling periods taken at least seven days apart show that employee exposure is below the action level and the STEL. The results must be statistically representative and consistent with the employer's knowledge of the job and work operation.

(e) Accuracy of monitoring. Monitoring shall be accurate, at the ninety-five percent confidence level, to within plus or minus twenty-five percent for airborne concentrations of formaldehyde at the TWA and the STEL and to within plus or minus thirty-five percent for airborne concentrations of formaldehyde at the action level.

(f) Employee notification of monitoring results. Within fifteen days of receiving the results of exposure monitoring conducted under this standard, the employer shall notify the affected employees of these results. Notification shall be in writing, either by distributing copies of the results to the employees or by posting the results. If the employee exposure is over either PEL, the employer shall develop and implement a written plan to reduce employee exposure to or below both PELs, and give written notice to employees. The written notice shall contain a description of the corrective action being taken by the employer to decrease exposure.

(g) Observation of monitoring.

(i) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to formaldehyde required by this standard.

(ii) When observation of the monitoring of employee exposure to formaldehyde requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the clothing and equipment to the observer, require the observer to use such clothing and equipment, and assure that the observer complies with all other applicable safety and health procedures.

(5) Regulated areas.

(a) The employer shall establish regulated areas where the concentration of airborne formaldehyde exceeds either the TWA or the STEL and post all entrances and accessways with signs bearing the following information:

DANGER
 FORMALDEHYDE
 IRRITANT AND POTENTIAL CANCER HAZARD
 AUTHORIZED PERSONNEL ONLY

(b) The employer shall limit access to regulated areas to authorized persons who have been trained to recognize the hazards of formaldehyde.

(c) An employer at a multi-employer worksite who establishes a regulated area shall communicate the access restrictions and locations of these areas to other employers with work operations at that worksite.

(6) Methods of compliance.

(a) Engineering controls and work practices. The employer shall institute engineering and work practice controls to reduce and maintain employee exposures to formaldehyde at or below the TWA and the STEL.

(b) Exception. Whenever the employer has established that feasible engineering and work practice controls cannot reduce employee exposure to or below either of the PELs, the employer shall apply these controls to reduce employee exposures to the extent feasible and shall supplement them with respirators which satisfy this standard.

(7) Respiratory protection.

(a) General. Where respiratory protection is required, the employer shall provide the respirators at no cost to the employee and shall assure that they are properly used. The respirators shall comply with the requirements of this standard and shall reduce the concentration of formaldehyde inhaled by the employee to at or below both the TWA and the STEL. Respirators shall be used in the following circumstances:

(i) During the interval necessary to install or implement feasible engineering and work practice controls;

(ii) In work operations, such as maintenance and repair activities or vessel cleaning, for which the employer establishes that engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the PELs; and

(iv) In emergencies.

(b) Respirator selection.

(i) The appropriate respirators as specified in Table 1 shall be selected from those approved by the Mine Safety and Health Administration (MSHA) and by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(ii) The employer shall make available a powered air-purifying respirator adequate to protect against formaldehyde exposure to any employee who experiences difficulty wearing a negative-pressure respirator to reduce exposure to formaldehyde.

(c) Respirator usage.

(i) Whenever respirator use is required by this standard, the employer shall institute a respiratory protection program in accordance with WAC 296-62-07109, 296-62-07111, 296-62-07115, and 296-62-07117.

(ii) The employer shall perform either quantitative or qualitative face fit tests in accordance with the procedures outlined in Appendix E at the time of initial fitting and at least

annually thereafter for all employees required by this standard to wear negative-pressure respirators.

(A) Respirators selected shall be from those exhibiting the best facepiece fit.

(B) No respirator shall be chosen that would potentially permit the employee to inhale formaldehyde at concentrations in excess of either the TWA or the STEL.

TABLE 1
 MINIMUM REQUIREMENTS FOR RESPIRATORY PROTECTION
 AGAINST FORMALDEHYDE

Condition of use or formaldehyde concentration (ppm)	Minimum respirator required ¹
Up to 7.5 ppm (10 x PEL)	Full facepiece with cartridges or canisters specifically approved for protection against formaldehyde ² .
Up to 75 ppm (100 x PEL)	Full-face mask with chin style or chest or back mounted type industrial size canister specifically approved for protection against formaldehyde. Type C supplied-air respirator pressure demand or continuous flow type, with full facepiece, hood, or helmet.
Above 75 ppm or unknown (emergencies) (100 x PEL)	Self-contained breathing apparatus (SCBA) with positive-pressure full facepiece. Combination supplied-air, full facepiece positive-pressure respirator with auxiliary self-contained air supply.
Fire fighting	SCBA with positive-pressure in full facepiece.
Escape	SCBA in demand or pressure demand mode. Full-face mask with chin style or front or back mounted type industrial size canister specifically approved for protection against formaldehyde.

¹ Respirators specified for use at higher concentrations may be used at lower concentrations.

² A half-mask respirator with cartridges specifically approved for protection against formaldehyde can be substituted for the full facepiece respirator providing that effective gas-proof goggles are provided and used in combination with the half-mask respirator.

(iii) Where air-purifying chemical cartridge respirators are used, the cartridges shall be replaced after three hours of use or at the end of the workshift, whichever is sooner unless the cartridge contains a NIOSH-approved end-of-service indicator to show when breakthrough occurs.

(iv) Unless the canister contains a NIOSH-approved end-of-service life indicator to show when breakthrough occurs, canisters used in atmospheres up to 7.5 ppm (10 x PEL) shall be replaced every four hours and industrial sized canisters used in atmospheres up to 75 ppm (100 x PEL) shall be replaced every two hours or at the end of the workshift, whichever is sooner.

(v) Employers shall permit employees to leave the work area to wash their faces and respirator facepieces as needed to prevent skin irritation from respirator use.

(8) Protective equipment and clothing. Employers shall comply with the provisions of WAC 296-24-07501 and 296-

24-07801. When protective equipment or clothing is provided under these provisions, the employer shall provide these protective devices at no cost to the employee and assure that the employee wears them.

(a) Selection. The employer shall select protective clothing and equipment based upon the form of formaldehyde to be encountered, the conditions of use, and the hazard to be prevented.

(i) All contact of the eyes and skin with liquids containing one percent or more formaldehyde shall be prevented by the use of chemical protective clothing made of material impervious to formaldehyde and the use of other personal protective equipment, such as goggles and face shields, as appropriate to the operation.

(ii) Contact with irritating or sensitizing materials shall be prevented to the extent necessary to eliminate the hazard.

(iii) Where a face shield is worn, chemical safety goggles are also required if there is a danger of formaldehyde reaching the area of the eye.

(iv) Full body protection shall be worn for entry into areas where concentrations exceed 100 ppm and for emergency reentry into areas of unknown concentration.

(b) Maintenance of protective equipment and clothing.

(i) The employer shall assure that protective equipment and clothing that has become contaminated with formaldehyde is cleaned or laundered before its reuse.

(ii) When ventilating formaldehyde-contaminated clothing and equipment, the employer shall establish a storage area so that employee exposure is minimized. Containers for contaminated clothing and equipment and storage areas shall have labels and signs containing the following information:

DANGER

**FORMALDEHYDE-CONTAMINATED (CLOTHING) EQUIPMENT
AVOID INHALATION AND SKIN CONTACT**

(iii) The employer shall assure that only persons trained to recognize the hazards of formaldehyde remove the contaminated material from the storage area for purposes of cleaning, laundering, or disposal.

(iv) The employer shall assure that no employee takes home equipment or clothing that is contaminated with formaldehyde.

(v) The employer shall repair or replace all required protective clothing and equipment for each affected employee as necessary to assure its effectiveness.

(vi) The employer shall inform any person who launders, cleans, or repairs such clothing or equipment of formaldehyde's potentially harmful effects and of procedures to safely handle the clothing and equipment.

(9) Hygiene protection.

(a) The employer shall provide change rooms, as described in WAC 296-24-120 for employees who are required to change from work clothing into protective clothing to prevent skin contact with formaldehyde.

(b) If employees' skin may become splashed with solutions containing one percent or greater formaldehyde, for example because of equipment failure or improper work practices, the employer shall provide conveniently located quick drench showers and assure that affected employees use these facilities immediately.

(c) If there is any possibility that an employee's eyes may be splashed with solutions containing 0.1 percent or greater formaldehyde, the employer shall provide acceptable eye-wash facilities within the immediate work area for emergency use.

(10) Housekeeping. For operations involving formaldehyde liquids or gas, the employer shall conduct a program to detect leaks and spills, including regular visual inspections.

(a) Preventative maintenance of equipment, including surveys for leaks, shall be undertaken at regular intervals.

(b) In work areas where spillage may occur, the employer shall make provisions to contain the spill, to decontaminate the work area, and to dispose of the waste.

(c) The employer shall assure that all leaks are repaired and spills are cleaned promptly by employees wearing suitable protective equipment and trained in proper methods for cleanup and decontamination.

(d) Formaldehyde-contaminated waste and debris resulting from leaks or spills shall be placed for disposal in sealed containers bearing a label warning of formaldehyde's presence and of the hazards associated with formaldehyde.

(11) Emergencies. For each workplace where there is the possibility of an emergency involving formaldehyde, the employer shall assure appropriate procedures are adopted to minimize injury and loss of life. Appropriate procedures shall be implemented in the event of an emergency.

(12) Medical surveillance.

(a) Employees covered.

(i) The employer shall institute medical surveillance programs for all employees exposed to formaldehyde at concentrations at or exceeding the action level or exceeding the STEL.

(ii) The employer shall make medical surveillance available for employees who develop signs and symptoms of overexposure to formaldehyde and for all employees exposed to formaldehyde in emergencies. When determining whether an employee may be experiencing signs and symptoms of possible overexposure to formaldehyde, the employer may rely on the evidence that signs and symptoms associated with formaldehyde exposure will occur only in exceptional circumstances when airborne exposure is less than 0.1 ppm and when formaldehyde is present in materials in concentrations less than 0.1 percent.

(b) Examination by a physician. All medical procedures, including administration of medical disease questionnaires, shall be performed by or under the supervision of a licensed physician and shall be provided without cost to the employee, without loss of pay, and at a reasonable time and place.

(c) Medical disease questionnaire. The employer shall make the following medical surveillance available to employees prior to assignment to a job where formaldehyde exposure is at or above the action level or above the STEL and annually thereafter. The employer shall also make the following medical surveillance available promptly upon determining that an employee is experiencing signs and symptoms indicative of possible overexposure to formaldehyde.

(i) Administration of a medical disease questionnaire, such as in Appendix D, which is designed to elicit information on work history, smoking history, any evidence of eye,

nose, or throat irritation; chronic airway problems or hyperactive airway disease; allergic skin conditions or dermatitis; and upper or lower respiratory problems.

(ii) A determination by the physician, based on evaluation of the medical disease questionnaire, of whether a medical examination is necessary for employees not required to wear respirators to reduce exposure to formaldehyde.

(d) Medical examinations. Medical examinations shall be given to any employee who the physician feels, based on information in the medical disease questionnaire, may be at increased risk from exposure to formaldehyde and at the time of initial assignment and at least annually thereafter to all employees required to wear a respirator to reduce exposure to formaldehyde. The medical examination shall include:

(i) A physical examination with emphasis on evidence of irritation or sensitization of the skin and respiratory system, shortness of breath, or irritation of the eyes.

(ii) Laboratory examinations for respirator wearers consisting of baseline and annual pulmonary function tests. As a minimum, these tests shall consist of forced vital capacity (FVC), forced expiratory volume in one second (FEV1), and forced expiratory flow (FEF).

(iii) Any other test which the examining physician deems necessary to complete the written opinion.

(iv) Counseling of employees having medical conditions that would be directly or indirectly aggravated by exposure to formaldehyde on the increased risk of impairment of their health.

(e) Examinations for employees exposed in an emergency. The employer shall make medical examinations available as soon as possible to all employees who have been exposed to formaldehyde in an emergency.

(i) The examination shall include a medical and work history with emphasis on any evidence of upper or lower respiratory problems, allergic conditions, skin reaction or hypersensitivity, and any evidence of eye, nose, or throat irritation.

(ii) Other examinations shall consist of those elements considered appropriate by the examining physician.

(f) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this standard and Appendices A, C, D, and E;

(ii) A description of the affected employee's job duties as they relate to the employee's exposure to formaldehyde;

(iii) The representative exposure level for the employee's job assignment;

(iv) Information concerning any personal protective equipment and respiratory protection used or to be used by the employee; and

(v) Information from previous medical examinations of the affected employee within the control of the employer.

(vi) In the event of a nonroutine examination because of an emergency, the employer shall provide to the physician as soon as possible: A description of how the emergency occurred and the exposure the victim may have received.

(g) Physician's written opinion.

(i) For each examination required under this standard, the employer shall obtain a written opinion from the examining physician. This written opinion shall contain the results of

the medical examination except that it shall not reveal specific findings or diagnoses unrelated to occupational exposure to formaldehyde. The written opinion shall include:

(A) The physician's opinion as to whether the employee has any medical condition that would place the employee at an increased risk of material impairment of health from exposure to formaldehyde;

(B) Any recommended limitations on the employee's exposure or changes in the use of personal protective equipment, including respirators;

(C) A statement that the employee has been informed by the physician of any medical conditions which would be aggravated by exposure to formaldehyde, whether these conditions may have resulted from past formaldehyde exposure or from exposure in an emergency, and whether there is a need for further examination or treatment.

(ii) The employer shall provide for retention of the results of the medical examination and tests conducted by the physician.

(iii) The employer shall provide a copy of the physician's written opinion to the affected employee within fifteen days of its receipt.

(h) Medical removal.

(i) The provisions of this subdivision apply when an employee reports significant irritation of the mucosa of the eyes or of the upper airways, respiratory sensitization, dermal irritation, or dermal sensitization attributed to workplace formaldehyde exposure. Medical removal provisions do not apply in case of dermal irritation or dermal sensitization when the product suspected of causing the dermal condition contains less than 0.05% formaldehyde.

(ii) An employee's report of signs or symptoms of possible overexposure to formaldehyde shall be evaluated by a physician selected by the employer pursuant to (c) of this subsection. If the physician determines that a medical examination is not necessary under (c)(ii) of this subsection, there shall be a two-week evaluation and remediation period to permit the employer to ascertain whether the signs or symptoms subside untreated or with the use of creams, gloves, first aid treatment, or personal protective equipment. Industrial hygiene measures that limit the employee's exposure to formaldehyde may also be implemented during this period. The employee shall be referred immediately to a physician prior to expiration of the two-week period if the signs or symptoms worsen. Earnings, seniority, and benefits may not be altered during the two-week period by virtue of the report.

(iii) If the signs or symptoms have not subsided or been remedied by the end of the two-week period, or earlier if signs or symptoms warrant, the employee shall be examined by a physician selected by the employer. The physician shall presume, absent contrary evidence, that observed dermal irritation or dermal sensitization are not attributable to formaldehyde when products to which the affected employee is exposed contain less than 0.1% formaldehyde.

(iv) Medical examinations shall be conducted in compliance with the requirements of (e)(i) and (ii) of this subsection. Additional guidelines for conducting medical exams are contained in WAC 296-62-07546, Appendix C.

(v) If the physician finds that significant irritation of the mucosa of the eyes or the upper airways, respiratory sensi-

zation, dermal irritation, or dermal sensitization result from workplace formaldehyde exposure and recommends restrictions or removal. The employer shall promptly comply with the restrictions or recommendations of removal. In the event of a recommendation of removal, the employer shall remove the affected employee from the current formaldehyde exposure and if possible, transfer the employee to work having no or significantly less exposure to formaldehyde.

(vi) When an employee is removed pursuant to item (v) of this subdivision, the employer shall transfer the employee to comparable work for which the employee is qualified or can be trained in a short period (up to six months), where the formaldehyde exposures are as low as possible, but not higher than the action level. The employer shall maintain the employee's current earnings, seniority, and other benefits. If there is no such work available, the employer shall maintain the employee's current earnings, seniority, and other benefits until such work becomes available, until the employee is determined to be unable to return to workplace formaldehyde exposure, until the employee is determined to be able to return to the original job status, or for six months, whichever comes first.

(vii) The employer shall arrange for a follow-up medical examination to take place within six months after the employee is removed pursuant to this subsection. This examination shall determine if the employee can return to the original job status, or if the removal is to be permanent. The physician shall make a decision within six months of the date the employee was removed as to whether the employee can be returned to the original job status, or if the removal is to be permanent.

(viii) An employer's obligation to provide earnings, seniority, and other benefits to a removed employee may be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program or from employment with another employer made possible by virtue of the employee's removal.

(ix) In making determinations of the formaldehyde content of materials under this subsection the employer may rely on objective data.

(i) Multiple physician review.

(i) After the employer selects the initial physician who conducts any medical examination or consultation to determine whether medical removal or restriction is appropriate, the employee may designate a second physician to review any findings, determinations, or recommendations of the initial physician and to conduct such examinations, consultations, and laboratory tests as the second physician deems necessary and appropriate to evaluate the effects of formaldehyde exposure and to facilitate this review.

(ii) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation for the purpose of medical removal or restriction.

(iii) The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen days after receipt of the notification of the right to seek a second medi-

cal opinion, or receipt of the initial physician's written opinion, whichever is later:

(A) The employee informs the employer of the intention to seek a second medical opinion; and

(B) The employee initiates steps to make an appointment with a second physician.

(iv) If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve the disagreement. If the two physicians are unable to quickly resolve their disagreement, then the employer and the employee through their respective physicians shall designate a third physician who shall be a specialist in the field at issue:

(A) To review the findings, determinations, or recommendations of the prior physicians; and

(B) To conduct such examinations, consultations, laboratory tests, and discussions with prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(v) In the alternative, the employer and the employee or authorized employee representative may jointly designate such third physician.

(vi) The employer shall act consistent with the findings, determinations, and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(13) Hazard communication.

(a) General. Notwithstanding any exemption granted in WAC 296-62-05403 (6)(c) for wood products, each employer who has a workplace covered by this standard shall comply with the requirements of WAC 296-62-05409 through 296-62-05419. The definitions of the hazard communication standard shall apply under this standard.

(i) The following shall be subject to the hazard communication requirements of this section: Formaldehyde gas, all mixtures or solutions composed of greater than 0.1 percent formaldehyde, and materials capable of releasing formaldehyde into the air under reasonably foreseeable concentrations reaching or exceeding 0.1 ppm.

(ii) As a minimum, specific health hazards that the employer shall address are: Cancer, irritation and sensitization of the skin and respiratory system, eye and throat irritation, and acute toxicity.

(b) Manufacturers and importers who produce or import formaldehyde or formaldehyde-containing products shall provide downstream employers using or handling these products with an objective determination through the required labels and MSDSs if these items may constitute a health hazard within the meaning of WAC 296-62-05407 under normal conditions of use.

(c) Labels.

(i) The employer shall assure that hazard warning labels complying with the requirements of WAC 296-62-05411 are affixed to all containers of materials listed in (a)(i) of this subsection, except to the extent that (a)(i) of this subsection is inconsistent with this item.

(ii) Information on labels. As a minimum, for all materials listed in (a)(i) of this subsection, capable of releasing

formaldehyde at levels of 0.1 ppm to 0.5 ppm, labels shall identify that the product contains formaldehyde: List the name and address of the responsible party; and state that physical and health hazard information is readily available from the employer and from material safety data sheets.

(iii) For materials listed in (a)(i) of this subsection, capable of releasing formaldehyde at levels above 0.5 ppm, labels shall appropriately address all the hazards as defined in Part C, WAC 296-62-054 through 296-62-05425, and Appendices A and B, including respiratory sensitization, and shall contain the words "Potential Cancer Hazard."

(iv) In making the determinations of anticipated levels of formaldehyde release, the employer may rely on objective data indicating the extent of potential formaldehyde release under reasonably foreseeable conditions of use.

(v) Substitute warning labels. The employer may use warning labels required by other statutes, regulations, or ordinances which impart the same information as the warning statements required by this subitem.

(d) Material safety data sheets.

(i) Any employer who uses formaldehyde-containing materials listed in (a)(i) of this subsection shall comply with the requirements of WAC 296-62-05413 with regard to the development and updating of material safety data sheets.

(ii) Manufacturers, importers, and distributors of formaldehyde containing materials listed in (a)(i) of this subsection shall assure that material safety data sheets and updated information are provided to all employers purchasing such materials at the time of the initial shipment and at the time of the first shipment after a material safety data sheet is updated.

(e) Written hazard communication program. The employer shall develop, implement, and maintain at the workplace, a written hazard communication program for formaldehyde exposures in the workplace, which at a minimum describes how the requirements specified in this section for labels and other forms of warning and material safety data sheets, and subsection (14) of this section for employee information and training, will be met. Employees in multi-employer workplaces shall comply with the requirements of WAC 296-62-05409 (2)(b).

(14) Employee information and training.

(a) Participation. The employer shall assure that all employees who are assigned to workplaces where there is a health hazard from formaldehyde participate in a training program, except that where the employer can show, using objective data, that employees are not exposed to formaldehyde at or above 0.1 ppm, the employer is not required to provide training.

(b) Frequency. Employers shall provide such information and training to employees at the time of their initial assignment and whenever a new exposure to formaldehyde is introduced into their work area. The training shall be repeated at least annually.

(c) Training program. The training program shall be conducted in a manner which the employee is able to understand and shall include:

(i) A discussion of the contents of this regulation and the contents of the material safety data sheet;

(ii) The purpose for and a description of the medical surveillance program required by this standard, including:

(A) A description of the potential health hazards associated with exposure to formaldehyde and a description of the signs and symptoms of exposure to formaldehyde.

(B) Instructions to immediately report to the employer the development of any adverse signs or symptoms that the employee suspects is attributable to formaldehyde exposure.

(iii) Description of operations in the work area where formaldehyde is present and an explanation of the safe work practices appropriate for limiting exposure to formaldehyde in each job;

(iv) The purpose for, proper use of, and limitations of personal protective clothing and equipment;

(v) Instructions for the handling of spills, emergencies, and clean-up procedures;

(vi) An explanation of the importance of engineering and work practice controls for employee protection and any necessary instruction in the use of these controls; and

(vii) A review of emergency procedures including the specific duties or assignments of each employee in the event of an emergency.

(d) Access to training materials.

(i) The employer shall inform all affected employees of the location of written training materials and shall make these materials readily available, without cost, to the affected employees.

(ii) The employer shall provide, upon request, all training materials relating to the employee training program to the director of labor and industries, or his/her designated representative.

(15) Recordkeeping.

(a) Exposure measurements. The employer shall establish and maintain an accurate record of all measurements taken to monitor employee exposure to formaldehyde. This record shall include:

(i) The date of measurement;

(ii) The operation being monitored;

(iii) The methods of sampling and analysis and evidence of their accuracy and precision;

(iv) The number, durations, time, and results of samples taken;

(v) The types of protective devices worn; and

(vi) The names, job classifications, Social Security numbers, and exposure estimates of the employees whose exposures are represented by the actual monitoring results.

(b) Exposure determinations. Where the employer has determined that no monitoring is required under this standard, the employer shall maintain a record of the objective data relied upon to support the determination that no employee is exposed to formaldehyde at or above the action level.

(c) Medical surveillance. The employer shall establish and maintain an accurate record for each employee subject to medical surveillance under this standard. This record shall include:

(i) The name and Social Security number of the employee;

(ii) The physician's written opinion;

(iii) A list of any employee health complaints that may be related to exposure to formaldehyde; and

(iv) A copy of the medical examination results, including medical disease questionnaires and results of any medical tests required by the standard or mandated by the examining physician.

(d) Respirator fit testing.

(i) The employer shall establish and maintain accurate records for employees subject to negative-pressure respirator fit testing required by this standard.

(ii) This record shall include:

(A) A copy of the protocol selected for respirator fit testing;

(B) A copy of the results of any fit testing performed;

(C) The size and manufacturer of the types of respirators available for selection; and

(D) The date of the most recent fit testing, the name and Social Security number of each tested employee, and the respirator type and facepiece selected.

(e) Record retention. The employer shall retain records required by this standard for at least the following periods:

(i) Exposure records and determinations shall be kept for at least thirty years;

(ii) Medical records shall be kept for the duration of employment plus thirty years; and

(iii) Respirator fit testing records shall be kept until replaced by a more recent record.

(f) Availability of records.

(i) Upon request, the employer shall make all records maintained as a requirement of this standard available for examination and copying to the director of labor and industries, or his/her designated representative.

(ii) The employer shall make employee exposure records, including estimates made from representative monitoring and available upon request for examination and copying, to the subject employee, or former employee, and employee representatives in accordance with WAC 296-62-052 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(iii) Employee medical records required by this standard shall be provided upon request for examination and copying, to the subject employee, or former employee, or to anyone having the specific written consent of the subject employee or former employee in accordance with WAC 296-62-05201 through 296-62-05209, and 296-62-05213 through 296-62-05217.

[Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07540, filed 7/20/94, effective 9/20/94; 92-23-017 (Order 92-13), § 296-62-07540, filed 11/10/92, effective 12/18/92; 91-11-070 (Order 91-01), § 296-62-07540, filed 5/20/91, effective 6/20/91; 90-03-029 (Order 89-20), § 296-62-07540, filed 1/11/90, effective 2/26/90; 88-21-002 (Order 88-23), § 296-62-07540, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07542 Appendix A—Substance technical guideline for formalin. (1) The following substance technical guideline for formalin provides information on uninhibited formalin solution (thirty-seven percent formaldehyde, no methanol stabilizer). It is designed to inform employees at the production level of their rights and duties under the formaldehyde standard whether their job title defines them as workers or supervisors. Much of the information provided is general; however, some information is specific for formalin. When employee exposure to formaldehyde

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is from resins capable of releasing formaldehyde, the resin itself and other impurities or decomposition products may also be toxic, and employers should include this information as well when informing employees of the hazards associated with the materials they handle. The precise hazards associated with exposure to formaldehyde depend both on the form (solid, liquid, or gas) of the material and the concentration of formaldehyde present. For example, thirty-seven to fifty percent solutions of formaldehyde present a much greater hazard to the skin and eyes from spills or splashes than solutions containing less than one percent formaldehyde. Individual substance technical guidelines used by the employer for training employees should be modified to properly give information on the material actually being used.

(a) Substance identification.

(i) Chemical name: Formaldehyde.

(ii) Chemical family: Aldehyde.

(iii) Chemical formula: HCHO.

(iv) Molecular weight: 30.03.

(v) Chemical abstracts service number (CAS number): 50-00-0.

Synonyms: Formalin; Formic Aldehyde; Paraform; Formol; Formalin (Methanol-free); Fyde; Formalith; Methanal; Methyl Aldehyde; Methylene Glycol; Methylene Oxide; Tetraoxymethalene; Oxomethane; Oxymethylene.

(b) Components and contaminants.

(i) Percent: 37.0 Formaldehyde.

(ii) Percent: 63.0 water.

Note: Inhibited solutions contain methanol.

(iii) Other contaminants: Formic acid (alcohol free).

Exposure limits:

(A) WISHA TWA-0.75 ppm.

(B) WISHA STEL-2 ppm.

(c) Physical data.

(i) Description: Colorless liquid, pungent odor.

(ii) Boiling point: 214°F (101°C).

(iii) Specific gravity: 1.08 (H₂O = 1 @ 20 C).

(iv) pH: 2.8-4.0.

(v) Solubility in water: Miscible.

(vi) Solvent solubility: Soluble in alcohol and acetone.

(vii) Vapor density: 1.04 (Air = 1 @ 20 C).

(viii) Odor threshold: 0.8-1 ppm.

(d) Fire and explosion hazard.

(i) Moderate fire and explosion hazard when exposed to heat or flame.

(ii) The flash point of thirty-seven percent formaldehyde solutions is above normal room temperature, but the explosion range is very wide, from seven to seventy-three percent by volume in air.

(iii) Reaction of formaldehyde with nitrogen dioxide, nitromethane, perchloric acid and aniline, or peroxyformic acid yields explosive compounds.

(iv) Flash point: 185°F (85°C) closed cup.

(v) Lower explosion limit: Seven percent.

(vi) Upper explosion limit: Seventy-three percent.

(vii) Autoignition temperature: 806°F (430°C).

(viii) Flammable class (WISHA): III A.

Extinguishing media:

(I) Use dry chemical, "alcohol foam," carbon dioxide, or

water in flooding amounts as fog. Solid streams may not be effective. Cool fire-exposed containers with water from side until well after fire is out.

(II) Use of water spray to flush spills can also dilute the spill to produce nonflammable mixtures. Water runoff, however, should be contained for treatment.

(ix) National Fire Protection Association Section 325M Designation:

(A) Health: 2-Materials hazardous to health, but areas may be entered with full-faced mask self-contained breathing apparatus which provides eye protection.

(B) Flammability: 2-Materials which must be moderately heated before ignition will occur. Water spray may be used to extinguish the fire because the material can be cooled below its flash point.

(C) Reactivity: D-Materials which (in themselves) are normally stable even under fire exposure conditions and which are not reactive with water. Normal fire fighting procedures may be used.

(e) Reactivity.

(i) Stability: Formaldehyde solutions may self-polymerize to form paraformaldehyde which precipitates.

(ii) Incompatibility (materials to avoid):

(A) Strong oxidizing agents, caustics, strong alkalis, isocyanates, anhydrides, oxides, and inorganic acids.

(B) Formaldehyde reacts with hydrochloric acid to form the potent carcinogen, bis-chloromethyl ether. Formaldehyde reacts with nitrogen dioxide, nitromethane, perchloric acid and aniline, or peroxyformic acid to yield explosive compounds. A violent reaction occurs when formaldehyde is mixed with strong oxidizers.

(C) Hazardous combustion or decomposition products: Oxygen from the air can oxidize formaldehyde to formic acid, especially when heated. Formic acid is corrosive.

(f) Health hazard data.

(i) Acute effects of exposure.

(A) Ingestion (swallowing): Liquids containing ten to forty percent formaldehyde cause severe irritation and inflammation of the mouth, throat, and stomach. Severe stomach pains will follow ingestion with possible loss of consciousness and death. Ingestion of dilute formaldehyde solutions (0.03-0.04%) may cause discomfort in the stomach and pharynx.

(B) Inhalation (breathing):

(I) Formaldehyde is highly irritating to the upper respiratory tract and eyes. Concentrations of 0.5 to 2.0 ppm may irritate the eyes, nose, and throat of some individuals.

(II) Concentrations of 3 to 5 ppm also cause tearing of the eyes and are intolerable to some persons.

(III) Concentrations of 10 to 20 ppm cause difficulty in breathing, burning of the nose and throat, coughing, and heavy tearing of the eyes, and 25 to 30 ppm causes severe respiratory tract injury leading to pulmonary edema and pneumonitis. A concentration of 100 ppm is immediately dangerous to life and health. Deaths from accidental exposure to high concentrations of formaldehyde have been reported.

(C) Skin (dermal): Formalin is a severe skin irritant and a sensitizer. Contact with formalin causes white discoloration, smarting, drying, cracking, and scaling. Prolonged and repeated contact can cause numbness and a hardening or tan-

ning of the skin. Previously exposed persons may react to future exposure with an allergic eczematous dermatitis or hives.

(D) Eye contact: Formaldehyde solutions splashed in the eye can cause injuries ranging from transient discomfort to severe, permanent corneal clouding and loss of vision. The severity of the effect depends on the concentration of formaldehyde in the solution and whether or not the eyes are flushed with water immediately after the accident.

Note: The perception of formaldehyde by odor and eye irritation becomes less sensitive with time as one adapts to formaldehyde. This can lead to overexposure if a worker is relying on formaldehyde's warning properties to alert him or her to the potential for exposure.

(E) Acute animal toxicity:

(I) Oral, rats: LD50 = 800 mg/kg.

(II) Oral, mouse: LD50 = 42 mg/kg.

(III) Inhalation, rats: LC50 = 250 mg/kg.

(IV) Inhalation, mouse: LC50 = 900 mg/kg.

(V) Inhalation, rats: LC50 = 590 mg/kg.

(g) Chronic effects of exposure.

(i) Carcinogenicity: Formaldehyde has the potential to cause cancer in humans. Repeated and prolonged exposure increases the risk. Various animal experiments have conclusively shown formaldehyde to be a carcinogen in rats. In humans, formaldehyde exposure has been associated with cancers of the lung, nasopharynx and oropharynx, and nasal passages.

(ii) Mutagenicity: Formaldehyde is genotoxic in several in vitro test systems showing properties of both an initiator and a promoter.

(iii) Toxicity: Prolonged or repeated exposure to formaldehyde may result in respiratory impairment. Rats exposed to formaldehyde at 2 ppm developed benign nasal tumors and changes of the cell structure in the nose as well as inflamed mucous membranes of the nose. Structural changes in the epithelial cells in the human nose have also been observed. Some persons have developed asthma or bronchitis following exposure to formaldehyde, most often as the result of an accidental spill involving a single exposure to a high concentration of formaldehyde.

(h) Emergency and first-aid procedures.

(i) Ingestion (swallowing): If the victim is conscious, dilute, inactivate, or absorb the ingested formaldehyde by giving milk, activated charcoal, or water. Any organic material will inactivate formaldehyde. Keep affected person warm and at rest. Get medical attention immediately. If vomiting occurs, keep head lower than hips.

(ii) Inhalation (breathing): Remove the victim from the exposure area to fresh air immediately. Where the formaldehyde concentration may be very high, each rescuer must put on a self-contained breathing apparatus before attempting to remove the victim, and medical personnel should be informed of the formaldehyde exposure immediately. If breathing has stopped, give artificial respiration. Keep the affected person warm and at rest. Qualified first-aid or medical personnel should administer oxygen, if available, and maintain the patient's airways and blood pressure until the victim can be transported to a medical facility. If exposure results in a highly irritated upper respiratory tract and cough-

ing continues for more than ten minutes, the worker should be hospitalized for observation and treatment.

(iii) Skin contact: Remove contaminated clothing (including shoes) immediately. Wash the affected area of your body with soap or mild detergent and large amounts of water until no evidence of the chemical remains (at least fifteen to twenty minutes). If there are chemical burns, get first aid to cover the area with sterile, dry dressing, and bandages. Get medical attention if you experience appreciable eye or respiratory irritation.

(iv) Eye contact: Wash the eyes immediately with large amounts of water occasionally lifting lower and upper lids, until no evidence of chemical remains (at least fifteen to twenty minutes). In case of burns, apply sterile bandages loosely without medication. Get medical attention immediately. If you have experienced appreciable eye irritation from a splash or excessive exposure, you should be referred promptly to an ophthalmologist for evaluation.

(i) Emergency procedures.

(i) Emergencies:

(A) If you work in an area where a large amount of formaldehyde could be released in an accident or from equipment failure, your employer must develop procedures to be followed in event of an emergency. You should be trained in your specific duties in the event of an emergency, and it is important that you clearly understand these duties. Emergency equipment must be accessible and you should be trained to use any equipment that you might need. Formaldehyde contaminated equipment must be cleaned before reuse.

(B) If a spill of appreciable quantity occurs, leave the area quickly unless you have specific emergency duties. Do not touch spilled material. Designated persons may stop the leak and shut off ignition sources if these procedures can be done without risk. Designated persons should isolate the hazard area and deny entry except for necessary people protected by suitable protective clothing and respirators adequate for the exposure. Use water spray to reduce vapors. Do not smoke, and prohibit all flames or flares in the hazard area.

(ii) Special fire fighting procedures:

(A) Learn procedures and responsibilities in the event of a fire in your workplace.

(B) Become familiar with the appropriate equipment and supplies and their location.

(C) In fire fighting, withdraw immediately in case of rising sound from venting safety device or any discoloration of storage tank due to fire.

(j) Spill, leak, and disposal procedures.

(i) Occupational spill: For small containers, place the leaking container in a well ventilated area. Take up small spills with absorbent material and place the waste into properly labeled containers for later disposal. For larger spills, dike the spill to minimize contamination and facilitate salvage or disposal. You may be able to neutralize the spill with sodium hydroxide or sodium sulfite. Your employer must comply with EPA rules regarding the clean-up of toxic waste and notify state and local authorities, if required. If the spill is greater than 1,000 lb/day, it is reportable under EPA's superfund legislation.

(ii) Waste disposal: Your employer must dispose of waste containing formaldehyde in accordance with applica-

ble local, state, and federal law and in a manner that minimizes exposure of employees at the site and of the clean-up crew.

(k) Monitoring and measurement procedures.

(i) Monitoring requirements: If your exposure to formaldehyde exceeds the 0.5 ppm action level or the 2 ppm STEL, your employer must monitor your exposure. Your employer need not measure every exposure if a "high exposure" employee can be identified. This person usually spends the greatest amount of time nearest the process equipment. If you are a "representative employee," you will be asked to wear a sampling device to collect formaldehyde. This device may be a passive badge, a sorbent tube attached to a pump, or an impinger containing liquid. You should perform your work as usual, but inform the person who is conducting the monitoring of any difficulties you are having wearing the device.

(ii) Evaluation of 8-hour exposure: Measurements taken for the purpose of determining time-weighted average (TWA) exposures are best taken with samples covering the full shift. Samples collected must be taken from the employee's breathing zone air.

(iii) Short-term exposure evaluation: If there are tasks that involve brief but intense exposure to formaldehyde, employee exposure must be measured to assure compliance with the STEL. Sample collections are for brief periods, only fifteen minutes, but several samples may be needed to identify the peak exposure.

(iv) Monitoring techniques: WISHA's only requirement for selecting a method for sampling and analysis is that the methods used accurately evaluate the concentration of formaldehyde in employees' breathing zones. Sampling and analysis may be performed by collection of formaldehyde on liquid or solid sorbents with subsequent chemical analysis. Sampling and analysis may also be performed by passive diffusion monitors and short-term exposure may be measured by instruments such as real-time continuous monitoring systems and portable direct reading instruments.

(v) Notification of results: Your employer must inform you of the results of exposure monitoring representative of your job. You may be informed in writing, but posting the results where you have ready access to them constitutes compliance with the standard.

(l) Protective equipment and clothing.

(Material impervious to formaldehyde is needed if the employee handles formaldehyde solutions of one percent or more. Other employees may also require protective clothing or equipment to prevent dermatitis.)

(i) Respiratory protection:

(A) Use NIOSH-approved full facepiece negative pressure respirators equipped with approved cartridges or canisters within the use limitations of these devices. (Present restrictions on cartridges and canisters do not permit them to be used for a full workshift.) In all other situations, use positive pressure respirators such as the positive-pressure air purifying respirator or the self-contained breathing apparatus (SCBA).

(B) If you use a negative pressure respirator, your employer must provide you with fit testing of the respirator at least once a year in accordance with the procedures outlined in WAC 296-62-07550 Appendix E.

(ii) Protective gloves:

(A) Wear protective (impervious) gloves provided by your employer, at no cost, to prevent contact with formalin.

(B) Your employer should select these gloves based on the results of permeation testing and in accordance with the ACGIH guidelines for selection of chemical protective clothing.

(iii) Eye protection:

(A) If you might be splashed in the eyes with formalin, it is essential that you wear goggles or some other type of complete protection for the eye.

(B) You may also need a face shield if your face is likely to be splashed with formalin, but you must not substitute face shields for eye protection. (This section pertains to formaldehyde solutions of one percent or more.)

(iv) Other protective equipment:

(A) You must wear protective (impervious) clothing and equipment provided by your employer at no cost to prevent repeated or prolonged contact with formaldehyde liquids.

(B) If you are required to change into whole-body chemical protective clothing, your employer must provide a change room for your privacy and for storage of your normal clothing.

(C) If you are splashed with formaldehyde, use the emergency showers and eyewash fountains provided by your employer immediately to prevent serious injury. Report the incident to your supervisor and obtain necessary medical support.

(2) Entry into an IDLH atmosphere. Enter areas where the formaldehyde concentration might be 100 ppm or more only with complete body protection including a self-contained breathing apparatus with a full facepiece operated in a positive pressure mode or a supplied-air respirator with full facepiece and operated in a positive pressure mode. This equipment is essential to protect your life and health under such extreme conditions.

(a) Engineering controls.

(i) Ventilation is the most widely applied engineering control method for reducing the concentration of airborne substances in the breathing zones of workers. There are two distinct types of ventilation.

(ii) Local exhaust: Local exhaust ventilation is designed to capture airborne contaminants as near to the point of generation as possible. To protect you, the direction of contaminant flow must always be toward the local exhaust system inlet and away from you.

(iii) General (mechanical):

(A) General dilution ventilation involves continuous introduction of fresh air into the workroom to mix with the contaminated air and lower your breathing zone concentration of formaldehyde. Effectiveness depends on the number of air changes per hour.

(B) Where devices emitting formaldehyde are spread out over a large area, general dilution ventilation may be the only practical method of control.

(iv) Work practices: Work practices and administrative procedures are an important part of a control system. If you are asked to perform a task in a certain manner to limit your exposure to formaldehyde, it is extremely important that you follow these procedures.

(b) Medical surveillance.

(i) Medical surveillance helps to protect employees' health. You are encouraged strongly to participate in the medical surveillance program.

(ii) Your employer must make a medical surveillance program available at no expense to you and at a reasonable time and place if you are exposed to formaldehyde at concentrations above 0.5 ppm as an 8-hour average or 2 ppm over any fifteen-minute period.

(A) You will be offered medical surveillance at the time of your initial assignment and once a year afterward as long as your exposure is at least 0.5 ppm (action level) or 2 ppm (STEL).

(B) Even if your exposure is below these levels, you should inform your employer if you have signs and symptoms that you suspect, through your training, are related to your formaldehyde exposure because you may need medical surveillance to determine if your health is being impaired by your exposure.

(iii) The surveillance plan includes:

(A) A medical disease questionnaire.

(B) A physical examination if the physician determines this is necessary.

(iv) If you are required to wear a respirator, your employer must offer you a physical examination and a pulmonary function test every year.

(v) The physician must collect all information needed to determine if you are at increased risk from your exposure to formaldehyde. At the physician's discretion, the medical examination may include other tests, such as a chest x-ray, to make this determination.

(vi) After a medical examination the physician will provide your employer with a written opinion which includes any special protective measures recommended and any restrictions on your exposure. The physician must inform you of any medical conditions you have which would be aggravated by exposure to formaldehyde. All records from your medical examinations, including disease surveys, must be retained at your employer's expense.

(c) Emergencies.

(i) If you are exposed to formaldehyde in an emergency and develop signs or symptoms associated with acute toxicity from formaldehyde exposure, your employer must provide you with a medical examination as soon as possible.

(ii) This medical examination will include all steps necessary to stabilize your health.

(iii) You may be kept in the hospital for observation if your symptoms are severe to ensure that any delayed effects are recognized and treated.

[Statutory Authority: Chapter 49.17 RCW, 94-15-096 (Order 94-07), § 296-62-07542, filed 7/20/94, effective 9/20/94; 92-23-017 (Order 92-13), § 296-62-07542, filed 11/10/92, effective 12/18/92; 88-21-002 (Order 88-23), § 296-62-07542, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07544 Appendix B—Sampling strategy and analytical methods for formaldehyde. (1) To protect the health of employees, exposure measurements must be unbiased and representative of employee exposure. The proper measurement of employee exposure requires more than a token commitment on the part of the employer. WISHA's mandatory requirements establish a baseline; under

the best of circumstances all questions regarding employee exposure will be answered. Many employers, however, will wish to conduct more extensive monitoring before undertaking expensive commitments, such as engineering controls, to assure that the modifications are truly necessary. The following sampling strategy, which was developed at NIOSH by Nelson A. Leidel, Kenneth A. Busch, and Jeremiah R. Lynch and described in NIOSH publication No. 77-173 (Occupational Exposure Sampling Strategy Manual) will assist the employer in developing a strategy for determining the exposure of his or her employees.

(2) There is no one correct way to determine employee exposure. Obviously, measuring the exposure of every employee exposed to formaldehyde will provide the most information on any given day. Where few employees are exposed, this may be a practical solution. For most employers, however, use of the following strategy will give just as much information at less cost.

(3) Exposure data collected on a single day will not automatically guarantee the employer that his or her workplace is always in compliance with the formaldehyde standard. This does not imply, however, that it is impossible for an employer to be sure that his or her worksite is in compliance with the standard. Indeed, a properly designed sampling strategy showing that all employees are exposed below the PELs, at least with a ninety-five percent certainty, is compelling evidence that the exposure limits are being achieved provided that measurements are conducted using valid sampling strategy and approved analytical methods.

(4) There are two PELs, the TWA concentration and the STEL.

(a) Most employers will find that one of these two limits is more critical in the control of their operations, and WISHA expects that the employer will concentrate monitoring efforts on the critical component.

(b) If the more difficult exposure is controlled, this information, along with calculations to support the assumptions, should be adequate to show that the other exposure limit is also being achieved.

(5) Sampling strategy.

(a) Determination of the need for exposure measurements.

(b) The employer must determine whether employees may be exposed to concentrations in excess of the action level. This determination becomes the first step in an employee exposure monitoring program that minimizes employer sampling burdens while providing adequate employee protection.

(c) If employees may be exposed above the action level, the employer must measure exposure. Otherwise, an objective determination that employee exposure is low provides adequate evidence that exposure potential has been examined.

(d) The employer should examine all available relevant information, e.g., insurance company and trade association data and information from suppliers or exposure data collected from similar operations.

(e) The employer may also use previously-conducted sampling including area monitoring. The employer must

make a determination relevant to each operation although this need not be on a separate piece of paper.

(f) If the employer can demonstrate conclusively that no employee is exposed above the action level or the STEL through the use of objective data, the employer need proceed no further on employee exposure monitoring until such time that conditions have changed and the determination is no longer valid.

(g) If the employer cannot determine that employee exposure is less than the action level and the STEL, employee exposure monitoring will have to be conducted.

(6) Workplace material survey.

(a) The primary purpose of a survey of raw material is to determine if formaldehyde is being used in the work environment and if so, the conditions under which formaldehyde is being used.

(b) The first step is to tabulate all situations where formaldehyde is used in a manner such that it may be released into the workplace atmosphere or contaminate the skin. This information should be available through analysis of company records and information on the MSDSs available through provisions of this standard and the hazard communication standard.

(c) If there is an indication from materials handling records and accompanying MSDSs that formaldehyde is being used in the following types of processes or work operations, there may be a potential for releasing formaldehyde into the workplace atmosphere:

(i) Any operation that involves grinding, sanding, sawing, cutting, crushing, screening, sieving, or any other manipulation of material that generates formaldehyde-bearing dust.

(ii) Any processes where there have been employee complaints or symptoms indicative of exposure to formaldehyde.

(iii) Any liquid or spray process involving formaldehyde.

(iv) Any process that uses formaldehyde in preserved tissue.

(v) Any process that involves the heating of a formaldehyde-bearing resin.

Processes and work operations that use formaldehyde in these manners will probably require further investigation at the worksite to determine the extent of employee monitoring that should be conducted.

(7) Workplace observations.

(a) To this point, the only intention has been to provide an indication as to the existence of potentially exposed employees. With this information, a visit to the workplace is needed to observe work operations, to identify potential health hazards, and to determine whether any employees may be exposed to hazardous concentrations of formaldehyde.

(b) In many circumstances, sources of formaldehyde can be identified through the sense of smell. However, this method of detection should be used with caution because of olfactory fatigue.

(c) Employee location in relation to source of formaldehyde is important in determining if an employee may be significantly exposed to formaldehyde. In most instances, the closer a worker is to the source, the higher the probability that a significant exposure will occur.

(d) Other characteristics should be considered. Certain high temperature operations give rise to higher evaporation rates. Locations of open doors and windows provide natural ventilation that tend to dilute formaldehyde emissions. General room ventilation also provides a measure of control.

(8) Calculation of potential exposure concentrations.

(a) By knowing the ventilation rate in a workplace and the quantity of formaldehyde generated, the employer may be able to determine by calculation if the PELs might be exceeded.

(b) To account for poor mixing of formaldehyde into the entire room, locations of fans and proximity of employees to the work operation, the employer must include a safety factor.

(c) If an employee is relatively close to a source, particularly if he or she is located downwind, a safety factor of one hundred may be necessary.

(d) For other situations, a factor of ten may be acceptable. If the employer can demonstrate through such calculations that employee exposure does not exceed the action level or the STEL, the employer may use this information as objective data to demonstrate compliance with the standard.

(9) Sampling strategy.

(a) Once the employer determines that there is a possibility of substantial employee exposure to formaldehyde, the employer is obligated to measure employee exposure.

(b) The next step is selection of a maximum risk employee. When there are different processes where employees may be exposed to formaldehyde, a maximum risk employee should be selected for each work operation.

(c) Selection of the maximum risk employee requires professional judgment. The best procedure for selecting the maximum risk employee is to observe employees and select the person closest to the source of formaldehyde. Employee mobility may affect this selection; e.g., if the closest employee is mobile in his tasks, he may not be the maximum risk employee. Air movement patterns and differences in work habits will also affect selection of the maximum risk employee.

(d) When many employees perform essentially the same task, a maximum risk employee cannot be selected. In this circumstance, it is necessary to resort to random sampling of the group of workers. The objective is to select a subgroup of adequate size so that there is a high probability that the random sample will contain at least one worker with high exposure if one exists. The number of persons in the group influences the number that need to be sampled to ensure that at least one individual from the highest ten percent exposure group is contained in the sample. For example, to have ninety percent confidence in the results, if the group size is ten, nine should be sampled; for fifty, only eighteen need to be sampled.

(e) If measurement shows exposure to formaldehyde at or above the action level or the STEL, the employer needs to identify all other employees who may be exposed at or above the action level or STEL and measure or otherwise accurately characterize the exposure of these employees.

(f) Whether representative monitoring or random sampling are conducted, the purpose remains the same to determine if the exposure of any employee is above the action

level. If the exposure of the most exposed employee is less than the action level and the STEL, regardless of how the employee is identified, then it is reasonable to assume that measurements of exposure of the other employees in that operation would be below the action level and the STEL.

(10) Exposure measurements.

(a) There is no "best" measurement strategy for all situations. Some elements to consider in developing a strategy are:

(i) Availability and cost of sampling equipment;

(ii) Availability and cost of analytic facilities;

(iii) Availability and cost of personnel to take samples;

(iv) Location of employees and work operations;

(v) Intraday and interday variations in the process;

(vi) Precision and accuracy of sampling and analytic methods; and

(vii) Number of samples needed.

(b) Samples taken for determining compliance with the STEL differ from those that measure the TWA concentration in important ways. STEL samples are best taken in a nonrandom fashion using all available knowledge relating to the area, the individual, and the process to obtain samples during periods of maximum expected concentrations. At least three measurements on a shift are generally needed to spot gross errors or mistakes; however, only the highest value represents the STEL.

(c) If an operation remains constant throughout the workshift, a much greater number of samples would need to be taken over the thirty-two discrete nonoverlapping periods in an 8-hour workshift to verify compliance with a STEL. If employee exposure is truly uniform throughout the workshift, however, an employer in compliance with the 1 ppm TWA would be in compliance with the 2 ppm STEL, and this determination can probably be made using objective data.

(11) Need to repeat the monitoring strategy.

(a) Interday and intraday fluctuations in employee exposure are mostly influenced by the physical processes that generate formaldehyde and the work habits of the employee. Hence, in-plant process variations influence the employer's determination of whether or not additional controls need to be imposed. Measurements that employee exposure is low on a day that is not representative of worst conditions may not provide sufficient information to determine whether or not additional engineering controls should be installed to achieve the PELs.

(b) The person responsible for conducting sampling must be aware of systematic changes which will negate the validity of the sampling results. Systematic changes in formaldehyde exposure concentration for an employee can occur due to:

(i) The employee changing patterns of movement in the workplace;

(ii) Closing of plant doors and windows;

(iii) Changes in ventilation from season to season;

(iv) Decreases in ventilation efficiency or abrupt failure of engineering control equipment; and

(v) Changes in the production process or work habits of the employee.

(c) Any of these changes, if they may result in additional exposure that reaches the next level of action (i.e., 0.5 or 1.0 ppm as an 8-hour average or 2 ppm over fifteen minutes)

require the employer to perform additional monitoring to reassess employee exposure.

(d) A number of methods are suitable for measuring employee exposure to formaldehyde or for characterizing emissions within the worksite. The preamble to this standard describes some methods that have been widely used or subjected to validation testing. A detailed analytical procedure derived from the WISHA Method A.C.R.O. for acrolein and formaldehyde is presented below for informational purposes.

(e) Inclusion of WISHA's method in this appendix in no way implies that it is the only acceptable way to measure employee exposure to formaldehyde. Other methods that are free from significant interferences and that can determine formaldehyde at the permissible exposure limits within ± 25 percent of the "true" value at the ninety-five percent confidence level are also acceptable. Where applicable, the method should also be capable of measuring formaldehyde at the action level to ± 35 percent of the "true" value with a ninety-five percent confidence level. WISHA encourages employers to choose methods that will be best for their individual needs. The employer must exercise caution, however, in choosing an appropriate method since some techniques suffer from interferences that are likely to be present in workplaces of certain industry sectors where formaldehyde is used.

(12) WISHA's analytical laboratory method.

A.C.R.O. (also use methods F.O.R.M. and F.O.R.M. 2 when applicable).

(a) Matrix: Air.

(b) Target concentration: 1 ppm (1.2 mg/m³).

(c) Procedures: Air samples are collected by drawing known volumes of air through sampling tubes containing XAD-2 adsorbent which have been coated with 2-(hydroxymethyl) piperidine. The samples are desorbed with toluene and then analyzed by gas chromatography using a nitrogen selective detector.

(d) Recommended sampling rate and air volumes: 0.1 L/min and 24 L.

(e) Reliable quantitation limit: 16 ppb (20 ug/m³).

(f) Standard error of estimate at the target concentration: 7.3%.

(g) Status of the method: A sampling and analytical method that has been subjected to the established evaluation procedures of the organic methods evaluation branch.

(h) Date: March, 1985.

(13) General discussion.

(a) Background: The current WISHA method for collecting acrolein vapor recommends the use of activated 13X molecular sieves. The samples must be stored in an ice bath during and after sampling and also they must be analyzed within forty-eight hours of collection. The current WISHA method for collecting formaldehyde vapor recommends the use of bubblers containing ten percent methanol in water as the trapping solution.

(b) This work was undertaken to resolve the sample stability problems associated with acrolein and also to eliminate the need to use bubblers to sample formaldehyde. A goal of this work was to develop and/or to evaluate a common sampling and analytical procedure for acrolein and formaldehyde.

(c) NIOSH has developed independent methodologies for acrolein and formaldehyde which recommend the use of reagent-coated adsorbent tubes to collect the aldehydes as stable derivatives. The formaldehyde sampling tubes contain Chromosorb 102 adsorbent coated with N-benzylethanolamine (BEA) which reacts with formaldehyde vapor to form a stable oxazolidine compound. The acrolein sampling tubes contain XAD-2 adsorbent coated with 2-(hydroxymethyl) piperidine (2-HMP) which reacts with acrolein vapor to form a different, stable oxazolidine derivative. Acrolein does not appear to react with BEA to give a suitable reaction product. Therefore, the formaldehyde procedure cannot provide a common method for both aldehydes. However, formaldehyde does react with 2-HMP to form a very suitable reaction product. It is the quantitative reaction of acrolein and formaldehyde with 2-HMP that provides the basis for this evaluation.

(d) This sampling and analytical procedure is very similar to the method recommended by NIOSH for acrolein. Some changes in the NIOSH methodology were necessary to permit the simultaneous determination of both aldehydes and also to accommodate WISHA laboratory equipment and analytical techniques.

(14) Limit-defining parameters: The analyte air concentrations reported in this method are based on the recommended air volume for each analyte collected separately and a desorption volume of 1 mL. The amounts are presented as acrolein and/or formaldehyde, even though the derivatives are the actual species analyzed.

(15) Detection limits of the analytical procedure: The detection limit of the analytical procedure was 386 pg per injection for formaldehyde. This was the amount of analyte which gave a peak whose height was about five times the height of the peak given by the residual formaldehyde derivative in a typical blank front section of the recommended sampling tube.

(16) Detection limits of the overall procedure: The detection limits of the overall procedure were 482 ng per sample (16 ppb or 20 ug/m³ for formaldehyde). This was the amount of analyte spiked on the sampling device which allowed recoveries approximately equal to the detection limit of the analytical procedure.

(17) Reliable quantitation limits:

(a) The reliable quantitation limit was 482 ng per sample (16 ppb or 20 ug/m³) for formaldehyde. These were the smallest amounts of analyte which could be quantitated within the limits of a recovery of at least seventy-five percent and a precision (± 1.96 SD) of $\pm 25\%$ or better.

(b) The reliable quantitation limit and detection limits reported in the method are based upon optimization of the instrument for the smallest possible amount of analyte. When the target concentration of an analyte is exceptionally higher than these limits, they may not be attainable at the routine operating parameters.

(18) Sensitivity: The sensitivity of the analytical procedure over concentration ranges representing 0.4 to 2 times the target concentration, based on the recommended air volumes, was seven thousand five hundred eighty-nine area units per ug/mL for formaldehyde. This value was determined from

the slope of the calibration curve. The sensitivity may vary with the particular instrument used in the analysis.

(19) Recovery: The recovery of formaldehyde from samples used in an eighteen-day storage test remained above ninety-two percent when the samples were stored at ambient temperature. These values were determined from regression lines which were calculated from the storage data. The recovery of the analyte from the collection device must be at least seventy-five percent following storage.

(20) Precision (analytical method only): The pooled coefficient of variation obtained from replicate determinations of analytical standards over the range of 0.4 to 2 times the target concentration was 0.0052 for formaldehyde ((d)(C)(iii) of this subsection).

(21) Precision (overall procedure): The precision at the ninety-five percent confidence level for the ambient temperature storage tests was $\pm 14.3\%$ for formaldehyde. These values each include an additional $\pm 5\%$ for sampling error. The overall procedure must provide results at the target concentrations that are $\pm 25\%$ at the ninety-five percent confidence level.

(22) Reproducibility: Samples collected from controlled test atmospheres and a draft copy of this procedure were given to a chemist unassociated with this evaluation. The formaldehyde samples were analyzed following fifteen days storage. The average recovery was 96.3% and the standard deviation was 1.7%.

(23) Advantages:

(a) The sampling and analytical procedures permit the simultaneous determination of acrolein and formaldehyde.

(b) Samples are stable following storage at ambient temperature for at least eighteen days.

(24) Disadvantages: None.

(25) Sampling procedure.

(a) Apparatus:

(i) Samples are collected by use of a personal sampling pump that can be calibrated to within $\pm 5\%$ of the recommended 0.1 L/min sampling rate with the sampling tube in line.

(ii) Samples are collected with laboratory prepared sampling tubes. The sampling tube is constructed of silane treated glass and is about 8-cm long. The ID is 4 mm and the OD is 6 mm. One end of the tube is tapered so that a glass wool end plug will hold the contents of the tube in place during sampling. The other end of the sampling tube is open to its full 4-mm ID to facilitate packing of the tube. Both ends of the tube are fire-polished for safety. The tube is packed with a 75-mg backup section, located nearest the tapered end and a 150-mg sampling section of pretreated XAD-2 adsorbent which has been coated with 2-HMP. The two sections of coated adsorbent are separated and retained with small plugs of silanized glass wool. Following packing, the sampling tubes are sealed with two 7/32 inch OD plastic end caps. Instructions for the pretreatment and the coating of XAD-2 adsorbent are presented in (d) of this subsection.

(b) Sampling tubes, similar to those recommended in this method, are marketed by Supelco, Inc. These tubes were not available when this work was initiated; therefore, they were not evaluated.

(26) Reagents: None required.

(27) Technique:

(a) Properly label the sampling tube before sampling and then remove the plastic end caps.

(b) Attach the sampling tube to the pump using a section of flexible plastic tubing such that the large, front section of the sampling tube is exposed directly to the atmosphere. Do not place any tubing ahead of the sampling tube. The sampling tube should be attached in the worker's breathing zone in a vertical manner such that it does not impede work performance.

(c) After sampling for the appropriate time, remove the sampling tube from the pump and then seal the tube with plastic end caps.

(d) Include at least one blank for each sampling set. The blank should be handled in the same manner as the samples with the exception that air is not drawn through it.

(e) List any potential interferences on the sample data sheet.

(28) Breakthrough:

(a) Breakthrough was defined as the relative amount of analyte found on a backup sample in relation to the total amount of analyte collected on the sampling train.

(b) For formaldehyde collected from test atmospheres containing six times the PEL, the average five percent breakthrough air volume was 41 L. The sampling rate was 0.1 L/min and the average mass of formaldehyde collected was 250 ug.

(29) Desorption efficiency: No desorption efficiency corrections are necessary to compute air sample results because analytical standards are prepared using coated adsorbent. Desorption efficiencies were determined, however, to investigate the recoveries of the analytes from the sampling device. The average recovery over the range of 0.4 to 2 times the target concentration, based on the recommended air volumes, was 96.2% for formaldehyde. Desorption efficiencies were essentially constant over the ranges studied.

(30) Recommended air volume and sampling rate:

(a) The recommended air volume for formaldehyde is 24 L.

(b) The recommended sampling rate is 0.1 L/min.

(31) Interferences:

(a) Any collected substance that is capable of reacting with 2-HMP and thereby depleting the derivatizing agent is a potential interference. Chemicals which contain a carbonyl group, such as acetone, may be capable of reacting with 2-HMP.

(b) There are no other known interferences to the sampling method.

(32) Safety precautions:

(a) Attach the sampling equipment to the worker in such a manner that it will not interfere with work performance or safety.

(b) Follow all safety practices that apply to the work area being sampled.

(33) Analytical procedure.

(a) Apparatus:

(i) A gas chromatograph (GC), equipped with a nitrogen selective detector. A Hewlett-Packard model 5840A GC fitted with a nitrogen phosphorus flame ionization detector (NPD) was used for this evaluation. Injections were per-

formed using a Hewlett-Packard model 7671A automatic sampler.

(ii) A GC column capable of resolving the analytes from any interference. A 6 ft x 1/4 in OD (2mm ID) glass GC column containing 10% UCON 50-HB-5100+ 2% KOH on 80/100 mesh Chromosorb W-AW was used for the evaluation. Injections were performed on-column.

(iii) Vials, glass 2-mL with Teflon-lined caps.

(iv) Volumetric flasks, pipets, and syringes for preparing standards, making dilutions, and performing injections.

(b) Reagents:

(i) Toluene and dimethylformamide. Burdick and Jackson solvents were used in this evaluation.

(ii) Helium, hydrogen, and air, GC grade.

(iii) Formaldehyde, thirty-seven percent by weight, in water. Aldrich Chemical, ACS Reagent Grade formaldehyde was used in this evaluation.

(iv) Amberlite XAD-2 adsorbent coated with 2-(hydroxymethyl) piperidine (2-HMP), 10% by weight ((d) of this subsection).

(v) Desorbing solution with internal standard. This solution was prepared by adding 20 uL of dimethylformamide to 100 mL of toluene.

(c) Standard preparation:

(i) Formaldehyde: Prepare stock standards by diluting known volumes of thirty-seven percent formaldehyde solution with methanol. A procedure to determine the formaldehyde content of these standards is presented in (d) of this subsection. A standard containing 7.7 mg/mL formaldehyde was prepared by diluting 1 mL of the thirty-seven percent reagent to 50 mL with methanol.

(ii) It is recommended that analytical standards be prepared about sixteen hours before the air samples are to be analyzed in order to ensure the complete reaction of the analytes with 2-HMP. However, rate studies have shown the reaction to be greater than ninety-five percent complete after four hours. Therefore, one or two standards can be analyzed after this reduced time if sample results are outside the concentration range of the prepared standards.

(iii) Place 150-mg portions of coated XAD-2 adsorbent, from the same lot number as used to collect the air samples, into each of several glass 2-mL vials. Seal each vial with a Teflon-lined cap.

(iv) Prepare fresh analytical standards each day by injecting appropriate amounts of the diluted analyte directly onto 150-mg portions of coated adsorbent. It is permissible to inject both acrolein and formaldehyde on the same adsorbent portion. Allow the standards to stand at room temperature. A standard, approximately the target levels, was prepared by injecting 11 uL of the acrolein and 12 uL of the formaldehyde stock standards onto a single coated XAD-2 adsorbent portion.

(v) Prepare a sufficient number of standards to generate the calibration curves. Analytical standard concentrations should bracket sample concentrations. Thus, if samples are not in the concentration range of the prepared standards, additional standards must be prepared to determine detector response.

(vi) Desorb the standards in the same manner as the samples following the sixteen-hour reaction time.

(d) Sample preparation:

(i) Transfer the 150-mg section of the sampling tube to a 2-mL vial. Place the 75-mg section in a separate vial. If the glass wool plugs contain a significant number of adsorbent beads, place them with the appropriate sampling tube section. Discard the glass wool plugs if they do not contain a significant number of adsorbent beads.

(ii) Add 1 mL of desorbing solution to each vial.

(iii) Seal the vials with Teflon-lined caps and then allow them to desorb for one hour. Shake the vials by hand with vigorous force several times during the desorption time.

(iv) Save the used sampling tubes to be cleaned and recycled.

(e) Analysis:

(f) GC conditions.

(34) Column temperature:

(a) Bi-level temperature program.

(i) First level: 100°C to 140°C at 4°C/min following completion of the first level.

(ii) Second level: 140°C to 180°C at 20°C/min following completion of the first level.

(b) Isothermal period: Hold column at 180°C until the recorder pen returns to baseline (usually about twenty-five minutes after injection).

(c) Injector temperature: 180°C.

(d) Helium flow rate: 30 mL/min (detector response will be reduced if nitrogen is substituted for helium carrier gas).

(e) Injection volume: 51 0.8 uL.

(f) GC column: Six-ft x 1/4-in OD (2 mm ID) glass GC column containing 10% UCON 50-HB-5100NZG651 +512% KOH on 80/100 Chromosorb W-AW.

(g) NPD conditions:

(i) Hydrogen flow rate: 3 mL/min.

(ii) Air flow rate: 50 mL/min.

(h) Detector temperature: 275 5151C.

(i) Use a suitable method, such as electronic integration, to measure detector response.

(ii) Use an internal standard method to prepare the calibration curve with several standard solutions of different concentrations. Prepare the calibration curve daily. Program the integrator to report results in ug/mL.

(iii) Bracket sample concentrations with standards.

(iv) Interferences (analytical).

(A) Any compound with the same general retention time as the analytes and which also gives a detector response is a potential interference. Possible interferences should be reported to the laboratory with submitted samples by the industrial hygienist.

(B) GC parameters (temperature, column, etc.), may be changed to circumvent interferences.

(C) A useful means of structure designation is GC/MS. It is recommended this procedure be used to confirm samples whenever possible.

(D) The coated adsorbent usually contains a very small amount of residual formaldehyde derivative.

(i) Calculations:

(i) Results are obtained by use of calibration curves. Calibration curves are prepared by plotting detector response against concentration for each standard. The best line through the data points is determined by curve fitting.

(ii) The concentration, in ug/mL, for a particular sample is determined by comparing its detector response to the calibration curve. If either of the analytes is found on the backup section, it is added to the amount found on the front section. Blank corrections should be performed before adding the results together.

(iii) The acrolein and/or formaldehyde air concentration can be expressed using the following equation:

$$\text{Mg/m}^3 = (A)(B)/C.$$

where A=ug/mL from 3.7.2, B=desorption volume, and C=L of air sampled.

No desorption efficiency corrections are required.

(iv) The following equation can be used to convert results in mg/m³ to ppm.

$$\text{ppm} = (\text{mg/m}^3)(24.45)/\text{MW}$$

where mg/m³=result from 3.7.3, 24.45=molar volume of an ideal gas at 760 mm Hg and 25 °C, MW=molecular weight (Formaldehyde=30.0).

(j) Backup data. Backup data on detection limits, reliable quantitation limits, sensitivity and precision of the analytical method, breakthrough, desorption efficiency, storage, reproducibility, and generation of test atmospheres are available in OSHA Method 52, developed by the Organics Methods Evaluation Branch, OSHA Analytical Laboratory, Salt Lake City, Utah.

(k) Procedure to coat XAD-2 adsorbent with 2-HMP:

(i) Apparatus: Soxhlet extraction apparatus, rotary evaporation apparatus, vacuum dessicator, 1-L vacuum flask, 1-L round-bottomed evaporative flask, 1-L Erlenmeyer flask, 250-mL Buchner funnel with a coarse fritted disc, etc.

(ii) Reagents:

(A) Methanol, isooctane, and toluene.

(B) (Hydroxymethyl) piperidine.

(C) Amberlite XAD-2 nonionic polymeric adsorbent, twenty to sixty mesh, Aldrich Chemical XAD-2 was used in this evaluation.

(l) Procedure: Weigh 125 g of crude XAD-2 adsorbent into a 1-L Erlenmeyer flask. Add about 200 mL of water to the flask and then swirl the mixture to wash the adsorbent. Discard any adsorbent that floats to the top of the water and then filter the mixture using a fritted Buchner funnel. Air dry the adsorbent for two minutes. Transfer the adsorbent back to the Erlenmeyer flask and then add about 200 mL of methanol to the flask. Swirl and then filter the mixture as before. Transfer the washed adsorbent back to the Erlenmeyer flask and then add about 200 mL of methanol to the flask. Swirl and then filter the mixture as before. Transfer the washed adsorbent to a 1-L round-bottomed evaporative flask, add 13 g of 2-HMP and then 200 mL of methanol, swirl the mixture and then allow it to stand for one hour. Remove the methanol at about 40°C and reduced pressure using a rotary evaporation apparatus. Transfer the coated adsorbent to a suitable container and store it in a vacuum desiccator at room temperature overnight. Transfer the coated adsorbent to a Soxhlet extractor and then extract the material with toluene for about twenty-four hours. Discard the contaminated toluene, add methanol in its place and then continue the Soxhlet extraction for an additional four hours. Transfer the adsorbent to a weighted 1-L round-bottom evaporative flask and remove the methanol using the rotary evaporation apparatus. Determine

the weight of the adsorbent and then add an amount of 2-HMP, which is ten percent by weight of the adsorbent. Add 200 mL of methanol and then swirl the mixture. Allow the mixture to stand for one hour. Remove the methanol by rotary evaporation. Transfer the coated adsorbent to a suitable container and store it in a vacuum dessicator until all traces of solvents are gone. Typically, this will take two to three days. The coated adsorbent should be protected from contamination. XAD-2 adsorbent treated in this manner will probably not contain residual acrolein derivative. However, this adsorbent will often contain residual formaldehyde derivative levels of about 0.1 ug per 150 mg of adsorbent. If the blank values for a batch of coated adsorbent are too high, then the batch should be returned to the Soxhlet extractor, extracted with toluene again and then recoated. This process can be repeated until the desired blank levels are attained.

The coated adsorbent is now ready to be packed into sampling tubes. The sampling tubes should be stored in a sealed container to prevent contamination. Sampling tubes should be stored in the dark at room temperature. The sampling tubes should be segregated by coated adsorbent lot number. A sufficient amount of each lot number of coated adsorbent should be retained to prepare analytical standards for use with air samples from that lot number.

(m) A procedure to determine formaldehyde by acid titration:

(i) Standardize the 0.1 N HCl solution using sodium carbonate and methyl orange indicator.

(ii) Place 50 mL of 0.1 M sodium sulfite and three drops of thymophthalein indicator into a 250-mL Erlenmeyer flask. Titrate the contents of the flask to a colorless endpoint with 0.1 N HCl (usually one or two drops is sufficient). Transfer 10 mL of the formaldehyde/methanol solution ((b)(iii)(A) of this subsection) into the same flask and titrate the mixture with 0.1 N HCl, again, to a colorless endpoint. The formaldehyde concentration of the standard may be calculated by the following equation:

$$\text{Formaldehyde, mg/mL} = \frac{\text{acid titer} \times \text{acid normality} \times 30.0}{\text{mL of Sample}}$$

(iii) This method is based on the quantitative liberation of sodium hydroxide when formaldehyde reacts with sodium sulfite to form the formaldehyde-bisulfite addition product. The volume of sample may be varied depending on the formaldehyde content but the solution to be titrated must contain excess sodium sulfite. Formaldehyde solutions containing substantial amounts of acid or base must be neutralized before analysis.

[Statutory Authority: Chapter 49.17 RCW. 91-11-070 (Order 91-01), § 296-62-07544, filed 5/20/91, effective 6/20/91; 90-03-029 (Order 89-20), § 296-62-07544, filed 1/11/90, effective 2/26/90; 89-11-035 (Order 89-03), § 296-62-07544, filed 5/15/89, effective 6/30/89; 88-21-002 (Order 88-23), § 296-62-07544, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07546 Appendix C medical surveillance—Formaldehyde. (1) Health hazards. The occupational health hazards of formaldehyde are primarily due to its toxic effects after inhalation, after direct contact with the skin or eyes by formaldehyde in liquid or vapor form, and after ingestion.

(2) Toxicology.

(a) Acute effects of exposure.

(i) Inhalation (breathing): Formaldehyde is highly irritating to the upper airways. The concentration of formaldehyde that is immediately dangerous to life and health is 100 ppm. Concentrations above 50 ppm can cause severe pulmonary reactions within minutes. These include pulmonary edema, pneumonia, and bronchial irritation which can result in death. Concentrations above 5 ppm readily cause lower airway irritation characterized by cough, chest tightness, and wheezing. There is some controversy regarding whether formaldehyde gas is a pulmonary sensitizer which can cause occupational asthma in a previously normal individual. Formaldehyde can produce symptoms of bronchial asthma in humans. The mechanism may be either sensitization of the individual by exposure to formaldehyde or direct irritation by formaldehyde in persons with preexisting asthma. Upper airway irritation is the most common respiratory effect reported by workers and can occur over a wide range of concentrations, most frequently above 1 ppm. However, airway irritation has occurred in some workers with exposures to formaldehyde as low as 0.1 ppm. Symptoms of upper airway irritation include dry or sore throat, itching and burning sensations of the nose, and nasal congestion. Tolerance to this level of exposure may develop within one to two hours. This tolerance can permit workers remaining in an environment of gradually increasing formaldehyde concentrations to be unaware of their increasingly hazardous exposure.

(ii) Eye contact: Concentrations of formaldehyde between 0.05 ppm and 0.5 ppm produce a sensation of irritation in the eyes with burning, itching, redness, and tearing. Increased rate of blinking and eye closure generally protects the eye from damage at these low levels, but these protective mechanisms may interfere with some workers' work abilities. Tolerance can occur in workers continuously exposed to concentrations of formaldehyde in this range. Accidental splash injuries of human eyes to aqueous solutions of formaldehyde (formalin) have resulted in a wide range of ocular injuries including corneal opacities and blindness. The severity of the reactions have been directly dependent on the concentration of formaldehyde in solution and the amount of time lapsed before emergency and medical intervention.

(iii) Skin contact: Exposure to formaldehyde solutions can cause irritation of the skin and allergic contact dermatitis. These skin diseases and disorders can occur at levels well below those encountered by many formaldehyde workers. Symptoms include erythema, edema, and vesiculation or hives. Exposure to liquid formalin or formaldehyde vapor can provoke skin reactions in sensitized individuals even when airborne concentrations of formaldehyde are well below 1 ppm.

(iv) Ingestion: Ingestion of as little as 30 ml of a thirty-seven percent solution of formaldehyde (formalin) can result in death. Gastrointestinal toxicity after ingestion is most severe in the stomach and results in symptoms which can include nausea, vomiting, and severe abdominal pain. Diverse damage to other organ systems including the liver, kidney, spleen, pancreas, brain, and central nervous systems can occur from the acute response to ingestion of formaldehyde.

(b) Chronic effects of exposure. Long-term exposure to formaldehyde has been shown to be associated with an increased risk of cancer of the nose and accessory sinuses, nasopharyngeal and oropharyngeal cancer, and lung cancer in humans. Animal experiments provide conclusive evidence of a causal relationship between nasal cancer in rats and formaldehyde exposure. Concordant evidence of carcinogenicity includes DNA binding, genotoxicity in short-term tests, and cytotoxic changes in the cells of the target organ suggesting both preneoplastic changes and a dose-rate effect. Formaldehyde is a complete carcinogen and appears to exert an effect on at least two stages of the carcinogenic process.

(3) Surveillance considerations.

(a) History.

(i) Medical and occupational history: Along with its acute irritative effects, formaldehyde can cause allergic sensitization and cancer. One of the goals of the work history should be to elicit information on any prior or additional exposure to formaldehyde in either the occupational or the nonoccupational setting.

(ii) Respiratory history: As noted above, formaldehyde has recognized properties as an airway irritant and has been reported by some authors as a cause of occupational asthma. In addition, formaldehyde has been associated with cancer of the entire respiratory system of humans. For these reasons, it is appropriate to include a comprehensive review of the respiratory system in the medical history. Components of this history might include questions regarding dyspnea on exertion, shortness of breath, chronic airway complaints, hyperreactive airway disease, rhinitis, bronchitis, bronchiolitis, asthma, emphysema, respiratory allergic reaction, or other preexisting pulmonary disease.

In addition, generalized airway hypersensitivity can result from exposures to a single sensitizing agent. The examiner should, therefore, elicit any prior history of exposure to pulmonary irritants, and any short-term or long-term effects of that exposure.

Smoking is known to decrease mucociliary clearance of materials deposited during respiration in the nose and upper airways. This may increase a worker's exposure to inhaled materials such as formaldehyde vapor. In addition, smoking is a potential confounding factor in the investigation of any chronic respiratory disease, including cancer. For these reasons, a complete smoking history should be obtained.

(iii) Skin disorders: Because of the dermal irritant and sensitizing effects of formaldehyde, a history of skin disorders should be obtained. Such a history might include the existence of skin irritation, previously documented skin sensitivity, and other dermatologic disorders. Previous exposure to formaldehyde and other dermal sensitizers should be recorded.

(iv) History of atopic or allergic diseases: Since formaldehyde can cause allergic sensitization of the skin and airways, it might be useful to identify individuals with prior allergen sensitization. A history of atopic disease and allergies to formaldehyde or any other substances should also be obtained. It is not definitely known at this time whether atopic diseases and allergies to formaldehyde or any other substances should also be obtained. Also it is not definitely known at this time whether atopic individuals have a greater

propensity to develop formaldehyde sensitivity than the general population, but identification of these individuals may be useful for ongoing surveillance.

(v) Use of disease questionnaires: Comparison of the results from previous years with present results provides the best method for detecting a general deterioration in health when toxic signs and symptoms are measured subjectively. In this way recall bias does not affect the results of the analysis. Consequently, WISHA has determined that the findings of the medical and work histories should be kept in a standardized form for comparison of the year-to-year results.

(b) Physical examination.

(i) Mucosa of eyes and airways: Because of the irritant effects of formaldehyde, the examining physician should be alert to evidence of this irritation. A speculum examination of the nasal mucosa may be helpful in assessing possible irritation and cytotoxic changes, as may be indirect inspection of the posterior pharynx by mirror.

(ii) Pulmonary system: A conventional respiratory examination, including inspection of the thorax and auscultation and percussion of the lung fields should be performed as part of the periodic medical examination. Although routine pulmonary function testing is only required by the standard once every year for persons who are exposed over the TWA concentration limit, these tests have an obvious value in investigating possible respiratory dysfunction and should be used wherever deemed appropriate by the physician. In cases of alleged formaldehyde-induced airway disease, other possible causes of pulmonary dysfunction (including exposures to other substances) should be ruled out. A chest radiograph may be useful in these circumstances. In cases of suspected airway hypersensitivity or allergy, it may be appropriate to use bronchial challenge testing with formaldehyde or methacholine to determine the nature of the disorder. Such testing should be performed by or under the supervision of a physician experienced in the procedures involved.

(iii) Skin: The physician should be alert to evidence of dermal irritation or sensitization, including reddening and inflammation, urticaria, blistering, scaling, formation of skin fissures, or other symptoms. Since the integrity of the skin barrier is compromised by other dermal diseases, the presence of such disease should be noted. Skin sensitivity testing carries with it some risk of inducing sensitivity, and therefore, skin testing for formaldehyde sensitivity should not be used as a routine screening test. Sensitivity testing may be indicated in the investigation of a suspected existing sensitivity. Guidelines for such testing have been prepared by the North American Contact Dermatitis Group.

(4) Additional examinations or tests. The physician may deem it necessary to perform other medical examinations or tests as indicated. The standard provides a mechanism whereby these additional investigations are covered under the standard for occupational exposure to formaldehyde.

(5) Emergencies. The examination of workers exposed in an emergency should be directed at the organ systems most likely to be affected. Much of the content of the examination will be similar to the periodic examination unless the patient has received a severe acute exposure requiring immediate attention to prevent serious consequences. If a severe overexposure requiring medical intervention or hospitalization has

occurred, the physician must be alert to the possibility of delayed symptoms. Followup nonroutine examinations may be necessary to assure the patient's well-being.

(6) Employer obligations. The employer is required to provide the physician with the following information: A copy of this standard and appendices A, C, D, and E; a description of the affected employee's duties as they relate to his or her exposure concentration; an estimate of the employee's exposure including duration (e.g., fifteen hr./wk., three eight-hour shifts, full-time); a description of any personal protective equipment, including respirators, used by the employee; and the results of any previous medical determinations for the affected employee related to formaldehyde exposure to the extent that this information is within the employer's control.

(7) Physician's obligations. The standard requires the employer to obtain a written statement from the physician. This statement must contain the physician's opinion as to whether the employee has any medical condition which would place him or her at increased risk of impaired health from exposure to formaldehyde or use of respirators, as appropriate. The physician must also state his opinion regarding any restrictions that should be placed on the employee's exposure to formaldehyde or upon the use of protective clothing or equipment such as respirators. If the employee wears a respirator as a result of his or her exposure to formaldehyde, the physician's opinion must also contain a statement regarding the suitability of the employee to wear the type of respirator assigned. Finally, the physician must inform the employer that the employee has been told the results of the medical examination and of any medical conditions which require further explanation or treatment. This written opinion is not to contain any information on specific findings or diagnoses unrelated to occupational exposure to formaldehyde.

The purpose in requiring the examining physician to supply the employer with a written opinion is to provide the employer with a medical basis to assist the employer in placing employees initially, in assuring that their health is not being impaired by formaldehyde, and to assess the employee's ability to use any required protective equipment.

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07546, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07548 Appendix D—Nonmandatory medical disease questionnaire. (1) Identification.

- (a) Plant name:
- (b) Date:
- (c) Employee name:
- (d) Social Security number:
- (e) Job title:
- (f) Birthdate:
- (g) Age:
- (h) Sex:
- (i) Height:
- (j) Weight:
- (2) Medical history.
- (a) Have you ever been in the hospital as a patient?
Yes No

If yes, what kind of problem were you having?

- (b) Have you ever had any kind of operation?
Yes No
If yes, what kind?
- (c) Do you take any kind of medicine regularly?
Yes No
If yes, what kind?
- (d) Are you allergic to any drugs, foods, or chemicals?
Yes No
If yes, what kind of allergy is it?

What causes the allergy?
- (e) Have you ever been told that you have asthma, hayfever, or sinusitis?
Yes No
- (f) Have you ever been told that you have emphysema, bronchitis, or any other respiratory problems?
Yes No
- (g) Have you ever been told you had hepatitis?
Yes No
- (h) Have you ever been told that you have cirrhosis?
Yes No
- (i) Have you ever been told that you had cancer?
Yes No
- (j) Have you ever had arthritis or joint pain?
Yes No
- (k) Have you ever been told that you had high blood pressure?
Yes No
- (l) Have you ever had a heart attack or heart trouble?
Yes No
- (3) Medical history update.
- (a) Have you been in the hospital as a patient any time within the past year?
Yes No
If so, for what condition?
- (b) Have you been under the care of a physician during the past year?
Yes No
If so, for what condition?
- (c) Is there any change in your breathing since last year?
Yes No
(i) Better?
(ii) Worse?
(iii) No change?
If change, do you know why?
- (d) Is your general health different this year from last year?
Yes No
If different, in what way?
- (e) Have you in the past year or are you now taking any medication on a regular basis?
Yes No
(i) Name Rx
(ii) Condition being treated
- (4) Occupational history.
- (a) How long have you worked for your present employer?
- (b) What jobs have you held with this employer? Include job title and length of time in each job.
- (c) In each of these jobs, how many hours a day were you exposed to chemicals?
- (d) What chemicals have you worked with most of the time?
- (e) Have you ever noticed any type of skin rash you feel was related to your work?
Yes No
- (f) Have you ever noticed that any kind of chemical makes you cough?
Yes No
(i) Wheeze:
Yes No
(ii) Become short of breath or cause your chest to become tight?
Yes No
- (g) Are you exposed to any dust or chemicals at home?
Yes No
If yes, explain:
- (h) In other jobs, have you ever had exposure to:
(i) Wood dust?
Yes No
(ii) Nickel or chromium?
Yes No
(iii) Silica (foundry, sand blasting)?
Yes No
(iv) Arsenic or asbestos?
Yes No
(v) Organic solvents?
Yes No

- (vi) Urethane foams?
Yes No
- (5) Occupational history update.
- (a) Are you working on the same job this year as you were last year?
Yes No
If not, how has your job changed?
- (b) What chemicals are you exposed to on your job?
- (c) How many hours a day are you exposed to chemicals?
- (d) Have you noticed any skin rash within the past year you feel was related to your work?
Yes No
If so, explain circumstances:
- (e) Have you noticed that any chemical makes you cough, be short of breath, or wheeze?
Yes No
If so, can you identify it?
- (6) Miscellaneous.
- (a) Do you smoke?
Yes No
If so, how much and for how long?
(i) Pipe
(ii) Cigars
(iii) Cigarettes
- (b) Do you drink alcohol in any form?
Yes No
If so, how much, how long, and how often?
- (c) Do you wear glasses or contact lenses?
Yes No
- (d) Do you get any physical exercise other than that required to do your job?
Yes No
If so, explain:
- (e) Do you have any hobbies or "side jobs" that require you to use chemicals, such as furniture stripping, sand blasting, insulation or manufacture of urethane foam, furniture, etc.?
Yes No
If so, please describe, giving type of business or hobby, chemicals used and length of exposures.
- (7) Symptoms questionnaire.
- (a) Do you ever have any shortness of breath?
Yes No
(i) If yes, do you have to rest after climbing several flights of stairs?
Yes No
(ii) If yes, if you walk on the level with people your own age, do you walk slower than they do?
Yes No
(iii) If yes, if you walk slower than a normal pace, do you have to limit the distance that you walk?
Yes No
(iv) If yes, do you have to stop and rest while bathing or dressing?
Yes No
- (b) Do you cough as much as three months out of the year?
Yes No
(i) If yes, have you had this cough for more than two years?
Yes No
(ii) If yes, do you ever cough anything up from the chest?
Yes No
- (c) Do you ever have a feeling of smothering, unable to take a deep breath, or tightness in your chest?
Yes No
(i) If yes, do you notice that this occurs on any particular day of the week?
Yes No
(ii) If yes, what day of the week?
(iii) If yes, do you notice that this occurs at any particular place?
Yes No
(iv) If yes, do you notice that this is worse after you have returned to work after being off for several days?
Yes No
- (d) Have you ever noticed any wheezing in your chest?
Yes No
(i) If yes, is this only with colds or other infections?
Yes No
(ii) Is this caused by exposure to any kind of dust or other material?
Yes No
(iii) If yes, what kind?
- (e) Have you noticed any burning, tearing, or redness of your eyes when you are at work?
Yes No
If so, explain circumstances:

- (f) Have you noticed any sore or burning throat or itchy or burning nose when you are at work?
Yes No
If so, explain circumstances:
- (g) Have you noticed any stuffiness or dryness of your nose?
Yes No
- (h) Do you ever have swelling of the eyelids or face?
Yes No
- (i) Have you ever been jaundiced?
Yes No
If yes, was this accompanied by any pain?
Yes No
- (j) Have you ever had a tendency to bruise easily or bleed excessively?
Yes No
- (k) Do you have frequent headaches that are not relieved by aspirin or tylenol?
Yes No
(i) If yes, do they occur at any particular time of the day or week?
Yes No
(ii) If yes, when do they occur?
- (l) Do you have frequent episodes of nervousness or irritability?
Yes No
- (m) Do you tend to have trouble concentrating or remembering?
Yes No
- (n) Do you ever feel dizzy, light-headed, excessively drowsy, or like you have been drugged?
Yes No
- (o) Does your vision ever become blurred?
Yes No
- (p) Do you have numbness or tingling of the hands or feet or other parts of your body?
Yes No
- (q) Have you ever had chronic weakness or fatigue?
Yes No
- (r) Have you ever had any swelling of your feet or ankles to the point where you could not wear your shoes?
Yes No
- (s) Are you bothered by heartburn or indigestion?
Yes No
- (t) Do you ever have itching, dryness, or peeling and scaling of the hands?
Yes No
- (u) Do you ever have a burning sensation in the hands, or reddening of the skin?
Yes No
- (v) Do you ever have cracking or bleeding of the skin on your hands?
Yes No

- (w) Are you under a physician's care?
Yes No
If yes, for what are you being treated?
- (x) Do you have any physical complaints today?
Yes No
If yes, explain:
- (y) Do you have other health conditions not covered by these questions?
Yes No
If yes, explain:

[Statutory Authority: Chapter 49.17 RCW. 88-21-002 (Order 88-23), § 296-62-07548, filed 10/6/88, effective 11/7/88.]

WAC 296-62-07550 Appendix E—Qualitative and quantitative fit testing procedures. FIT test protocols. Because exposure to formaldehyde can affect the employee's ability to detect common odorants, fit test results from the isoamyl acetate test must be augmented by results from either the saccharin or irritant smoke test.

(1) The employer shall include the following provisions in the fit test procedures. These provisions apply to both qualitative fit testing (QLFT) and quantitative fit testing (QNFT).

(a) The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least three sizes of elastomeric facepieces of the type of respirator that is to be tested, i.e., three sizes of half mask; or three sizes of full facepiece; and units from at least two manufacturers.

(b) Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a comfortable fit. A mirror shall be available to assist the subject in evaluating the fit and positioning the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

(c) The test subject shall be informed that he/she is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape, and if fitted and used properly, will provide adequate protection.

(d) The test subject shall be instructed to hold each facepiece up to the face and eliminate those which obviously do not give a comfortable fit.

(e) The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. Assistance in assessing comfort can be given by discussing the points in (f) of this subsection. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

(f) Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

- (i) Position of the mask on the nose;
 - (ii) Room for eye protection;
 - (iii) Room to talk;
 - (iv) Position of mask on face and cheeks.
- (g) The following criteria shall be used to help determine the adequacy of the respirator fit:
- (i) Chin properly placed;
 - (ii) Adequate strap tension, not overly tightened;
 - (iii) Fit across nose bridge;
 - (iv) Respirator of proper size to span distance from nose to chin;
 - (v) Tendency of respirator to slip;
 - (vi) Self-observation in mirror to evaluate fit and respirator position.

(h) The test subject shall conduct the negative and positive pressure fit checks as described below or in the latest edition of ANSI Z88.2. Before conducting the negative or positive pressure test, the subject shall be told to seat the mask on the face by moving the head from side to side and up and down slowly while taking in a few slow deep breaths. Another facepiece shall be selected and retested if the test subject fails the fit check tests.

(i) Positive pressure test. Close off the exhalation valve and exhale gently onto the facepiece. The face fit is considered satisfactory if a slight positive pressure can be built up inside the facepiece without any evidence of outward leakage of air at the seal. For most respirators this method of leak testing requires the wearer to first remove the exhalation valve cover before closing off the exhalation valve and then carefully replacing it after the test.

(ii) Negative pressure test. Close off the inlet opening of the canister or cartridge(s) by covering with the palm of the hand(s) or by replacing the filter seal(s), inhale gently so that the facepiece collapses slightly, and hold the breath for ten seconds. If the facepiece remains in its slightly collapsed condition and no inward leakage of air is detected, the tightness of the respirator is considered satisfactory.

(i) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface, such as stubble beard growth, beard, or long sideburns which cross the respirator sealing surface. Any type of apparel which interferes with a satisfactory fit shall be altered or removed.

(j) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory disease or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(k) The test subject shall be given the opportunity to wear the successfully fitted respirator for a period of two weeks. If at any time during this period the respirator becomes uncomfortable, the test subject shall be given the opportunity to select a different facepiece and to be retested.

(l) The employer shall certify that a successful fit test has been administered to the employee. The certification shall include the following information:

- (i) Name of employee;
- (ii) Type, brand, and size of respirator; and
- (iii) Date of test.

Where QNFT is used, the fit factor, strip chart, or other recording of the results of the test, shall be retained with the certification. The certification shall be maintained until the next fit test is administered.

(m) Exercise regimen. Prior to the commencement of the fit test, the test subject shall be given a description of the fit test and the test subject's responsibilities during the test procedure.

The description of the process shall include a description of the test exercises that the subject will be performing. The respirator to be tested shall be worn for at least five minutes before the start of the fit test.

(n) Test exercises. The test subject shall perform exercises, in the test environment, in the manner described below:

(i) Normal breathing. In a normal standing position, without talking, the subject shall breathe normally.

(ii) Deep breathing. In a normal standing position, the subject shall breathe slowly and deeply, taking caution so as to not hyperventilate.

(iii) Turning head side to side. Standing in place, the subject shall slowly turn his/her head from side to side between the extreme positions on each side. The head shall be held at each extreme momentarily so the subject can inhale at each side.

(iv) Moving head up and down. Standing in place, the subject shall slowly move his/her head up and down. The subject shall be instructed to inhale in the up position (i.e., when looking toward the ceiling).

(v) Talking. The subject shall talk out loud slowly and loudly enough so as to be heard clearly by the test conductor. The subject can read from a prepared text such as the Rainbow Passage, count backward from one hundred, or recite a memorized poem or song.

(vi) Grimace. The test subject shall grimace by smiling or frowning.

(vii) Bending over. The test subject shall bend at the waist as if he/she were to touch his/her toes. Jogging in place shall be substituted for this exercise in those test environments such as shroud type QNFT units which prohibit bending at the waist.

(viii) Normal breathing. Same as (n)(i) of this subsection.

(A) Each test exercise shall be performed for one minute except for the grimace exercise which shall be performed for fifteen seconds.

(B) The test subject shall be questioned by the test conductor regarding the comfort of the respirator upon completion of the protocol. If it has become uncomfortable, another model of respirator shall be tried.

(2) Qualitative fit test (QLFT) protocols.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator qualitative fit test program.

(ii) The employer shall ensure that persons administering QLFT are able to prepare test solutions, calibrate equipment and perform tests properly, recognize invalid tests, and assure that the equipment is in proper working order.

(iii) The employer shall assure the QLFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

(b) Isoamyl acetate protocol.

(i) Odor threshold screening. The odor threshold screening test, performed without wearing a respirator, is intended to determine if the individual tested can detect the odor of isoamyl acetate.

(A) Three one-liter glass jars with metal lids are required.

(B) Odor-free water (e.g., distilled or spring water) at approximately 25°C shall be used for the solutions.

(C) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor-free water in a one-liter jar and shaking for thirty seconds. A new solution shall be prepared at least weekly.

(D) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

(E) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor-free water using a clear dropper or pipette. The solution shall be shaken for thirty seconds and allowed to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution shall be used for only one day.

(F) A test blank shall be prepared in a third jar by adding 500 cc of odor-free water.

(G) The odor test and test blank jars shall be labeled 1 and 2 for jar identification. Labels shall be placed on the lids so they can be periodically peeled, dried off and switched to maintain the integrity of the test.

(H) The following instruction shall be typed on a card and placed on the table in front of the two jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contain a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(I) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(J) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test shall not be performed.

(K) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(ii) Isoamyl acetate fit test.

(A) The fit test chamber shall be similar to a clear fifty-five gallon drum liner suspended inverted over a two-foot diameter frame so that the top of the chamber is about six inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(B) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer pro-

tection against organic vapors. The cartridges or masks shall be changed at least weekly.

(C) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(D) A copy of the test exercises and any prepared text from which the subject is to read shall be taped to the inside of the test chamber.

(E) Upon entering the test chamber, the test subject shall be given a six-inch by five-inch piece of paper towel, or other porous, absorbent, single-ply material, folded in half, and wetted with 0.75 cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

(F) Allow two minutes for the IAA test concentration to stabilize before starting the fit test exercises. This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of his/her cooperation, and the purpose for the head exercises; or to demonstrate some of the exercises.

(G) If at any time during the test, the subject detects the bananalike odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(H) If the test has failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber and again begin the procedure described in (b)(ii)(A) through (G) of this subsection. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about five minutes before retesting. Odor sensitivity will usually have returned by this time.

(I) When a respirator is found that passes the test, its efficiency shall be demonstrated for the subject by having the subject break the face seal and take a breath before exiting the chamber.

(J) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the test area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration build-up in the test chamber during subsequent tests.

(c) Saccharin solution aerosol protocol. The saccharin solution aerosol QLFT protocol is the only currently available, validated test protocol for use with particulate disposable dust respirators not equipped with high-efficiency filters. The entire screening and testing procedure shall be explained to the test subject prior to the conduct of the screening test.

(i) Taste threshold screening. The saccharin taste threshold screening, performed without wearing a respirator, is intended to determine whether the individual being tested can detect the taste of saccharin.

(A) Threshold screening as well as fit testing subjects shall wear an enclosure about the head and shoulders that is approximately twelve inches in diameter by fourteen inches tall with at least the front portion clear and that allows free

movements of the head when a respirator is worn. An enclosure substantially similar to the 3M hood assembly, parts NZ FT 14 and NZ FT 15 combined, is adequate.

(B) The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(C) The test subject shall don the test enclosure. Throughout the threshold screening test, the test subject shall breathe through his/her wide open mouth with tongue extended.

(D) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(E) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the fit test solution (see (c)(ii)(E) of this subsection) in 100 cc of distilled water.

(F) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then released and allowed to fully expand.

(G) Ten squeezes are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(H) If the first response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(I) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin is tasted.

(J) The test conductor will take note of the number of squeezes required to solicit a taste response.

(K) If the saccharin is not tasted after thirty squeezes, the test subject may not perform the saccharin fit test.

(L) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(M) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

(N) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least each morning and afternoon or at least every four hours.

(ii) Saccharin solution aerosol fit test procedure.

(A) The test subject may not eat, drink (except plain water), or chew gum for fifteen minutes before the test.

(B) The fit test uses the same enclosure described in (c)(i) of this subsection.

(C) The test subject shall don the enclosure while wearing the respirator selected in (c)(i) of this subsection. The respirator shall be properly adjusted and equipped with a particular filter(s).

(D) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(E) The fit test solution is prepared by adding eighty-three grams of sodium saccharin to 100 cc of warm water.

(F) As before, the test subject shall breathe through the open mouth with tongue extended.

(G) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the

enclosure using the same number of squeezes required to elicit a taste response in the screening test.

(H) After generating the aerosol the test subject shall be instructed to perform the exercises in subsection (1)(n) of this section.

(I) Every thirty seconds the aerosol concentration shall be replenished using one-half the number of squeezes as initially used.

(J) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(K) If the taste of saccharin is detected, the fit is deemed unsatisfactory and a different respirator shall be tried.

(d) Irritant fume protocol.

(i) The respirator to be tested shall be equipped with high-efficiency particulate air (HEPA) filters.

(ii) The test subject shall be allowed to smell a weak concentration of the irritant smoke before the respirator is donned to become familiar with its characteristic odor.

(iii) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part No. 5645, or equivalent. Attach one end of the smoke tube to a low flow air pump set to deliver two hundred milliliters per minute.

(iv) If a half-mask is being fitted, advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep his/her eyes closed while the test is performed.

(v) The test conductor shall direct the stream of irritant smoke from the smoke tube towards the face seal area of the test subject. He/she shall begin at least twelve inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(vi) The exercises identified in subsection (1)(n) of this section shall be performed by the test subject while the respirator seal is being challenged by the smoke.

(vii) Each test subject passing the smoke test without evidence of a response shall be given a sensitivity check of the smoke from the same tube once the respirator has been removed to determine whether he/she reacts to the smoke. Failure to evoke a response shall void the fit test.

(viii) The fit test shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agent.

(3) Quantitative fit test (QNFT) protocol.

(a) General.

(i) The employer shall assign specific individuals who shall assume full responsibility for implementing the respirator quantitative fit test program.

(ii) The employer shall ensure that persons administering QNFT are able to calibrate equipment and perform tests properly, recognize invalid tests, calculate fit factors properly and assure that test equipment is in proper working order.

(iii) The employer shall assure that QNFT equipment is kept clean and well maintained so as to operate at the parameters for which it was designed.

(b) Definitions.

(i) "Quantitative fit test." The test is performed in a test chamber. The normal air-purifying element of the respirator is replaced by a high-efficiency particulate air (HEPA) filter in the case of particulate QNFT aerosols or a sorbent offering

contaminant penetration protection equivalent to high-efficiency filters where the QNFT test agency is a gas or vapor.

(ii) "Challenge agent" means the aerosol, gas, or vapor introduced into a test chamber so that its concentration inside and outside the respirator may be measured.

(iii) "Test subject" means the person wearing the respirator for quantitative fit testing.

(iv) "Normal standing position" means standing erect and straight with arms down along the sides and looking straight ahead.

(v) "Maximum peak penetration method" means the method of determining test agent penetration in the respirator as determined by strip chart recordings of the test. The highest peak penetration for a given exercise is taken to be representative of average penetration into the respirator for that exercise.

(vi) "Average peak penetration method" means the method of determining test agent penetration into the respirator utilizing a strip chart recorder, integrator, or computer. The agent penetration is determined by an average of the peak heights on the graph or by computer integration, for each exercise except the grimace exercise. Integrators or computers which calculate the actual test agent penetration into the respirator for each exercise will also be considered to meet the requirements of the average peak penetration method.

(vii) "Fit factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

(c) Apparatus.

(i) Instrumentation. Aerosol generation, dilution, and measurement systems using corn oil or sodium chloride as test aerosols shall be used for quantitative fit testing.

(ii) Test chamber. The test chamber shall be large enough to permit all test subjects to perform freely all required exercises without disturbing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air, yet uniform in concentration throughout the chamber.

(iii) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate filter supplied by the same manufacturer.

(iv) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of the challenge agent concentration with each inspiration and expiration at fit factors of at least two thousand. Integrators or computers which integrate the amount of test agent penetration leakage into the respirator for each exercise may be used provided a record of the readings is made.

(v) The combination of substitute air-purifying elements, challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of an established exposure limit for the challenge agent at any time during the testing process.

(vi) The sampling port on the test specimen respirator shall be placed and constructed so that no leakage occurs around the port (e.g., where the respirator is probed), a free air flow is allowed into the sampling line at all times and so

that there is no interference with the fit or performance of the respirator.

(vii) The test chamber and test set-up shall permit the person administering the test to observe the test subject inside the chamber during the test.

(viii) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent inside the test chamber constant to within a ten percent variation for the duration of the test.

(ix) The time lag (interval between an event and the recording of the event on the strip chart or computer or integrator) shall be kept to a minimum. There shall be a clear association between the occurrence of an event inside the test chamber and its being recorded.

(x) The sampling line tubing for the test chamber atmosphere and for the respirator sampling port shall be of equal diameter and of the same material. The length of the two lines shall be equal.

(xi) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release.

(xii) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed fifty percent.

(xiii) The limitations of instrument detection shall be taken into account when determining the fit factor.

(xiv) Test respirators shall be maintained in proper working order and inspected for deficiencies such as cracks, missing valves and gaskets, etc.

(d) Procedural requirements.

(i) When performing the initial positive or negative pressure test the sampling line shall be crimped closed in order to avoid air pressure leakage during either of these tests.

(ii) An abbreviated screening isoamyl acetate test or irritant fume test may be utilized in order to quickly identify poor fitting respirators which passed the positive and/or negative pressure test and thus reduce the amount of QNFT time. When performing a screening isoamyl acetate test, combination high-efficiency organic vapor cartridges/canisters shall be used.

(iii) A reasonable stable challenge agent concentration shall be measured in the test chamber prior to testing. For canopy or shower curtain type of test units the determination of the challenge agent stability may be established after the test subject has entered the test environment.

(iv) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed five percent for a half mask or one percent for a full facepiece respirator.

(v) A stable challenge concentration shall be obtained prior to the actual start of testing.

(vi) Respirator restraining straps shall not be overtightened for testing. The straps shall be adjusted by the wearer without assistance from other persons to give a reasonable comfortable fit typical of normal use.

(vii) The test shall be terminated whenever any single peak penetration exceeds five percent for half masks and one percent for full facepiece respirators. The test subject shall be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(viii) In order to successfully complete a QNFT, three successful fit tests are required. The results of each of the three independent fit tests must exceed the minimum fit factor needed for the class of respirator (e.g., half mask respirator, full facepiece respirator).

(ix) Calculation of fit factors.

(A) The fit factor shall be determined for the quantitative fit test by taking the ratio of the average chamber concentration to the concentration inside the respirator.

(B) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

(c) The concentration of the challenge agent inside the respirator shall be determined by one of the following methods:

(I) Average peak concentration;

(II) Maximum peak concentration;

(III) Integration by calculation of the area under the individual peak for each exercise. This includes computerized integration.

(x) Interpretation of test results. The fit factor established by the quantitative fit testing shall be the lowest of the three fit factor values calculated from the three required fit tests.

(xi) The test subject shall not be permitted to wear a half mask, or full facepiece respirator unless a minimum fit factor equivalent to at least ten times the hazardous exposure level is obtained.

(xii) Filters used for quantitative fit testing shall be replaced at least weekly, or whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily (when used) or sooner if there is any indication of breakthrough by a test agent.

[Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-62-07550, filed 4/10/96, effective 6/1/96; 88-21-002 (Order 88-23), § 296-62-07550, filed 10/6/88, effective 11/7/88.]

WAC 296-62-076 Methylenedianiline.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-076, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07601 Scope and application. (1) WAC 296-62-076 applies to all occupational exposures to MDA, Chemical Abstracts Service Registry No. 101-77-9, except as provided in subsections (2) through (7) of this section.

(2) Except as provided in subsection (8) of this section and WAC 296-62-07609(5), this section does not apply to the processing, use, and handling of products containing MDA where initial monitoring indicates that the product is not capable of releasing MDA in excess of the action level under the expected conditions of processing, use, and handling which will cause the greatest possible release; and where no "dermal exposure to MDA" can occur.

(3) Except as provided in subsection (8) of this section, WAC 296-62-076 does not apply to the processing, use, and handling of products containing MDA where objective data are reasonably relied upon which demonstrate the product is not capable of releasing MDA under the expected conditions of processing, use, and handling which will cause the greatest possible release; and where no "dermal exposure to MDA" can occur.

(4) WAC 296-62-076 does not apply to the storage, transportation, distribution, or sale of MDA in intact containers sealed in such a manner as to contain the MDA dusts, vapors, or liquids, except for the provisions of WAC 296-62-054 and 296-62-07607.

(5) WAC 296-62-076 does not apply to the construction industry as defined in WAC 296-155-012(6). (Exposure to MDA in the construction industry is covered by WAC 296-155-173.)

(6) Except as provided in subsection (8) of this section, WAC 296-62-076 does not apply to materials in any form which contain less than 0.1% MDA by weight or volume.

(7) Except as provided in subsection (8) of this section, WAC 296-62-076 does not apply to "finished articles containing MDA."

(8) Where products containing MDA are exempted under subsections (2) through (7) of this section, the employer shall maintain records of the initial monitoring results or objective data supporting that exemption and the basis for the employer's reliance on the data, as provided in the recordkeeping provision of WAC 296-62-07631.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07601, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07603 Definitions. For the purpose of WAC 296-62-076, the following definitions shall apply:

(1) "Action level" means a concentration of airborne MDA of 5 ppb as an 8-hour time-weighted average.

(2) "Authorized person" means any person specifically authorized by the employer whose duties require the person to enter a regulated area, or any person entering such an area as a designated representative of employees, for the purpose of exercising the right to observe monitoring and measuring procedures under WAC 296-62-07633 of WAC 296-62-076, or any other person authorized by WISHA or regulations issued by WISHA.

(3) "Container" means any barrel, bottle, can, cylinder, drum, reaction vessel, storage tank, commercial packaging, or the like, but does not include piping systems.

(4) "Dermal exposure to MDA" occurs where employees are engaged in the handling, application, or use of mixtures or materials containing MDA, with any of the following nonairborne forms of MDA:

(a) Liquid, powdered, granular, or flaked mixtures containing MDA in concentrations greater than 0.1% by weight or volume; and

(b) Materials other than "finished articles" containing MDA in concentrations greater than 0.1% by weight or volume.

(5) "Director" means the director of the department of labor and industries, or his/her designated representative.

(6) "Emergency" means any occurrence such as, but not limited to, equipment failure, rupture of containers, or failure of control equipment which results in an unexpected and potentially hazardous release of MDA.

(7) "Employee exposure" means exposure to MDA which would occur if the employee were not using respirators or protective work clothing and equipment.

(8) "Finished article containing MDA" is defined as a manufactured item:

(a) Which is formed to a specific shape or design during manufacture;

(b) Which has end use function(s) dependent in whole or part upon its shape or design during end use; and

(c) Where applicable, is an item which is fully cured by virtue of having been subjected to the conditions (temperature, time) necessary to complete the desired chemical reaction.

(9) "4,4' methylenedianiline" or "MDA" means the chemical 4,4'-diaminodiphenylmethane, Chemical Abstract Service Registry number 101-77-9, in the form of a vapor, liquid, or solid. The definition also includes the salts of MDA.

(10) "Regulated areas" means areas where airborne concentrations of MDA exceed or can reasonably be expected to exceed, the permissible exposure limits, or where dermal exposure to MDA can occur.

(11) "STEL" means short-term exposure limit as determined by any 15 minute sample period.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07603, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07605 Permissible exposure limits (PEL). The employer shall assure that no employee is exposed to an airborne concentration of MDA in excess of ten parts per billion (10 ppb) as an 8-hour time-weighted average or a STEL of 100 ppb.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07605, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07607 Emergency situations. (1) Written plan.

(a) A written plan for emergency situations shall be developed for each workplace where there is a possibility of an emergency. Appropriate portions of the plan shall be implemented in the event of an emergency.

(b) The plan shall specifically provide that employees engaged in correcting emergency conditions shall be equipped with the appropriate personal protective equipment and clothing as required in WAC 296-62-07615 and 296-62-07617 until the emergency is abated.

(c) The plan shall specifically include provisions for alerting and evacuating affected employees as well as the elements prescribed in chapter 296-24 WAC, Part G-1, "Employee emergency plans and fire prevention plans."

(2) Alerting employees. Where there is the possibility of employee exposure to MDA due to an emergency, means shall be developed to alert promptly those employees who have the potential to be directly exposed. Affected employees not engaged in correcting emergency conditions shall be evacuated immediately in the event that an emergency occurs. Means shall also be developed and implemented for alerting other employees who may be exposed as a result of the emergency.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07607, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07609 Exposure monitoring. (1) General.

(a) Determinations of employee exposure shall be made from breathing zone air samples that are representative of

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each employee's exposure to airborne MDA over an 8-hour period. Determination of employee exposure to the STEL shall be made from breathing zone air samples collected over a 15 minute sampling period.

(b) Representative employee exposure shall be determined on the basis of one or more samples representing full shift exposure for each shift for each job classification in each work area where exposure to MDA may occur.

(c) Where the employer can document that exposure levels are equivalent for similar operations in different work shifts, the employer shall only be required to determine representative employee exposure for that operation during one shift.

(2) Initial monitoring. Each employer who has a workplace or work operation covered by this standard shall perform initial monitoring to determine accurately the airborne concentrations of MDA to which employees may be exposed.

(3) Periodic monitoring and monitoring frequency.

(a) If the monitoring required by subsection (2) of this section reveals employee exposure at or above the action level, but at or below the PELs, the employer shall repeat such representative monitoring for each such employee at least every six months.

(b) If the monitoring required by subsection (2) of this section reveals employee exposure above the PELs, the employer shall repeat such monitoring for each such employee at least every three months.

(c) The employer may alter the monitoring schedule from every three months to every six months for any employee for whom two consecutive measurements taken at least 7 days apart indicate that the employee exposure has decreased to below the TWA but above the action level.

(4) Termination of monitoring.

(a) If the initial monitoring required by subsection (2) of this section reveals employee exposure to be below the action level, the employer may discontinue the monitoring for that employee, except as otherwise required by subsection (5) of this section.

(b) If the periodic monitoring required by subsection (3) of this section reveals that employee exposures, as indicated by at least two consecutive measurements taken at least 7 days apart, are below the action level the employer may discontinue the monitoring for that employee, except as otherwise required by subsection (5) of this section.

(5) Additional monitoring. The employer shall institute the exposure monitoring required under subsections (2) and (3) of this section when there has been a change in production process, chemicals present, control equipment, personnel, or work practices which may result in new or additional exposures to MDA, or when the employer has any reason to suspect a change which may result in new or additional exposures.

(6) Accuracy of monitoring. Monitoring shall be accurate, to a confidence level of 95 percent, to within plus or minus 25 percent for airborne concentrations of MDA.

(7) Employee notification of monitoring results.

(a) The employer shall, within 15 working days after the receipt of the results of any monitoring performed under this standard, notify each employee of these results, in writing,

either individually or by posting of results in an appropriate location that is accessible to affected employees.

(b) The written notification required by subdivision (a) of this subsection shall contain the corrective action being taken by the employer to reduce the employee exposure to or below the PELs, wherever the PELs are exceeded.

(8) Visual monitoring. The employer shall make routine inspections of employee hands, face, and forearms potentially exposed to MDA. Other potential dermal exposures reported by the employee must be referred to the appropriate medical personnel for observation. If the employer determines that the employee has been exposed to MDA the employer shall:

(a) Determine the source of exposure;

(b) Implement protective measures to correct the hazard; and

(c) Maintain records of the corrective actions in accordance with WAC 296-62-07631.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07609, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07611 Regulated areas. (1) Establishment.

(a) Airborne exposures. The employer shall establish regulated areas where airborne concentrations of MDA exceed or can reasonably be expected to exceed, the permissible exposure limits.

(b) Dermal exposures. Where employees are subject to dermal exposure to MDA the employer shall establish those work areas as regulated areas.

(2) Demarcation. Regulated areas shall be demarcated from the rest of the workplace in a manner that minimizes the number of persons potentially exposed.

(3) Access. Access to regulated areas shall be limited to authorized persons.

(4) Personal protective equipment and clothing. Each person entering a regulated area shall be supplied with, and required to use, the appropriate personal protective clothing and equipment in accordance with WAC 296-62-07615 and 296-62-07617.

(5) Prohibited activities. The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in regulated areas.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07611, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07613 Methods of compliance. (1) Engineering controls and work practices.

(a) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to MDA at or below the PELs except to the extent that the employer can establish that these controls are not feasible or where the provisions of subdivision (b) of this subsection or WAC 296-62-07615(1) apply.

(b) Wherever the feasible engineering controls and work practices which can be instituted are not sufficient to reduce employee exposure to or below the PELs, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by

the use of respiratory protective devices which comply with the requirements of WAC 296-62-07615.

(2) Compliance program.

(a) The employer shall establish and implement a written program to reduce employee exposure to or below the PELs by means of engineering and work practice controls, as required by subsection (1) of this section, and by use of respiratory protection where permitted under WAC 296-62-076. The program shall include a schedule for periodic maintenance (e.g., leak detection) and shall include the written plan for emergency situations as specified in WAC 296-62-07607.

(b) Upon request this written program shall be furnished for examination and copying to the director, affected employees, and designated employee representatives. The employer shall review and, as necessary, update such plans at least once every 12 months to make certain they reflect the current status of the program.

(3) Employee rotation. Employee rotation shall not be permitted as a means of reducing exposure.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07613, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07615 Respiratory protection. (1) General. The employer shall provide respirators, and ensure that they are used, where required by this section. Respirators shall be used in the following circumstances:

(a) During the time period necessary to install or implement feasible engineering and work practice controls;

(b) In work operations for which the employer establishes that engineering and work practice controls are not feasible;

(c) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the PEL; and

(d) In emergencies.

(2) Respirator selection.

(a) Where respirators are required or allowed under WAC 296-62-076, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1, and shall assure that the employee uses the respirator provided.

(b) The employer shall select respirators from among those approved by the Mine Safety and Health Administration and the National Institute for Occupational Safety and Health under the provisions of 30 C.F.R. Part 11 and Part E of this chapter.

(c) Any employee who cannot wear a negative pressure respirator shall be given the option of wearing a positive pressure respirator or any supplied-air respirator operated in the continuous flow or pressure demand mode.

(3) Respirator program. The employer shall institute a respiratory protection program in accordance with Part E of this chapter.

(4) Respirator use.

(a) Where air-purifying respirators (cartridge or canister) are used, the employer shall replace the air-purifying element as needed to maintain the effectiveness of the respirator. The employer shall ensure that each cartridge is dated at the beginning of use.

(b) Employees who wear respirators shall be allowed to leave the regulated area to readjust the facepiece or to wash their faces and to wipe clean the facepieces on their respirators in order to minimize potential skin irritation associated with respirator use.

Table 1.—Respiratory Protection for MDA

Airborne concentration of MDA or condition of use	Respirator type
a. Less than or equal to 10xPEL	(1) Half-mask respirator with HEPA ¹ cartridge ² .
b. Less than or equal to 50xPEL	(1) Full facepiece respirator with HEPA ¹ cartridge or canister ² .
c. Less than or equal to 1000xPEL	(1) Full facepiece powered air-purifying respirator with HEPA ¹ cartridges ² .
d. Greater than 1000xPEL or	(1) Self-contained breathing unknown concentrations apparatus with full facepiece in positive pressure mode;
	(2) Full facepiece positive pressure demand supplied-air respirator with auxiliary self-contained air supply.
e. Escape	(1) Any full facepiece air-purifying respirator with HEPA ¹ cartridges ² ;
	(2) Any positive pressure or continuous flow self-contained breathing apparatus with full facepiece or hood.
f. Fire fighting	(1) Full facepiece self-contained breathing apparatus in positive pressure demand mode.

Note: Respirators assigned for higher environmental concentrations may be used at lower concentrations.

¹ High efficiency particulate in air filter (HEPA) means a filter that is at least 99.97 percent efficient against mono-dispersed particles of 0.3 micrometers or larger.

² Combination HEPA/organic vapor cartridges shall be used whenever MDA in liquid form or a process requiring heat is used.

(5) Respirator fit testing.

(a) The employer shall perform and record the results of either quantitative or qualitative fit tests at the time of initial fitting and at least annually thereafter for each employee wearing a negative pressure respirator. The test shall be used to select a respirator facepiece which provides the required protection as prescribed in Table 1.

(b) The employer shall follow the test protocols outlined in Appendix E of this standard for whichever type of fit testing the employer chooses.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07615, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07617 Protective work clothing and equipment. (1) Provision and use. Where employees are subject to dermal exposure to MDA, where liquids containing MDA can be splashed into the eyes, or where airborne concentrations of MDA are in excess of the PEL, the employer shall provide, at no cost to the employee, and ensure that the employee uses, appropriate protective work clothing and equipment which prevent contact with MDA such as, but not limited to:

- (a) Aprons, coveralls, or other full-body work clothing;
- (b) Gloves, head coverings, and foot coverings; and

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(c) Face shields, chemical goggles; or
(d) Other appropriate protective equipment which comply with chapter 296-24 WAC, Part A-2.

(2) Removal and storage.

(a) The employer shall ensure that, at the end of their work shift, employees remove MDA-contaminated protective work clothing and equipment that is not routinely removed throughout the day in change rooms provided in accordance with the provisions established for change rooms.

(b) The employer shall ensure that, during their work shift, employees remove all other MDA-contaminated protective work clothing or equipment before leaving a regulated area.

(c) The employer shall ensure that no employee takes MDA-contaminated work clothing or equipment out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(d) MDA-contaminated work clothing or equipment shall be placed and stored in closed containers which prevent dispersion of the MDA outside the container.

(e) Containers of MDA-contaminated protective work clothing or equipment which are to be taken out of change rooms or the workplace for cleaning, maintenance, or disposal shall bear labels warning of the hazards of MDA.

(3) Cleaning and replacement.

(a) The employer shall provide the employee with clean protective clothing and equipment. The employer shall ensure that protective work clothing or equipment required by this paragraph is cleaned, laundered, repaired, or replaced at intervals appropriate to maintain its effectiveness.

(b) The employer shall prohibit the removal of MDA from protective work clothing or equipment by blowing, shaking, or any methods which allow MDA to reenter the workplace.

(c) The employer shall ensure that laundering of MDA-contaminated clothing shall be done so as to prevent the release of MDA in the workplace.

(d) Any employer who gives MDA-contaminated clothing to another person for laundering shall inform such person of the requirement to prevent the release of MDA.

(e) The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with MDA of the potentially harmful effects of exposure.

(f) MDA-contaminated clothing shall be transported in properly labeled, sealed, impermeable bags or containers.

[Statutory Authority: Chapter 49.17 RCW. 94-20-057 (Order 94-16), § 296-62-07617, filed 9/30/94, effective 11/20/94; 93-04-111 (Order 92-15), § 296-62-07617, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07619 Hygiene facilities and practices.

(1) Change rooms.

(a) The employer shall provide clean change rooms for employees, who must wear protective clothing, or who must use protective equipment because of their exposure to MDA.

(b) Change rooms must be equipped with separate storage for protective clothing and equipment and for street clothes which prevents MDA contamination of street clothes.

(2) Showers.

(a) The employer shall ensure that employees, who work in areas where there is the potential for exposure resulting

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from airborne MDA (e.g., particulates or vapors) above the action level, shower at the end of the work shift.

(i) Shower facilities required by this section shall comply with WAC 296-24-12009(3).

(ii) The employer shall ensure that employees who are required to shower pursuant to the provisions contained herein do not leave the workplace wearing any protective clothing or equipment worn during the work shift.

(b) Where dermal exposure to MDA occurs, the employer shall ensure that materials spilled or deposited on the skin are removed as soon as possible by methods which do not facilitate the dermal absorption of MDA.

(3) Lunch facilities.

(a) Availability and construction.

(i) Whenever food or beverages are consumed at the worksite and employees are exposed to MDA at or above the PEL or are subject to dermal exposure to MDA the employer shall provide readily accessible lunch areas.

(ii) Lunch areas located within the workplace and in areas where there is the potential for airborne exposure to MDA at or above the PEL shall have a positive pressure, temperature controlled, filtered air supply.

(iii) Lunch areas may not be located in areas within the workplace where the potential for dermal exposure to MDA exists.

(b) The employer shall ensure that employees who have been subjected to dermal exposure to MDA or who have been exposed to MDA above the PEL wash their hands and faces with soap and water prior to eating, drinking, smoking, or applying cosmetics.

(c) The employer shall ensure that employees exposed to MDA do not enter lunch facilities with MDA-contaminated protective work clothing or equipment.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07619, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07621 Communication of hazards to employees. (1) Signs and labels.

(a) The employer shall post and maintain legible signs demarcating regulated areas and entrances or accessways to regulated areas that bear the following legend:

DANGER MDA MAY CAUSE CANCER LIVER TOXIN
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING
MAY BE REQUIRED TO BE WORN IN THIS AREA

(b) The employer shall ensure that labels or other appropriate forms of warning are provided for containers of MDA within the workplace. The labels shall comply with the requirements of WAC 296-62-05411 and shall include the following legend:

(i) For pure MDA

DANGER CONTAINS MDA MAY CAUSE CANCER LIVER TOXIN

(ii) For mixtures containing MDA

DANGER CONTAINS MDA CONTAINS MATERIALS
WHICH MAY CAUSE CANCER LIVER TOXIN

(2) Material safety data sheets (MSDS).

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(a) Employers shall obtain or develop, and shall provide access to their employees, to a material safety data sheet (MSDS) for MDA. In meeting this obligation, employers shall make appropriate use of the information found in Appendices A and B.

(b) Employers who are manufacturers or importers shall:

(i) Comply with subdivision (1)(b) of this section as appropriate; and

(ii) Comply with the requirement in WISHA hazard communication standard, WAC 296-62-054, that they deliver to downstream employers an MSDS for MDA.

(3) Information and training.

(a) The employer shall provide employees with information and training on MDA, in accordance with WAC 296-62-054 through 296-62-05415, at the time of initial assignment and at least annually thereafter.

(b) In addition to the information required under WAC 296-62-054, the employer shall:

(i) Provide an explanation of the contents of WAC 296-62-076, including Appendices A and B, and indicate to employees where a copy of the standard is available;

(ii) Describe the medical surveillance program required under WAC 296-62-07625, and explain the information contained in Appendix C; and

(iii) Describe the medical removal provision required under WAC 296-62-07625.

(4) Access to training materials.

(a) The employer shall make readily available to all affected employees, without cost, all written materials relating to the employee training program, including a copy of this regulation.

(b) The employer shall provide to the director, upon request, all information and training materials relating to the employee information and training program.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07621, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07623 Housekeeping. (1) All surfaces shall be maintained as free as practicable of visible accumulations of MDA.

(2) The employer shall institute a program for detecting MDA leaks, spills, and discharges, including regular visual inspections of operations involving liquid or solid MDA.

(3) All leaks shall be repaired and liquid or dust spills cleaned up promptly.

(4) Surfaces contaminated with MDA may not be cleaned by the use of compressed air.

(5) Shoveling, dry sweeping, and other methods of dry clean-up of MDA may be used where HEPA-filtered vacuuming and/or wet cleaning are not feasible or practical.

(6) Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with MDA shall be collected and disposed of in a manner to prevent the reentry of MDA into the workplace.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07623, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07625 Medical surveillance. (1) General.

(a) The employer shall make available a medical surveillance program for employees exposed to MDA:

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(i) Employees exposed at or above the action level for 30 or more days per year;

(ii) Employees who are subject to dermal exposure to MDA for 15 or more days per year;

(iii) Employees who have been exposed in an emergency situation;

(iv) Employees whom the employer, based on results from compliance with WAC 296-62-07609(8), has reason to believe are being dermally exposed; and

(v) Employees who show signs or symptoms of MDA exposure.

(b) The employer shall ensure that all medical examinations and procedures are performed by, or under the supervision of, a licensed physician, at a reasonable time and place, and provided without cost to the employee.

(2) Initial examinations.

(a) Within 150 days of the effective date of this standard, or before the time of initial assignment, the employer shall provide each employee covered by subdivision (1)(a) of this section with a medical examination including the following elements:

(i) A detailed history which includes:

(A) Past work exposure to MDA or any other toxic substances;

(B) A history of drugs, alcohol, tobacco, and medication routinely taken (duration and quantity); and

(C) A history of dermatitis, chemical skin sensitization, or previous hepatic disease.

(ii) A physical examination which includes all routine physical examination parameters, skin examination, and signs of liver disease.

(iii) Laboratory tests including:

(A) Liver function tests; and

(B) Urinalysis.

(iv) Additional tests as necessary in the opinion of the physician.

(b) No initial medical examination is required if adequate records show that the employee has been examined in accordance with the requirements of WAC 296-62-076 within the previous six months prior to the effective date of this standard or prior to the date of initial assignment.

(3) Periodic examinations.

(a) The employer shall provide each employee covered by WAC 296-62-076 with a medical examination at least annually following the initial examination. These periodic examinations shall include at least the following elements:

(i) A brief history regarding any new exposure to potential liver toxins, changes in drug, tobacco, and alcohol intake, and the appearance of physical signs relating to the liver and the skin;

(ii) The appropriate tests and examinations including liver function tests and skin examinations; and

(iii) Appropriate additional tests or examinations as deemed necessary by the physician.

(b) If in the physicians' opinion the results of liver function tests indicate an abnormality, the employee shall be removed from further MDA exposure in accordance with WAC 296-62-07627 and 296-62-07629. Repeat liver function tests shall be conducted on advice of the physician.

(4) Emergency examinations. If the employer determines that the employee has been exposed to a potentially hazardous amount of MDA in an emergency situation as addressed in WAC 296-62-07607, the employer shall provide medical examinations in accordance with subsection (3) of this section. If the results of liver function testing indicate an abnormality, the employee shall be removed in accordance with WAC 296-62-07627 and 296-62-07629. Repeat liver function tests shall be conducted on the advice of the physician. If the results of the tests are normal, tests must be repeated two to three weeks from the initial testing. If the results of the second set of tests are normal and on the advice of the physician, no additional testing is required.

(5) Additional examinations. Where the employee develops signs and symptoms associated with exposure to MDA, the employer shall provide the employee with an additional medical examination including a liver function test. Repeat liver function tests shall be conducted on the advice of the physician. If the results of the tests are normal, tests must be repeated two to three weeks from the initial testing. If the results of the second set of tests are normal and, on the advice of the physician, no additional testing is required.

(6) Multiple physician review mechanism.

(a) If the employer selects the initial physician who conducts any medical examination or consultation provided to an employee under WAC 296-62-076, and the employee has signs or symptoms of occupational exposure to MDA (which could include an abnormal liver function test), and the employee disagrees with the opinion of the examining physician, and this opinion could affect the employee's job status, the employee may designate an appropriate, mutually acceptable second physician:

(i) To review any findings, determinations, or recommendations of the initial physician; and

(ii) To conduct such examinations, consultations, and laboratory tests as the second physician deems necessary to facilitate this review.

(b) The employer shall promptly notify an employee of the right to seek a second medical opinion after each occasion that an initial physician conducts a medical examination or consultation pursuant to WAC 296-62-076. The employer may condition its participation in, and payment for, the multiple physician review mechanism upon the employee doing the following within fifteen days after receipt of the foregoing notification, or receipt of the initial physician's written opinion, whichever is later:

(i) The employee informing the employer that he or she intends to seek a second medical opinion; and

(ii) The employee initiating steps to make an appointment with a second physician.

(c) If the findings, determinations, or recommendations of the second physician differ from those of the initial physician, then the employer and the employee shall assure that efforts are made for the two physicians to resolve any disagreement.

(d) If the two physicians have been unable to resolve quickly their disagreement, then the employer and the employee through their respective physicians shall designate a third physician:

(i) To review any findings, determinations, or recommendations of the prior physicians; and

(ii) To conduct such examinations, consultations, laboratory tests, and discussions with the prior physicians as the third physician deems necessary to resolve the disagreement of the prior physicians.

(e) The employer shall act consistent with the findings, determinations, and recommendations of the third physician, unless the employer and the employee reach an agreement which is otherwise consistent with the recommendations of at least one of the three physicians.

(7) Information provided to the examining and consulting physicians.

(a) The employer shall provide the following information to the examining physician:

(i) A copy of this regulation and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's potential exposure to MDA;

(iii) The employee's current actual or representative MDA exposure level;

(iv) A description of any personal protective equipment used or to be used; and

(v) Information from previous employment-related medical examinations of the affected employee.

(b) The employer shall provide the foregoing information to a second physician under this section upon request either by the second physician or by the employee.

(8) Physician's written opinion.

(a) For each examination under WAC 296-62-076, the employer shall obtain, and provide the employee with a copy of, the examining physician's written opinion within 15 days of its receipt. The written opinion shall include the following:

(i) The occupationally-pertinent results of the medical examination and tests;

(ii) The physician's opinion concerning whether the employee has any detected medical conditions which would place the employee at increased risk of material impairment of health from exposure to MDA;

(iii) The physician's recommended limitations upon the employee's exposure to MDA or upon the employee's use of protective clothing or equipment and respirators; and

(iv) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions resulting from MDA exposure which require further explanation or treatment.

(b) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposures.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07625, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07627 Medical removal—Temporary medical removal of an employee. Temporary medical removal of an employee.

(1) Temporary removal resulting from occupational exposure. The employee shall be removed from work environments in which exposure to MDA is at or above the action level or where dermal exposure to MDA may occur, following an initial examination (WAC 296-62-07625(2)), periodic examinations (WAC 296-62-07625(3)), an emergency situa-

tion (WAC 296-62-07625(4)), or an additional examination (WAC 296-62-07625(5)) in the following circumstances:

(a) When the employee exhibits signs and/or symptoms indicative of acute exposure to MDA; or

(b) When the examining physician determines that an employee's abnormal liver function tests are not associated with MDA exposure but that the abnormalities may be exacerbated as a result of occupational exposure to MDA.

(c) Temporary removal due to a final medical determination.

(i) The employer shall remove an employee from work environments in which exposure to MDA is at or above the action level or where dermal exposure to MDA may occur, on each occasion that there is a final medical determination or opinion that the employee has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to MDA.

(ii) For the purposes of WAC 296-62-076, the phrase "final medical determination" shall mean the outcome of the physician review mechanism used pursuant to the medical surveillance provisions of this section.

(iii) Where a final medical determination results in any recommended special protective measures for an employee, or limitations on an employee's exposure to MDA, the employer shall implement and act consistent with the recommendation.

(2) Return of the employee to former job status.

(a) The employer shall return an employee to his or her former job status:

(i) When the employee no longer shows signs or symptoms of exposure to MDA or upon the advice of the physician.

(ii) When a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition which places the employee at increased risk of material impairment to health from exposure to MDA.

(b) For the purposes of this section, the requirement that an employer return an employee to his or her former job status is not intended to expand upon or restrict any rights an employee has or would have had, absent temporary medical removal, to a specific job classification or position under the terms of a collective bargaining agreement.

(3) Removal of other employee special protective measure or limitations. The employer shall remove any limitations placed on an employee, or end any special protective measures provided to an employee, pursuant to a final medical determination, when a subsequent final medical determination indicates that the limitations or special protective measures are no longer necessary.

(4) Employer options pending a final medical determination. Where the physician review mechanism used pursuant to the medical surveillance provisions of WAC 296-62-076, has not yet resulted in a final medical determination with respect to an employee, the employer shall act as follows:

(a) Removal. The employer may remove the employee from exposure to MDA, provide special protective measures to the employee, or place limitations upon the employee, consistent with the medical findings, determinations, or recom-

recommendations of any of the physicians who have reviewed the employee's health status.

(b) Return. The employer may return the employee to his or her former job status, and end any special protective measures provided to the employee, consistent with the medical findings, determinations, or recommendations of any of the physicians who have reviewed the employee's health status, with two exceptions.

(i) If the initial removal, special protection, or limitation of the employee resulted from a final medical determination which differed from the findings, determinations, or recommendations of the initial physician; or

(ii) If the employee has been on removal status for the preceding six months as a result of exposure to MDA, then the employer shall await a final medical determination.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07627, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07629 Medical removal protection benefits. (1) Provisions of medical removal protection benefits. The employer shall provide to an employee up to six months of medical removal protection benefits on each occasion that an employee is removed from exposure to MDA or otherwise limited pursuant to this section.

(2) Definition of medical removal protection benefits. For the purposes of this section, the requirement that an employer provide medical removal protection benefits means that the employer shall maintain the earnings, seniority, and other employment rights and benefits of an employee as though the employee had not been removed from normal exposure to MDA or otherwise limited.

(3) Follow-up medical surveillance during the period of employee removal or limitations. During the period of time that an employee is removed from normal exposure to MDA or otherwise limited, the employer may condition the provision of medical removal protection benefits upon the employee's participation in follow-up medical surveillance made available pursuant to WAC 296-62-076.

(4) Workers' compensation claims. If a removed employee files a claim for workers' compensation payments for an MDA-related disability, then the employer shall continue to provide medical removal protection benefits pending disposition of the claim. To the extent that an award is made to the employee for earnings lost during the period of removal, the employer's medical removal protection obligation shall be reduced by such amount. The employer shall receive no credit for workers' compensation payments received by the employee for treatment-related expenses.

(5) Other credits. The employer's obligation to provide medical removal protection benefits to a removed employee shall be reduced to the extent that the employee receives compensation for earnings lost during the period of removal either from a publicly or employer-funded compensation program, or receives income from non-MDA-related employment with any employer made possible by virtue of the employee's removal.

(6) Employees who do not recover within the 6 months of removal. The employer shall take the following measures with respect to any employee removed from exposure to MDA:

(a) The employer shall make available to the employee a medical examination pursuant to this section to obtain a final medical determination with respect to the employee;

(b) The employer shall assure that the final medical determination obtained indicates whether or not the employee may be returned to his or her former job status, and, if not, what steps should be taken to protect the employee's health;

(c) Where the final medical determination has not yet been obtained, or, once obtained indicates that the employee may not yet be returned to his or her former job status, the employer shall continue to provide medical removal protection benefits to the employee until either the employee is returned to former job status, or a final medical determination is made that the employee is incapable of ever safely returning to his or her former job status; and

(d) Where the employer acts pursuant to a final medical determination which permits the return of the employee to his or her former job status, despite what would otherwise be an abnormal liver function test, later questions concerning removing the employee again shall be decided by a final medical determination. The employer need not automatically remove such an employee pursuant to the MDA removal criteria provided by WAC 296-62-076.

(7) Voluntary removal or restriction of an employee. Where an employer, although not required by WAC 296-62-076 to do so, removes an employee from exposure to MDA or otherwise places limitations on an employee due to the effects of MDA exposure on the employee's medical condition, the employer shall provide medical removal protection benefits to the employee equal to that required by this section.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07629, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07631 Recordkeeping. (1) Monitoring data for exempted employers.

(a) Where as a result of the initial monitoring the processing, use, or handling of products made from or containing MDA are exempted from other requirements of this section under WAC 296-62-07601(2), the employer shall establish and maintain an accurate record of monitoring relied on in support of the exemption.

(b) This record shall include at least the following information:

(i) The product qualifying for exemption;

(ii) The source of the monitoring data (e.g., was monitoring performed by the employer or a private contractor);

(iii) The testing protocol, results of testing, and/or analysis of the material for the release of MDA;

(iv) A description of the operation exempted and how the data support the exemption (e.g., are the monitoring data representative of the conditions at the affected facility); and

(v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(2) Objective data for exempted employers.

(a) Where the processing, use, or handling of products made from or containing MDA are exempted from other

requirements of WAC 296-62-076 under WAC 296-62-07601, the employer shall establish and maintain an accurate record of objective data relied upon in support of the exemption.

(b) This record shall include at least the following information:

- (i) The product qualifying for exemption;
 - (ii) The source of the objective data;
 - (iii) The testing protocol, results of testing, and/or analysis of the material for the release of MDA;
 - (iv) A description of the operation exempted and how the data support the exemption; and
 - (v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.
- (c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

(3) Exposure measurements.

(a) The employer shall establish and maintain an accurate record of all measurements required by WAC 296-62-07609, in accordance with Part B of this chapter.

(b) This record shall include:

(i) The dates, number, duration, and results of each of the samples taken, including a description of the procedure used to determine representative employee exposures;

(ii) Identification of the sampling and analytical methods used;

(iii) A description of the type of respiratory protective devices worn, if any; and

(iv) The name, Social Security number, job classification, and exposure levels of the employee monitored and all other employees whose exposure the measurement is intended to represent.

(c) The employer shall maintain this record for at least 30 years, in accordance with Part B of this chapter.

(4) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by WAC 296-62-07625, 296-62-07627, and 296-62-07629, in accordance with Part B of this chapter.

(b) This record shall include:

(i) The name, Social Security number, and description of the duties of the employee;

(ii) The employer's copy of the physician's written opinion on the initial, periodic, and any special examinations, including results of medical examination and all tests, opinions, and recommendations;

(iii) Results of any airborne exposure monitoring done for that employee and the representative exposure levels supplied to the physician; and

(iv) Any employee medical complaints related to exposure to MDA.

(c) The employer shall keep, or assure that the examining physician keeps, the following medical records:

(i) A copy of this standard and its appendices, except that the employer may keep one copy of the standard and its appendices for all employees provided the employer references the standard and its appendices in the medical surveillance record of each employee;

(ii) A copy of the information provided to the physician as required by any sections in the regulatory text;

(iii) A description of the laboratory procedures and a copy of any standards or guidelines used to interpret the test results or references to the information;

(iv) A copy of the employee's medical and work history related to exposure to MDA.

(d) The employer shall maintain this record for at least the duration of employment plus 30 years, in accordance with Part B of this chapter.

(5) Medical removals.

(a) The employer shall establish and maintain an accurate record for each employee removed from current exposure to MDA pursuant to WAC 296-62-07625, 296-62-07627, and 296-62-07629.

(b) Each record shall include:

(i) The name and Social Security number of the employee;

(ii) The date of each occasion that the employee was removed from current exposure to MDA as well as the corresponding date on which the employee was returned to his or her former job status;

(iii) A brief explanation of how each removal was or is being accomplished; and

(iv) A statement with respect to each removal indicating the reason for the removal.

(c) The employer shall maintain each medical removal record for at least the duration of an employee's employment plus 30 years.

(6) Availability.

(a) The employer shall assure that records required to be maintained by WAC 296-62-076 shall be made available, upon request, to the director for examination and copying.

(b) Employee exposure monitoring records required by WAC 296-62-076 shall be provided upon request for examination and copying to employees, employee representatives, and the director in accordance with the applicable sections of WAC 296-62-054.

(c) Employee medical records required by this section shall be provided upon request for examination and copying, to the subject employee, to anyone having the specific written consent of the subject employee, and to the director in accordance with Part B of this chapter.

(7) Transfer of records.

(a) The employer shall comply with the requirements involving transfer of records set forth in WAC 296-62-05215.

(b) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director, at least 90 days prior to disposal, and transmit the records to the director if so requested by the director within that period.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07631, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07633 Observation of monitoring. (1) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe the measuring or monitoring of employee exposure to MDA conducted pursuant to WAC 296-62-07609.

(2) Observation procedures. When observation of the measuring or monitoring of employee exposure to MDA

requires entry into areas where the use of protective clothing and equipment or respirators is required, the employer shall provide the observer with personal protective clothing and equipment or respirators required to be worn by employees working in the area, assure the use of such clothing and equipment or respirators, and require the observer to comply with all other applicable safety and health procedures.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07633, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07635 Effective date. This standard shall become effective March 15, 1993.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07635, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07637 Appendices. The information contained in Appendices A, B, C, and D of WAC 296-62-076 is not intended by itself, to create any additional obligations not otherwise imposed by this standard nor detract from any existing obligation. The protocols for respiratory fit testing in Appendix E of WAC 296-62-076 are mandatory.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07637, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07639 Startup dates. Compliance with all obligations of this standard commence on the effective date except as follows:

(1) Initial monitoring under WAC 296-62-07609(2) of WAC 296-62-076 shall be completed as soon as possible but no later than June 13, 1993.

(2) Medical examinations under WAC 296-62-07625, 296-62-07627, and 296-62-07629 shall be completed as soon as possible but no later than August 14, 1993.

(3) Emergency plans required by WAC 296-62-07607 shall be provided and available for inspection and copying as soon as possible but no later than July 13, 1993.

(4) Initial training and education shall be completed as soon as possible but no later than July 13, 1993.

(5) Hygiene and lunchroom facilities under WAC 296-62-07619 shall be in operation as soon as possible but no later than March 15, 1994.

(6) Respiratory protection required by WAC 296-62-07615 shall be provided as soon as possible but no later than July 13, 1993.

(7) Written compliance plans required by WAC 296-62-07613(2) shall be completed and available for inspection and copying as soon as possible but no later than July 13, 1993.

(8) WISHA shall enforce the permissible exposure limits in WAC 296-62-07605 no earlier than July 13, 1993.

(9) Engineering controls needed to achieve the PELs must be in place March 15, 1993.

(10) Personal protective clothing required by WAC 296-62-07617 shall be available July 13, 1993.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07639, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07654 Appendix A to WAC 296-62-076—Substance data sheet, for 4,4'-methylenedianiline.

(1) Substance identification.

(a) Substance: Methylenedianiline (MDA).

(b) Permissible exposure:

(i) Airborne: Ten parts per billion parts of air (10 ppb), time-weighted average (TWA) for an 8-hour workday and an action level of five parts per billion parts of air (5 ppb).

(ii) Dermal: Eye contact and skin contact with MDA are not permitted.

(c) Appearance and odor: White to tan solid; amine odor.

(2) Health hazard data.

(a) Ways in which MDA affects your health. MDA can affect your health if you inhale it, or if it comes in contact with your skin or eyes. MDA is also harmful if you happen to swallow it. Do not get MDA in eyes, on skin, or on clothing.

(b) Effects of overexposure.

(i) Short-term (acute) overexposure: Overexposure to MDA may produce fever, chills, loss of appetite, vomiting, jaundice. Contact may irritate skin, eyes, and mucous membranes. Sensitization may occur.

(ii) Long-term (chronic) exposure. Repeated or prolonged exposure to MDA, even at relatively low concentrations, may cause cancer. In addition, damage to the liver, kidneys, blood, and spleen may occur with long-term exposure.

(iii) Reporting signs and symptoms: You should inform your employer if you develop any signs or symptoms which you suspect are caused by exposure to MDA including yellow staining of the skin.

(3) Protective clothing and equipment.

(a) Respirators. Respirators are required for those operations in which engineering controls or work practice controls are not adequate or feasible to reduce exposure to the permissible limit. If respirators are worn, they must have the joint Mine Safety and Health Administration and National Institute for Occupational Safety and Health (NIOSH) seal of approval, and cartridges or canisters must be replaced as necessary to maintain the effectiveness of the respirator. If you experience difficulty breathing while wearing a respirator, you may request a positive pressure respirator from your employer. You must be thoroughly trained to use the assigned respirator, and the training will be provided by your employer. MDA does not have a detectable odor except at levels well above the permissible exposure limits. Do not depend on odor to warn you when a respirator canister is exhausted. If you can smell MDA while wearing a respirator, proceed immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.

(b) Protective clothing. You may be required to wear coveralls, aprons, gloves, face shields, or other appropriate protective clothing to prevent skin contact with MDA. Where protective clothing is required, your employer is required to provide clean garments to you, as necessary, to assure that the clothing protects you adequately. Replace or repair impervious clothing that has developed leaks. MDA should never be allowed to remain on the skin. Clothing and shoes which are not impervious to MDA should not be allowed to become contaminated with MDA, and if they do, the clothing and shoes should be promptly removed and decontaminated. The clothing should be laundered to remove MDA or discarded. Once MDA penetrates shoes or other leather articles, they should not be worn again.

(c) Eye protection. You must wear splashproof safety goggles in areas where liquid MDA may contact your eyes. Contact lenses should not be worn in areas where eye contact

with MDA can occur. In addition, you must wear a face shield if your face could be splashed with MDA liquid.

(4) Emergency and first aid procedures.

(a) Eye and face exposure. If MDA is splashed into the eyes, wash the eyes for at least 15 minutes. See a doctor as soon as possible.

(b) Skin exposure. If MDA is spilled on your clothing or skin, remove the contaminated clothing and wash the exposed skin with large amounts of soap and water immediately. Wash contaminated clothing before you wear it again.

(c) Breathing. If you or any other person breathes in large amounts of MDA, get the exposed person to fresh air at once. Apply artificial respiration if breathing has stopped. Call for medical assistance or a doctor as soon as possible. Never enter any vessel or confined space where the MDA concentration might be high without proper safety equipment and at least one other person present who will stay outside. A life line should be used.

(d) Swallowing. If MDA has been swallowed and the patient is conscious, do not induce vomiting. Call for medical assistance or a doctor immediately.

(5) Medical requirements. If you are exposed to MDA at a concentration at or above the action level for more than 30 days per year, or exposed to liquid mixtures more than 15 days per year, your employer is required to provide a medical examination, including a medical history and laboratory tests, within 60 days of the effective date of this standard and annually thereafter. These tests shall be provided without cost to you. In addition, if you are accidentally exposed to MDA (either by ingestion, inhalation, or skin/eye contact) under conditions known or suspected to constitute toxic exposure to MDA, your employer is required to make special examinations and tests available to you.

(6) Observation of monitoring. Your employer is required to perform measurements that are representative of your exposure to MDA and you or your designated representative are entitled to observe the monitoring procedure. You are entitled to observe the steps taken in the measurement procedure and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, you and your representative must also be provided with, and must wear, the protective clothing and equipment.

(7) Access to records. You or your representative are entitled to see the records of measurements of your exposure to MDA upon written request to your employer. Your medical examination records can be furnished to your physician or designated representative upon request by you to your employer.

(8) Precautions for safe use, handling, and storage.

(a) Material is combustible. Avoid strong acids and their anhydrides. Avoid strong oxidants. Consult supervisor for disposal requirements.

(b) Emergency clean-up. Wear self-contained breathing apparatus and fully clothe the body in the appropriate personal protective clothing and equipment.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07654, filed 2/3/93, effective 3/15/93.]

[Title 296 WAC—p. 1570]

WAC 296-62-07656 Appendix B to WAC 296-62-076—Substance technical guidelines, MDA. (1) Identification.

(a) Substance identification. Synonyms: CAS No. 101-77-9. 4,4'-methylenedianiline; 4,4'-methylenebisaniline; methylenedianiline; dianilinomethane.

(b) Formula: $C_{13}H_{14}N_2$.

(2) Physical data.

(a) Appearance and odor: White to tan solid; amine odor.

(b) Molecular weight: 198.26.

(c) Boiling point: 398-399 degrees C. at 760 mm Hg.

(d) Melting point: 88-93 degrees C. (190-100 degrees F.).

(e) Vapor pressure: 9 mmHg at 232 degrees C.

(f) Evaporation rate (n-butyl acetate= 1): Negligible.

(g) Vapor density (Air=1): Not applicable.

(h) Volatile fraction by weight: Negligible.

(i) Specific gravity (Water=1): Slight.

(j) Heat of combustion: -8.40 kcal/g.

(k) Solubility in water: Slightly soluble in cold water, very soluble in alcohol, benzene, ether, and many organic solvents.

(3) Fire, explosion, and reactivity hazard data.

(a) Flash point: 190 degrees C. (374 degrees F.) Set-
aflash closed cup.

(b) Flash point: 226 degrees C. (439 degrees F.) Cleve-
land open cup.

(c) Extinguishing media: Water spray; dry chemical; car-
bon dioxide.

(d) Special fire fighting procedures: Wear self-contained
breathing apparatus and protective clothing to prevent con-
tact with skin and eyes.

(e) Unusual fire and explosion hazards: Fire or excessive
heat may cause production of hazardous decomposition prod-
ucts.

(4) Reactivity data.

(a) Stability: Stable.

(b) Incompatibility: Strong oxidizers.

(c) Hazardous decomposition products: As with any
other organic material, combustion may produce carbon
monoxide. Oxides of nitrogen may also be present.

(d) Hazardous polymerization: Will not occur.

(5) Spill and leak procedures.

(a) Sweep material onto paper and place in fiber carton.

(b) Package appropriately for safe feed to an incinerator
or dissolve in compatible waste solvents prior to incineration.

(c) Dispose of in an approved incinerator equipped with
afterburner and scrubber or contract with licensed chemical
waste disposal service.

(d) Discharge treatment or disposal may be subject to
federal, state, or local laws.

(e) Wear appropriate personal protective equipment.

(6) Special storage and handling precautions.

(a) High exposure to MDA can occur when transferring
the substance from one container to another. Such operations
should be well ventilated and good work practices must be
established to avoid spills.

(b) Pure MDA is a solid with a low vapor pressure.
Grinding or heating operations increase the potential for
exposure.

(c) Store away from oxidizing materials.

(d) Employers shall advise employees of all areas and operations where exposure to MDA could occur.

(7) Housekeeping and hygiene facilities.

(a) The workplace should be kept clean, orderly, and in a sanitary condition. The employer should institute a leak and spill detection program for operations involving MDA in order to detect sources of fugitive MDA emissions.

(b) Adequate washing facilities with hot and cold water are to be provided and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of MDA from the skin.

(8) Common operations. Common operations in which exposure to MDA is likely to occur include the following: Manufacture of MDA; manufacture of methylene diisocyanate; curing agent for epoxy resin structures; wire coating operations; and filament winding.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07656, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07658 Appendix C to WAC 296-62-076—Medical surveillance guidelines for MDA. (1) Route of entry:

Inhalation; skin absorption; ingestion. MDA can be inhaled, absorbed through the skin, or ingested.

(2) Toxicology:

MDA is a suspect carcinogen in humans. There are several reports of liver disease in humans and animals resulting from acute exposure to MDA. A well documented case of an acute cardiomyopathy secondary to exposure to MDA is on record. Numerous human cases of hepatitis secondary to MDA are known. Upon direct contact MDA may also cause damage to the eyes. Dermatitis and skin sensitization have been observed. Almost all forms of acute environmental hepatic injury in humans involve the hepatic parenchyma and produce hepatocellular jaundice. This agent produces intrahepatic cholestasis. The clinical picture consists of cholestatic jaundice, preceded or accompanied by abdominal pain, fever, and chills. Onset in about 60 percent of all observed cases is abrupt with severe abdominal pain. In about 30 percent of observed cases, the illness presented and evolved more slowly and less dramatically, with only slight abdominal pain. In about 10 percent of the cases only jaundice was evident. The cholestatic nature of the jaundice is evident in the prominence of itching, the histologic predominance of bile stasis, and portal inflammatory infiltration, accompanied by only slight parenchymal injury in most cases, and by the moderately elevated transaminase values. Acute, high doses, however, have been known to cause hepatocellular damage resulting in elevated SGPT, SGOT, alkaline phosphatase, and bilirubin.

Absorption through the skin is rapid. MDA is metabolized and excreted over a 48-hour period. Direct contact may be irritating to the skin, causing dermatitis. Also MDA which is deposited on the skin is not thoroughly removed through washing.

MDA may cause bladder cancer in humans. Animal data supporting this assumption is not available nor is conclusive human data. However, human data collected on workers at a helicopter manufacturing facility where MDA is used sug-

gests a higher incidence of bladder cancer among exposed workers.

(3) Signs and symptoms:

Skin may become yellow from contact with MDA.

Repeated or prolonged contact with MDA may result in recurring dermatitis (red-itchy, cracked skin) and eye irritation. Inhalation, ingestion, or absorption through the skin at high concentrations may result in hepatitis, causing symptoms such as fever and chills, nausea and vomiting, dark urine, anorexia, rash, right upper quadrant pain, and jaundice. Corneal burns may occur when MDA is splashed in the eyes.

(4) Treatment of acute toxic effects/emergency situation:

If MDA gets into the eyes, immediately wash eyes with large amounts of water. If MDA is splashed on the skin, immediately wash contaminated skin with mild soap or detergent. Employee should be removed from exposure and given proper medical treatment. Medical tests required under the emergency section of the medical surveillance subsection (13)(d) must be conducted.

If the chemical is swallowed do not induce vomiting but remove by gastric lavage.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07658, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07660 Appendix D to WAC 296-62-076—Sampling and analytical methods for MDA monitoring and measurement procedures. Measurements taken for the purpose of determining employee exposure to MDA are best taken so that the representative average 8-hour exposure may be determined from a single 8-hour sample or two 4-hour samples. Short-time interval samples (or grab samples) may also be used to determine average exposure level if a minimum of five measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random samples taken on one work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

There are a number of methods available for monitoring employee exposures to MDA. The method WISHA currently uses is included below.

The employer, however, has the obligation of selecting any monitoring method which meets the accuracy and precision requirements of the standard under his/her unique field conditions. The standard requires that the method of monitoring must have an accuracy, to a 95 percent confidence level, of not less than plus or minus 25 percent for the select PEL.

WISHA methodology.

Sampling procedure.

Apparatus:

Samples are collected by use of a personal sampling pump that can be calibrated within ± 5 percent of the recommended flow rate with the sampling filter in line.

Samples are collected on 37 mm Gelman type A/E glass fiber filters treated with sulfuric acid. The filters are prepared by soaking each filter with 0.5 mL of 0.26N H₂SO₄. (0.26 N H₂SO₄ can be prepared by diluting 1.5 mL of 36N H₂SO₄ to 200 mL with deionized water.) The filters are dried in an oven at 100 degrees C. for one hour and then assembled into three-piece 37 mm polystyrene cassettes without backup pads. The front filter is separated from the back filter by a polystyrene spacer. The cassettes are sealed with shrink bands and the ends are plugged with plastic plugs.

After sampling, the filters are carefully removed from the cassettes and individually transferred to small vials containing approximately 2 mL deionized water. The vials must be tightly sealed. The water can be added before or after the filters are transferred. The vials must be sealable and capable of holding at least 7 mL of liquid. Small glass scintillation vials with caps containing Teflon liners are recommended.

Reagents:

Deionized water is needed for addition to the vials.

Sampling technique:

Immediately before sampling, remove the plastic plugs from the filter cassettes.

Attach the cassette to the sampling pump with flexible tubing and place the cassette in the employee's breathing zone.

After sampling, seal the cassettes with plastic plugs until the filters are transferred to the vials containing deionized water.

At some convenient time within 10 hours of sampling, transfer the sample filters to vials.

Seal the small vials lengthwise.

Submit at least one blank filter with each sample set. Blanks should be handled in the same manner as samples, but no air is drawn through them.

Record sample volumes (in L of air) for each sample, along with any potential interferences.

Retention efficiency:

A retention efficiency study was performed by drawing 100 L of air (80 percent relative humidity) at 1 L/min through sample filters that had been spiked with 0.814 microgram MDA. Instead of using backup pads, blank acid-treated filters were used as backups in each cassette. Upon analysis, the top filters were found to have an average of 91.8 percent of the spiked amount. There was no MDA found on the bottom filters, so the amount lost was probably due to the slight instability of the MDA salt.

Extraction efficiency:

The average extraction efficiency for six filters spiked at the target concentration is 99.6 percent.

The stability of extracted and derivatized samples was verified by reanalyzing the above six samples the next day using fresh standards. The average extraction efficiency for the reanalyzed samples is 98.7 percent.

Recommended air volume and sampling rate:

The recommended air volume is 100 L.

The recommended sampling rate is 1 L/min.

Interferences (sampling):

MDI appears to be a positive interference. It was found that when MDI was spiked onto an acid-treated filter, the MDI converted to MDA after air was drawn through it.

Suspected interferences should be reported to the laboratory with submitted samples.

Safety precautions (sampling):

Attach the sampling equipment to the employees so that it will not interfere with work performance or safety.

Follow all safety procedures that apply to the work area being sampled.

Analytical procedure:

Apparatus: The following are required for analysis.

A GC equipped with an electron capture detector. For this evaluation a Hewlett Packard 5880 Gas Chromatograph equipped with a Nickel 63 High Temperature Electron Capture Detector and a Linearizer was used.

A GC column capable of separating the MDA derivative from the solvent and interferences. A 6 ft X 2 mm ID glass column packed with 3 percent OV-101 coated on 100/120 Gas Chrom Q or a 25 meter DB-1 or DB-5 capillary column is recommended for this evaluation.

A electronic integrator or some other suitable means of measuring peak areas or heights.

Small resealable vials with Teflon-lined caps capable of holding 4 mL.

A dispenser or pipet for toluene capable of delivering 2.0 mL.

Pipets (or repipets with plastic or Teflon tips) capable of delivering 1 mL for the sodium hydroxide and buffer solutions.

A repipet capable of delivering 25 micro-L HFAA.

Syringes for preparation of standards and injection of standards and samples into a GC.

Volumetric flasks and pipets to dilute the pure MDA in preparation of standards.

Disposable pipets to transfer the toluene layers after the samples are extracted.

Reagents:

0.5 NaOH prepared from reagent grade NaOH.

Toluene, pesticide grade. Burdick and Jackson distilled in glass toluene was used.

Heptafluorobutyric acid anhydride (HFAA). HFAA from Pierce Chemical Company was used.

pH 7.0 phosphate buffer, prepared from 136 g potassium dihydrogen phosphate and 1 L deionized water. The pH is adjusted to 7.0 with saturated sodium hydroxide solution.

4,4'-Methylenedianiline (MDA), reagent grade.

Standard preparation:

Concentrated stock standards are prepared by diluting pure MDA with toluene. Analytical standards are prepared by injecting μL amounts of diluted stock standards into vials that contain 2.0 mL toluene.

25 μL HFAA are added to each vial and the vials are capped and shaken for 10 seconds.

After 10 min, 1 mL of buffer is added to each vial.

The vials are recapped and shaken for 10 seconds.

After allowing the layers to separate, aliquots of the toluene (upper) layers are removed with a syringe and analyzed by GC.

Analytical standard concentrations should bracket sample concentrations. Thus, if samples fall out of the range of prepared standards, additional standards must be prepared to ascertain detector response.

Sample preparation:

The sample filters are received in vials containing deionized water.

1 mL of 0.5N NaOH and 2.0 mL toluene are added to each vial.

The vials are recapped and shaken for 10 min.

After allowing the layers to separate, approximately 1 mL aliquots of the toluene (upper) layers are transferred to separate vials with clean disposable pipets.

The toluene layers are treated and analyzed.

Analysis:

GC conditions

Zone temperatures:

Column—220 degrees C.

Injector—235 degrees C.

Detector—335 degrees C.

C Gas flows, N_2 Column—30 mL/min

He Column 0.9 mL/min. (capillary) with 30 mL/min. A_2CH_4 (95/5) makeup gas

Injection volume: 5.0 μL

Column: 6 ft X 1/8 in ID glass, 3% OV-101 on 100/120

Gas Chrom Q or 25 meter x .25 mm DB-1 or DB-5 capillary

Retention time of MDA derivative: 2.5 to 3.5, depending on column and flow

Chromatogram:

Peak areas or heights are measured by an integrator or other suitable means.

A calibration curve is constructed by plotting response (peak areas or heights) of standard injections versus μg of MDA per sample. Sample concentrations must be bracketed by standards.

Interferences (analytical):

Any compound that gives an electron capture detector response and has the same general retention time as the HFAA derivative of MDA is a potential interference. Suspected interferences reported to the laboratory with submitted

samples by the industrial hygienist must be considered before samples are derivatized.

GC parameters may be changed to possibly circumvent interferences.

Retention time on a single column is not considered proof of chemical identity. Analyte identity should be confirmed by GC/MS if possible.

Calculations:

The analyte concentration for samples is obtained from the calibration curve in terms of μg MDA per sample. The extraction efficiency is 100 percent. If any MDA is found on the blank, that amount is subtracted from the sample amounts. The air concentrations are calculated using the following formulae: $\text{Microgram}/\text{m}^3 = (\text{microgram MDA per sample}) (1000) / (\text{L of air sampled})$ $\text{ppb} = (\text{microgram}/\text{m}^3) (24.46) / (198.3) = (\text{microgram}/\text{m}^3) (0.1233)$ where 24.46 is the molar volume at 25 degrees C. and 760 mm Hg.

Safety precautions (analytical):

Avoid skin contact and inhalation of all chemicals.

Restrict the use of all chemicals to a fume hood if possible.

Wear safety glasses and a lab coat at all times while in the lab area.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07660, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07662 Appendix E to WAC 296-62-076—Qualitative and quantitative fit testing procedures.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07662, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07664 Appendix E-1—Qualitative fit test protocols.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07664, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07666 Appendix E-1-a—Isoamyl acetate (banana oil) protocol. (1) Odor threshold screening.

(a) Three 1-liter glass jars with metal lids (e.g., Mason or Ball jars) are required.

(b) Odor-free water (e.g., distilled or spring water) at approximately 25 deg. C. shall be used for the solutions.

(c) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding 1 cc of pure IAA to 800 cc of odor-free water in a 1-liter jar and shaking for 30 seconds. This solution shall be prepared new at least weekly.

(d) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated so that circulation of the test solution does not occur and cross contaminate the different testing sites.

(e) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into 500 cc of odor-free water using a clean dropper or pipette. Shake for 30 seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

(f) A test blank is prepared in a third jar by adding 500 cc of odor-free water.

(g) The odor test and test blank jars shall be labelled 1 and 2 for jar identification.

(h) The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e., 1 and 2): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(i) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed in order to prevent olfactory fatigue in the subject.

(j) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

(k) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(2) Respirator selection.

(a) The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least three sizes of elastomeric half facepieces, from at least two manufacturers.

(b) The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "comfortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

(c) The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit.

(d) The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a comfortable fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

(e) The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in subdivision (f) below. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and adjust the straps each time to become adept at setting proper tension on the straps.

(f) Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator after donning:

*Positioning of mask on nose.

*Room for eye protection.

*Room to talk.

*Positioning mask on face and cheeks.

(g) The following criteria shall be used to help determine the adequacy of the respirator fit:

*Chin properly placed.

*Strap tension.

*Fit across nose bridge.

*Distance from nose to chin.

*Tendency to slip.

*Self-observation in mirror.

(h) The test subject shall perform the conventional negative- or positive-pressure fit checks (e.g., see ANSI Z88.2-1980A7). Before beginning the negative- or positive-pressure test, the subject shall be told to "seat" the mask by rapidly moving the head from side to side and up and down, while taking a few deep breaths.

(i) The test subject is now ready for fit testing.

(j) After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If the respirator has become uncomfortable, another model of respirator shall be tried.

(k) The employee shall be given the opportunity to select a different facepiece and to be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

(3) Fit test.

(a) The fit test chamber shall be similar to a clear 55 gallon drum liner suspended inverted over a 2-foot diameter frame, so that the top of chamber is about 6 inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(b) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or canisters shall be replaced as necessary to maintain the effectiveness of the respirator.

(c) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(d) A copy of the following test exercises and Rainbow Passage shall be taped to the inside of the test chamber.

(e) Test exercises:

(i) Breathe normally.

(ii) Breathe deeply. Be certain breaths are deep and regular.

(iii) Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

(iv) Nod head up and down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

(v) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it aloud will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alterna-

tive passages which serve the same purpose may also be used.

Rainbow Passage: When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(vi) Jog in place.

(vii) Breathe normally.

(f) Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

(g) Upon entering the test chamber, the test subject shall be given a 6-inch by 5-inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

(h) Allow two minutes for the IAA test concentration to be reached before starting the fit test exercises.

(i) Each exercise described in subdivision (e) above shall be performed for at least one minute.

(j) If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(k) If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in subdivisions (d) through (i) above. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about 5 minutes before retesting. Odor sensitivity will usually have returned by this time.

(l) If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

(m) When a respirator is found that passes the test, the subject must break the face seal and take a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

(n) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

(o) Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 10 times the PEL. In atmospheres greater than 10 times, and less than 50 times the PEL (up to 50 ppm), the subject must pass the IAA test using a full face negative pressure respirator. (The concentration of

the IAA inside the test chamber must be increased by five times for QLFT of the full facepiece.)

(p) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(q) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as a powered air-purifying respirator, supplied air respirator, or self-contained breathing apparatus.

(r) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(s) Qualitative fit testing shall be repeated at least every 12 months.

(t) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(i) Weight change of 20 pounds or more;

(ii) Significant facial scarring in the area of the facepiece seal;

(iii) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures;

(iv) Reconstructive or cosmetic surgery; or

(v) Any other condition that may interfere with facepiece sealing.

(4) Recordkeeping. A summary of all test results shall be maintained by the employer for 3 years. The summary shall include:

(a) Name of test subject.

(b) Date of testing.

(c) Name of the test conductor.

(d) Respirators selected (indicate manufacturer, model, size, and approval number).

(e) Testing agent.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07666, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07668 Appendix E-1-b—Saccharin solution aerosol protocol. (1) Respirator selection. Respirators shall be selected as described in WAC 296-62-07666(2) Appendix E-1-a (respirator selection), except that each respirator shall be equipped with a particulate filter.

(2) Taste threshold screening.

(a) An enclosure placed over the head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately 12 inches in diameter by 14 inches tall with at least the front clear to allow free movement of the head when a respirator is worn.

(b) The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.

(c) The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.

(d) During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.

(e) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.

(f) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the test solution (see subdivision (3)(g)) in 100 cc of water.

(g) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.

(h) Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.

(i) If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

(j) If the second response is negative ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.

(k) The test conductor will take note of the number of squeezes required to elicit a taste response.

(l) If the saccharin is not tasted after 30 squeezes, subdivision (j), the saccharin fit test cannot be performed on the test subject.

(m) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.

(n) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.

(o) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.

(3) Fit test.

(a) The test subject may not eat, drink (except plain water), or chew gum for 15 minutes before the test.

(b) The test subject shall don and adjust the respirator without assistance from any person.

(c) The fit test uses the same enclosure described in subsection (2) of this section.

(d) Each test subject shall wear the respirator for at least 10 minutes before starting the fit test.

(i) This would be an appropriate time to talk with the test subject; to explain the fit test, the importance of cooperation, and the purpose for the head exercises; or to demonstrate some of the exercises.

(ii) The test subject shall perform the conventional negative- or positive-pressure fit tests (see ANSI Z88.2 1980 A7).

(e) The test subject shall enter the enclosure while wearing the respirator selected in WAC 296 -62-07666(2). This respirator shall be properly adjusted and equipped with a particulate filter.

(f) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.

(g) The fit test solution is prepared by adding 83 grams of sodium saccharin to 100 cc of warm water.

(h) As before, the test subject shall breathe with mouth open and tongue extended.

(i) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See subdivisions (2)(h) through (j).)

(j) After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.

(i) Breathe normally.

(ii) Breathe deeply. Be certain breaths are deep and regular.

(iii) Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

(iv) Nod head up and down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.

(v) Talk. Talk aloud and slowly. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement.

Rainbow Passage: When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(vi) Jog in place.

(vii) Breathe normally.

(k) At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in subdivision (i) of this subsection.

(l) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(m) If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

(n) Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 10 times the PEL of MDA. In other words this protocol may not be used to assign protection factors higher than ten.

(o) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(p) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

(q) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(r) Qualitative fit testing shall be repeated at least every 12 months.

(s) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(i) Weight change of 20 pounds or more;

(ii) Significant facial scarring in the area of the facepiece seal;

(iii) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures;

(iv) Reconstructive or cosmetic surgery; or

(v) Any other condition that may interfere with facepiece sealing.

(4) Recordkeeping. A summary of all test results shall be maintained by the employer for 3 years. The summary shall include:

(a) Name of test subject.

(b) Date of testing.

(c) Name of test conductor.

(d) Respirators selected (indicate manufacturer, model, size, and approval number).

(e) Testing agent.

[Statutory Authority: Chapter 49.17 RCW. 96-09-030, § 296-62-07668, filed 4/10/96, effective 6/1/96; 93-04-111 (Order 92-15), § 296-62-07668, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07670 Appendix E-1-c—Irritant fume protocol. (1) Respirator selection. Respirators shall be selected as described in WAC 296-62-07666(2), except that each respirator shall be equipped with a combination of high-efficiency and acid-gas cartridges.

(2) Fit test.

(a) The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

(b) The test subject shall properly don the respirator selected as above, and wear it for at least 10 minutes before starting the fit test.

(c) The test conductor shall review this protocol with the test subject before testing.

(d) The test subject shall perform the conventional positive-pressure and negative-pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

(e) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver 200 milliliters per minute.

(f) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

(g) The test conductor shall direct the stream of irritant smoke from the tube towards the facepiece area of the test subject. The person conducting the test shall begin with the tube at least 12 inches from the facepiece and gradually move to

within one inch, moving around the whole perimeter of the mask.

(h) The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

(i) Breathe normally.

(ii) Breathe deeply. Be certain breaths are deep and regular.

(iii) Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

(iv) Nod head up and down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

(v) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the Rainbow Passage. Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

Rainbow Passage: When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(vi) Jogging in place.

(vii) Breathe normally.

(i) The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

(j) Each test subject passing the smoke test (i.e., without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

(k) Subdivisions (d), (i), and (j) of this subsection of this fit test protocol shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

(l) Respirators successfully tested by the protocol may be used in contaminated atmospheres up to ten times the PEL of MDA.

(m) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(n) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

(o) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respiratory diseases or pulmonary medicine to determine

whether the test subject can wear a respirator while performing her or his duties.

(p) Qualitative fit testing shall be repeated at least every 12 months.

(q) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(i) Weight change of 20 pounds or more;

(ii) Significant facial scarring in the area of the facepiece seal;

(iii) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures;

(iv) Reconstructive or cosmetic surgery; or

(v) Any other condition that may interfere with facepiece sealing.

(3) Recordkeeping. A summary of all test results shall be maintained by the employer for 3 years. The summary shall include:

(a) Name of test subject.

(b) Date of testing.

(c) Name of test conductor.

(d) Respirators selected (indicate manufacturer, model, size, and approval number).

(e) Testing agent.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07670, filed 2/3/93, effective 3/15/93.]

WAC 296-62-07672 Appendix E-2—Quantitative fit test procedures. (1) General.

(a) The method applies to the negative-pressure nonpowered air-purifying respirators only.

(b) The employer shall assign an individual (with help as needed) who shall assume the full responsibility for implementing the respirator quantitative fit test program.

(2) Definition.

(a) "Quantitative fit test" means the measurement of the effectiveness of a respirator seal in excluding the ambient atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air-purifying element has been replaced by an essentially perfect purifying element.

(b) "Challenge agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

(c) "Test subject" means the person wearing the respirator for quantitative fit testing.

(d) "Normal standing position" means standing erect and straight with arms down along the sides and looking straight ahead.

(e) "Fit factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

(3) Apparatus.

(a) Instrumentation. Corn oil, sodium chloride, or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

(b) Test chamber. The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration

or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

(c) When testing air-purifying respirators, the normal filter or cartridge element shall be replaced with a high-efficiency particulate filter supplied by the same manufacturer.

(d) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least 2,000.

(e) The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

(f) The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow is allowed into the sampling line at all times, and so there is no interference with the fit or performance of the respirator.

(g) The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

(h) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a 10 percent variation for the duration of the test.

(i) The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed 2 seconds.

(j) The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length, and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

(k) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

(l) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed 50 percent.

(4) Procedural requirements.

(a) The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfr II-M, Norton M, Survivair M A-O M, or Scott-M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(i) Positive-pressure test. With the exhaust port(s) blocked the negative pressure of slight inhalation should remain constant for several seconds.

(ii) Negative-pressure test. With the intake port(s) blocked the negative pressure slight inhalation should remain constant for several seconds.

(b) After a facepiece is adjusted, the test subject shall wear the facepiece for at least 5 minutes before conducting a qualitative test by using either of the methods described below and using the exercise regime described in subsection (5), subdivisions (a) through (e).

(i) Isoamyl acetate test. When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the

air near the most vulnerable portions of the facepiece seal. In a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(ii) Irritant fume test. When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

(c) The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in subdivision (b) of this subsection.

(d) Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

(e) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed 5 percent for a half-mask and 1 percent for a full facepiece.

(f) A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(g) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

(5) Exercise regime. Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall perform the following exercises, in the order given, for each independent test.

(a) Normal breathing (NB). In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

(b) Deep breathing (DB). In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

(c) Turning head side to side (SS). Standing in place the subject shall slowly turn his head from side between the extreme positions to each side. The head shall be held at each extreme position for at least 5 seconds. Perform for at least five complete cycles.

(d) Moving head up and down (UD). Standing in place, the subject shall slowly move his head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least 5 seconds. Perform for at least five complete cycles.

(e) Reading (R). The subject shall read out slowly and loud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "Rainbow Passage."

Rainbow Passage: When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the

horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(f) Grimace (G). The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least 15 seconds.

(g) Bend over and touch toes (B). The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least one minute.

(h) Jogging in place (J). The test subject shall jog in place for at least one minute.

(i) Normal breathing (NB). In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

(6) Termination of tests. The test shall be terminated whenever any single peak penetration exceeds 5 percent for half-masks and 1 percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(7) Calculation of fit factors.

(a) The fit factor determined by the quantitative fit test equals the average concentration inside the respirator.

(b) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and of the end of the test.

(c) The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average peak concentrations for each of the nine exercises of the test which are computed as the arithmetic average of the peak concentrations found for each breath during the exercise.

(d) The average peak concentration for an exercise may be determined graphically if there is not a great variation in the peak concentrations during a single exercise.

(8) Interpretation of test results. The fit factor measured by the quantitative fit testing shall be the lowest of the three protection factors resulting from three independent tests.

(9) Other requirements.

(a) The test subject shall not be permitted to wear a half-mask or full facepiece if the minimum fit factor of 250 or 1,250, respectively, cannot be obtained. If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied air respirator, or self-contained breathing apparatus.

(b) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(c) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician to determine whether the test subject can wear a respirator while performing her or his duties.

(d) The test subject shall be given the opportunity to wear the assigned respirator for one week. If the respirator does not provide a satisfactory fit during actual use, the test subject may request another QNFT which shall be performed immediately.

(e) A respirator fit factor card shall be issued to the subject with the following information:

- (i) Name.
- (ii) Date of fit test.
- (iii) Protection factors obtained through each manufacturer, model and approval number of respirator tested.
- (iv) Name and signature of the person that conducted the test.

(f) Filters used for qualitative or quantitative fit testing shall be replaced weekly, whenever increased breathing resistance is encountered, or when the test agent has altered the integrity of the filter media. Organic vapor cartridges/canisters shall be replaced daily or sooner if there is any indication of breakthrough by the test agent.

(10) Retesting. In addition, because the sealing of the respirator may be affected, quantitative fit testing shall be repeated immediately when the test subject has a:

- (a) Weight change of 20 pounds or more;
- (b) Significant facial scarring in the area of the facepiece seal;
- (c) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures;
- (d) Reconstructive or cosmetic surgery; or
- (e) Any other condition that may interfere with facepiece sealing.

(11) Recordkeeping.

(a) A summary of all test results shall be maintained for three years. The summary shall include:

- (i) Name of test subject.
- (ii) Date of testing.
- (iii) Name of the test conductor.
- (iv) Fit factors obtained from every respirator tested (indicate manufacturer, model, size, and approval number).

(b) A copy of all test data including the strip chart and results shall be kept for at least five years.

[Statutory Authority: Chapter 49.17 RCW. 93-04-111 (Order 92-15), § 296-62-07672, filed 2/3/93, effective 3/15/93.]

PART I-1--ASBESTOS, TREMOLITE, ANTHOPHYLLITE, AND ACTINOLITE

WAC 296-62-077 Asbestos, tremolite, anthophyllite, and actinolite.

[Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-077, filed 4/27/87.]

WAC 296-62-07701 Scope and application. (1) WAC 296-62-07701 through 296-62-07753 applies to all occupational exposures to asbestos in all industries covered by the Washington Industrial Safety and Health Act.

(2) This section does apply to construction work as defined in WAC 296-155-012.

(3) This section does apply to ship repairing, shipbuilding and shipbreaking employments and related employments as defined in WAC 296-304-01001.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07701, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07701, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07701, filed 4/27/87.]

[Title 296 WAC—p. 1580]

WAC 296-62-07703 Definitions. For the purpose of WAC 296-62-07701 through 296-62-07753:

Accredited inspector means any person meeting the accreditation requirements of the Federal Toxic Substance Control Act, Section 206(a)(1) and (3). 15 U.S.C. 2646(a)(1) and (3).

Aggressive method means removal or disturbance of building material by sanding, abrading, grinding or other method that breaks, crumbles, or disintegrates intact ACM.

Amended water means water to which surfactant (wetting agent) has been added to increase the ability of the liquid to penetrate ACM.

Asbestos includes chrysotile, amosite, crocidolite, tremolite asbestos, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated and/or altered.

For purposes of this standard, "asbestos" includes PACM, as defined below.

Asbestos abatement project means an asbestos project involving three square feet or three linear feet, or more, of asbestos-containing material.

Asbestos-containing material (ACM) means any material containing more than 1% asbestos.

Asbestos project - definition as stated in WAC 296-65-003.

Authorized person means any person authorized by the employer and required by work duties to be present in regulated areas.

Building/facility/vessel owner means any legal entity or person who owns any public or private building, vessel, structure, facility, or mechanical system or the remnants thereof, including the agent of such person, but does not include individuals who work on asbestos projects in their own single-family residences, no part of which is used for commercial purposes. Also included is any lessee, who exercises control over management and recordkeeping functions relating to a building, vessel, and/or facility in which activities covered by this standard takes place.

Certified asbestos supervisor means an individual certified by the department under WAC 296-65-012.

Certified asbestos worker means an individual certified by the department under WAC 296-65-010.

Certified industrial hygienist (CIH) means one certified in the practice of industrial hygiene by the American Board of Industrial Hygiene.

Class I asbestos work means activities involving the removal of thermal system insulation or surfacing ACM/PACM.

Class II asbestos work means activities involving the removal of ACM which is not thermal system insulation or surfacing material. This includes, but is not limited to, the removal of asbestos-containing wallboard, floor tile and sheeting, roofing and siding shingles, and construction mastics.

Class III asbestos work means repair and maintenance operations where "ACM," including TSI and surfacing ACM and PACM, may be disturbed.

Class IV asbestos work means maintenance and custodial activities during which employees contact but do not dis-

turb ACM or PACM and activities to clean up dust, waste and debris resulting from Class I, II, and III activities.

Clean room means an uncontaminated room having facilities for the storage of employees' street clothing and uncontaminated materials and equipment.

Closely resemble means that the major workplace conditions which have contributed to the levels of historic asbestos exposure, are no more protective than conditions of the current workplace.

Competent person means, in addition to the definition in WAC 296-62-07728, one who is capable of identifying existing asbestos, hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, who has the authority to take prompt corrective measures to eliminate them as specified in WAC 296-62-07728. The competent person shall be certified as an asbestos supervisor in compliance with WAC 296-65-030(3) and 296-65-012 for Class I and Class II work, and for Class III and Class IV work involving 3 square feet or 3 linear feet or more of asbestos-containing material. For Class III and Class IV work, involving less than 3 square feet or 3 linear feet, the competent person shall be trained in an operations and maintenance (O&M) course which meets the criteria of EPA (40 CFR 763.92(a)(2)).

Critical barrier means one or more layers of plastic sealed over all openings into a work area or any other similarly placed physical barrier sufficient to prevent airborne asbestos in a work area from migrating to an adjacent area.

Decontamination area means an enclosed area adjacent and connected to the regulated area and consisting of an equipment room, shower area, and clean room, which is used for the decontamination of workers, materials, and equipment contaminated with asbestos.

Demolition means the wrecking or taking out of any load-supporting structural member and any related razing, removing, or stripping of asbestos products. Where feasible, asbestos-containing materials shall be removed from all structures prior to the commencement of any demolition activity as per WAC 296-155-775(9).

Department means the department of labor and industries.

Director means the director of the department of labor and industries or his/her authorized representative.

Director of NIOSH means the Director, National Institute for Occupational Safety and Health, U.S. Department of Health and Human Services, or designee.

Disturbance means activities that disrupt the matrix of ACM or PACM, crumble or pulverize ACM or PACM, or generate visible debris from ACM or PACM. This term includes activities that disrupt the matrix of ACM or PACM, render ACM or PACM friable, or generate visible debris. Disturbance includes cutting away small amounts of ACM or PACM, no greater than the amount which can be contained in one standard size glove bag or waste bag in order to access a building or vessel component. In no event shall the amount of ACM or PACM so disturbed exceed that which can be contained in one glove bag or waste bag which shall not exceed 60 inches in length and width.

Employee exposure means that exposure to airborne asbestos that would occur if the employee were not using respiratory protective equipment.

Equipment room(change room) means a contaminated room located within the decontamination area that is supplied with impermeable bags or containers for the disposal of contaminated protective clothing and equipment.

Fiber means a particulate form of asbestos, five micrometers or longer, with a length-to-diameter ratio of at least three to one.

Glove bag means not more than a 60 x 60 inch impervious plastic bag-like enclosure affixed around an asbestos-containing material, with glove-like appendages through which material and tools may be handled.

High-efficiency particulate air (HEPA) filter means a filter capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers mean aerodynamic diameter or larger.

Homogeneous area means an area of surfacing material or thermal system insulation that is uniform in color and texture.

Industrial hygienist means a professional qualified by education, training, and experience to anticipate, recognize, evaluate and develop controls for occupational health hazards.

Intact means that the ACM has not crumbled, been pulverized, or otherwise deteriorated so that the asbestos is no longer likely to be bound with its matrix.

Modification for the purpose of WAC 296-62-07712 means a changed or altered procedure, material or component of a control system, which replaces a procedure, material or component of a required system. Omitting a procedure or component, or reducing or diminishing the stringency or strength of a material or component of the control system is not a "modification" for the purposes of WAC 296-62-07712.

Negative initial exposure assessment means a demonstration by the employer (which complies with the criteria in WAC 296-62-07709) that employee exposure during an operation is expected to be consistently below the PELs.

PACM means "presumed asbestos-containing material."

Presumed asbestos-containing material means thermal system insulation and surfacing material found in buildings, vessels, and vessel sections constructed no later than 1980. The designation of a material as "PACM" may be rebutted pursuant to WAC 296-62-07721.

Project designer means a person who has successfully completed the training requirements for an abatement project designer established by 40 U.S.C. 763.90(g).

Regulated area means an area established by the employer to demarcate areas where Class I, II, and III asbestos work is conducted, and any adjoining area where debris and waste from such asbestos work accumulate; and a work area within which airborne concentrations of asbestos, exceed or can reasonably be expected to exceed the permissible exposure limit. Requirements for regulated areas are set out in WAC 296-62-07711.

Removal means all operations where ACM and/or PACM is taken out or stripped from structures or substrates, and includes demolition operations.

Renovation means the modifying of any existing vessel, vessel section, structure, or portion thereof.

Repair means overhauling, rebuilding, reconstructing, or reconditioning of vessels, vessel sections, structures or substrates, including encapsulation or other repair of ACM or PACM attached to vessels, vessel sections, structures or substrates.

Surfacing material means material that is sprayed, troweled-on or otherwise applied to surfaces (such as acoustical plaster on ceilings and fireproofing materials on structural members, or other materials on surfaces for acoustical, fireproofing, and other purposes).

Surfacing ACM means surfacing material which contains more than 1% asbestos.

Thermal system insulation (TSI) means ACM applied to pipes, fittings, boilers, breaching, tanks, ducts, or other structural components to prevent heat loss or gain.

Thermal system insulation ACM is thermal system insulation which contains more than 1% asbestos.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07703, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-21-018 (Order 89-10), § 296-62-07703, filed 10/10/89, effective 11/24/89; 89-11-035 (Order 89-03), § 296-62-07703, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07703, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07703, filed 4/27/87.]

WAC 296-62-07705 Permissible exposure limits (PEL). (1) Time weighted average (TWA). The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter (0.1 f/cc) of air as an eight-hour time-weighted average (TWA) as determined by the method prescribed in Appendix A of this part, or by an equivalent method recognized by the department.

(2) Excursion limit. The employer shall ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1.0 fiber per cubic centimeter of air (1 f/cc) as averaged over a sampling period of thirty minutes, as determined by the method prescribed in Appendix A of this part, or by an equivalent method recognized by the department.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07705, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-07705, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07705, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07705, filed 4/27/87.]

WAC 296-62-07706 Multi-employer worksites. (1) On multi-employer worksites, an employer performing work requiring the establishment of a regulated area shall inform other employers on the site of the nature of the employer's work with asbestos and/or PACM, of the existence of and requirements pertaining to regulated areas, and the measures taken to ensure that employees of such other employers are not exposed to asbestos.

(2) Asbestos hazards at a multi-employer worksite shall be abated by the employer who created or controls the source of asbestos contamination. For example, if there is a significant breach of an enclosure containing Class I work, the employer responsible for erecting the enclosure shall repair the breach immediately.

[Title 296 WAC—p. 1582]

(3) In addition, all employers of employees exposed to asbestos hazards shall comply with applicable protective provisions to protect their employees. For example, if employees working immediately adjacent to a Class I asbestos job are exposed to asbestos due to the inadequate containment of such jobs, their employer shall either remove the employees from the area until the enclosure breach is repaired; or perform an initial exposure assessment pursuant to WAC 296-62-07709.

(4) All employers of employees working adjacent to regulated areas established by another employer on a multi-employer worksite, shall take steps on a daily basis to ascertain the integrity of the enclosure and/or the effectiveness of the control method relied on by the primary asbestos contractor to assure that asbestos fibers do not migrate to such adjacent areas.

(5) All general contractors on a construction project which includes work covered by this standard shall be deemed to exercise general supervisory authority over the work covered by this standard, even though the general contractor is not qualified to serve as the asbestos "competent person" as defined by WAC 296-62-07703. As supervisor of the entire project, the general contractor shall ascertain whether the asbestos contractor is in compliance with this standard, and shall require such contractor to come into compliance with this standard when necessary.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07706, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 94-16-145, § 296-62-07706, filed 8/3/94, effective 9/12/94; 87-24-051 (Order 87-24), § 296-62-07706, filed 11/30/87.]

WAC 296-62-07709 Exposure assessment and monitoring. (1) General monitoring criteria.

(a) Each employer who has a workplace or work operation where exposure monitoring is required under this section shall perform monitoring to determine accurately the airborne concentrations of asbestos to which employees may be exposed.

(b) Determinations of employee exposure shall be made from breathing zone air samples that are representative of the eight-hour TWA and thirty minute short-term exposures of each employee.

(c) Representative eight-hour TWA employee exposures shall be determined on the basis of one or more samples representing full-shift exposure for each shift for each employee in each job classification in each work area.

(d) Representative thirty minute short-term employee exposures shall be determined on the basis of one or more samples representing thirty minute exposures associated with operations that are most likely to produce exposures above the excursion limit for each shift for each job classification in each work area.

(2) Exposure monitoring requirements for all occupational exposures to asbestos in all industries covered by the Washington Industrial Safety and Health Act except construction work, as defined in WAC 296-155-012, and except ship repairing, shipbuilding and shipbreaking employments and related employments as defined in WAC 296-304-01001.

(a) Initial monitoring.

(i) Each employer who has a workplace or work operation covered by this standard, except as provided for in (a)(ii)

and (iii) of this subsection, shall perform initial monitoring of employees who are, or may reasonably be expected to be exposed to airborne concentrations at or above the TWA permissible exposure limit and/or excursion limit. The initial monitoring shall be at the initiation of each asbestos job to accurately determine the airborne concentration of asbestos to which employees may be exposed.

(ii) Where the employer or his/her representative has monitored after March 31, 1992, for the TWA permissible exposure limit and/or excursion limit, and the monitoring satisfies all other requirements of this section, and the monitoring data was obtained during work operations conducted under workplace conditions closely resembling the processes, type of material including percentage of asbestos, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the employer may rely on such earlier monitoring results to satisfy the requirements of (a)(i) of this subsection.

(iii) Where the employer has relied upon objective data that demonstrates that asbestos is not capable of being released in airborne concentrations at or above the TWA permissible exposure limit and/or excursion limit under those work conditions of processing, use, or handling expected to have the greatest potential for releasing asbestos, then no initial monitoring is required.

(b) Monitoring frequency (periodic monitoring) and patterns. After the initial determinations required by subsection (2)(a)(i) of this section, samples shall be of such frequency and pattern as to represent with reasonable accuracy the levels of exposure of the employees. In no case shall sampling be at intervals greater than six months for employees whose exposures may reasonably be foreseen to exceed the TWA permissible exposure limit and/or excursion limit.

(c) Daily monitoring within regulated areas: The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area. Exception: When all employees within a regulated area are equipped with full facepiece supplied-air respirators operated in the pressure-demand mode equipped with either an auxiliary positive pressure self-contained breathing apparatus or a HEPA filter, the employer may dispense with the daily monitoring required by this subsection.

(d) Changes in monitoring frequency. If either the initial or the periodic monitoring required by subsection (2)(a) and (b) of this section statistically indicates that employee exposures are below the TWA permissible exposure limit and/or excursion limit, the employer may discontinue the monitoring for those employees whose exposures are represented by such monitoring.

(e) Additional monitoring. Notwithstanding the provisions of subsection (2)(a)(ii) and (c) of this section, the employer shall institute the exposure monitoring required under subsection (2)(a)(i) and (ii) of this section whenever there has been a change in the production, process, control equipment, personnel, or work practices that may result in new or additional exposures above the TWA permissible exposure limit and/or excursion limit, or when the employer has any reason to suspect that a change may result in new or

additional exposures above the TWA permissible exposure limit and/or excursion limit.

(3) Exposure assessment monitoring requirements for all construction work as defined in WAC 296-155-012 and for all ship repairing, shipbuilding and shipbreaking employments and related employments as defined in WAC 296-304-01001.

(a) Initial exposure assessment.

(i) Each employer who has a workplace or work operation covered by this standard shall ensure that a "competent person" conducts an exposure assessment immediately before or at the initiation of the operation to ascertain expected exposures during that operation or workplace. The assessment must be completed in time to comply with the requirements which are triggered by exposure data or lack of a "negative exposure assessment," and to provide information necessary to assure that all control systems planned are appropriate for that operation and will work properly.

(ii) Basis of initial exposure assessment: Unless a negative exposure assessment has been made pursuant to (b) of this subsection, the initial exposure assessment shall, if feasible, be based on monitoring conducted pursuant to (b) of this subsection. The assessment shall take into consideration both the monitoring results and all observations, information or calculations which indicate employee exposure to asbestos, including any previous monitoring conducted in the workplace, or of the operations of the employer which indicate the levels of airborne asbestos likely to be encountered on the job. For Class I asbestos work, until the employer conducts exposure monitoring and documents that employees on that job will not be exposed in excess of the PELs, or otherwise makes a negative exposure assessment pursuant to (b) of this subsection, the employer shall presume that employees are exposed in excess of the TWA and excursion limit.

(b) Negative exposure assessment: For any one specific asbestos job which will be performed by employees who have been trained in compliance with the standard, the employer may demonstrate that employee exposures will be below the PELs by data which conform to the following criteria:

(i) Objective data demonstrating that the products or material containing asbestos minerals or the activity involving such product or material cannot release airborne fibers in concentrations exceeding the TWA and excursion limit under those work conditions having the greatest potential for releasing asbestos; or

(ii) Where the employer has monitored prior asbestos jobs for the PEL and the excursion limit within 12 months of the current or projected job, the monitoring and analysis were performed in compliance with the asbestos standard in effect; and the data was obtained during work operations conducted under workplace conditions "closely resembling" the processes, type of material including percentage of asbestos, control methods, work practices, and environmental conditions used and prevailing in the employer's current operations, the operations were conducted by employees whose training and experience are no more extensive than that of employees performing the current job, and these data show that under the conditions prevailing and which will prevail in the current workplace there is a high degree of certainty that

employee exposures will not exceed the TWA or excursion limit; or

(iii) The results of initial exposure monitoring of the current job made from breathing zone samples that are representative of the 8-hour TWA and 30-minute short-term exposures of each employee covering operations which are most likely during the performance of the entire asbestos job to result in exposures over the PELs; or

(iv) Monitoring outside negative-pressure enclosures: The employer shall conduct representative area monitoring of the airborne fiber levels at least every other day at the HEPA machine exhaust and entrance to the decontamination area.

(c) Periodic monitoring.

(i) Class I and Class II operations. The employer shall conduct daily monitoring that is representative of the exposure of each employee who is assigned to work within a regulated area who is performing Class I or II work, unless the employer pursuant to (b) of this subsection, has made a negative exposure assessment for the entire operation.

(ii) All operations under the standard other than Class I and II operations. The employer shall conduct periodic monitoring of all work where exposures are expected to exceed a PEL, at intervals sufficient to document the validity of the exposure prediction.

(iii) Exception. When all employees required to be monitored daily are equipped with supplied-air respirators operated in the pressure demand mode, the employer may dispense with the daily monitoring required by subsection (2)(c) of this section. However, employees performing Class I work using a control method which is not listed in WAC 296-62-07712 of this section or using a modification of a listed control method, shall continue to be monitored daily even if they are equipped with supplied-air respirators.

(d) Termination of monitoring. If the periodic monitoring required by (c) of this subsection reveals that employee exposures, as indicated by statistically reliable measurements, are below the permissible exposure limit and excursion limit the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(e) Additional monitoring. Notwithstanding the provisions of (b), (c), and (d) of this subsection, the employer shall institute the exposure monitoring required under (c) of this subsection whenever there has been a change in process, control equipment, personnel or work practices that may result in new or additional exposures above the permissible exposure limit and/or excursion limit or when the employer has any reason to suspect that a change may result in new or additional exposures above the permissible exposure limit and/or excursion limit. Such additional monitoring is required regardless of whether a "negative exposure assessment" was previously produced for a specific job.

(f) Prior to the start of the removal, demolition, or renovation project, representative area monitoring shall be conducted for later use (see WAC 296-62-07712 (5)(c)).

(4) Method of monitoring.

(a) All samples taken to satisfy the monitoring requirements of this section shall be personal samples collected following the procedures specified in WAC 296-62-07735, Appendix A.

(b) Monitoring shall be performed by persons having a thorough understanding of monitoring principles and procedures and who can demonstrate proficiency in sampling techniques.

(c) All samples taken to satisfy the monitoring requirements of this section shall be evaluated using the WISHA reference method specified in WAC 296-62-07735, Appendix A, or an equivalent counting method recognized by the department.

(d) If an equivalent method to the WISHA reference method is used, the employer shall ensure that the method meets the following criteria:

(i) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

(ii) The comparison indicates that ninety percent of the samples collected in the range 0.5 to 2.0 times the permissible limit have an accuracy range of plus or minus twenty-five percent of the WISHA reference method results at a ninety-five percent confidence level as demonstrated by a statistically valid protocol; and

(iii) The equivalent method is documented and the results of the comparison testing are maintained.

(e) To satisfy the monitoring requirements of this section, employers must use the results of monitoring analysis performed by laboratories which have instituted quality assurance programs that include the elements as prescribed in WAC 296-62-07735, Appendix A.

(5) Employee notification of monitoring results.

(a) The employer shall, as soon as possible but no later than within fifteen working days after the receipt of the results of any monitoring performed under the standard, notify the affected employees of these results in writing either individually or by posting of results in an appropriate location that is accessible to affected employees.

(b) The written notification required by (a) of this subsection shall contain the corrective action being taken by the employer to reduce employee exposure to or below the TWA and/or excursion exposure limits, wherever monitoring results indicated that the TWA and/or excursion exposure limits had been exceeded.

(6) Observation of monitoring.

(a) The employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to asbestos conducted in accordance with this section.

(b) When observation of the monitoring of employee exposure to asbestos requires entry into an area where the use of protective clothing or equipment is required, the observer shall be provided with and be required to use such clothing and equipment and shall comply with all other applicable safety and health procedures.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07709, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-07709, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07709, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07709, filed 4/27/87.]

WAC 296-62-07711 Regulated areas. (1) General. The employer shall establish a regulated area in work areas where

airborne concentrations of asbestos exceed or can reasonably be expected to exceed the permissible exposure limits prescribed in WAC 296-62-07705. All Class I, II and III asbestos work shall be conducted within regulated areas. All other operations covered by this standard shall be conducted within the regulated area where airborne concentrations of asbestos exceed or can reasonably be expected to exceed permissible exposure limits. Regulated areas shall comply with the requirements of subsections (2), (3), (4), (5), (6), (7), and (8) of this section.

(2) Demarcation. The regulated area shall be demarcated in any manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. Where critical barriers or negative pressure enclosures are used, they may demarcate the regulated area. Signs shall be provided and displayed pursuant to the requirements of WAC 296-62-07721.

(3) Access. Access to regulated areas shall be limited to authorized persons or to persons authorized by the Washington Industrial Safety and Health Act or regulations issued pursuant thereto.

(4) Provision of respirators. Each person entering a regulated area where employees are required in WAC 296-62-07715(1) to wear respirators shall be supplied with and required to use a respirator, selected in accordance with WAC 296-62-07715(2).

(5) Protective clothing. All persons entering a regulated area shall be supplied with and required to wear protective clothing, selected in accordance with WAC 296-62-07717.

(6) Prohibited activities. The employer shall ensure that employees do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics in the regulated areas.

(7) Permit-required confined space. The employer shall determine if a permit-required confined space hazard exists and shall take any necessary precautions in accordance with chapter 296-62 WAC Part M.

(8) Competent persons. For construction and shipyard work the employer shall ensure that all asbestos work performed within regulated areas is supervised by a competent person, as defined in WAC 296-62-07703. The duties of the competent person are set out in WAC 296-62-07728.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07711, filed 9/5/97, effective 11/5/97. Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07711, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-07711, filed 1/18/95, effective 3/1/95; 93-19-142 (Order 93-04), § 296-62-07711, filed 9/22/93, effective 11/1/93; 89-11-035 (Order 89-03), § 296-62-07711, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07711, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07711, filed 4/27/87.]

WAC 296-62-07712 Requirements for asbestos activities in construction and shipyard work. (1) Methods of compliance, the following engineering controls and work practices of this section shall be used for construction work defined in WAC 296-155-012 and for all ship repair defined in WAC 296-304-010.

(2) Engineering controls and work practices for all operations covered by this section. The employer shall use the following engineering controls and work practices in all opera-

tions covered by this section, regardless of the levels of exposure:

(a) Vacuum cleaners equipped with HEPA filters to collect all debris and dust containing ACM and PACM, except as provided in subsection (10)(b) of this section in the case of roofing material.

(b) Wet methods, or wetting agents, to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup, except where employers demonstrate that the use of wet methods is infeasible due to, for example, the creation of electrical hazards, equipment malfunction, and, in roofing, except as provided in subsection (10)(b) of this section.

(c) Asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet saturated state to prevent the emission of airborne fibers unless the usefulness of the product would be diminished thereby.

(d) Prompt cleanup and disposal of wastes and debris contaminated with asbestos in leak-tight containers except in roofing operations, where the procedures specified in this section apply.

(3) In addition to the requirements of subsection (2) of this section, the employer shall use the following control methods to achieve compliance with the TWA permissible exposure limit and excursion limit prescribed by WAC 296-62-07705:

(a) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(b) Enclosure or isolation of processes producing asbestos dust;

(c) Ventilation of the regulated area to move contaminated air away from the breathing zone of employees and toward a filtration or collection device equipped with a HEPA filter;

(d) Use of other work practices and engineering controls that the department can show to be feasible;

(e) Wherever the feasible engineering and work practice controls described above are not sufficient to reduce employee exposure to or below the permissible exposure limit and/or excursion limit prescribed in WAC 296-62-07705, the employer shall use them to reduce employee exposure to the lowest levels attainable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of WAC 296-62-07715.

(4) Prohibitions. The following work practices and engineering controls shall not be used for work related to asbestos or for work which disturbs ACM or PACM, regardless of measured levels of asbestos exposure or the results of initial exposure assessments:

(a) High-speed abrasive disc saws that are not equipped with point or cut ventilator or enclosures with HEPA filtered exhaust air;

(b) Compressed air used to remove asbestos, or materials containing asbestos, unless the compressed air is used in conjunction with an enclosed ventilation system designed to capture the dust cloud created by the compressed air;

(c) Dry sweeping, shoveling or other dry cleanup of dust and debris containing ACM and PACM;

(d) Employee rotation as a means of reducing employee exposure to asbestos.

(5) Cleanup.

(a) After completion of asbestos removal, demolition, and renovation operations, all surfaces in and around the work area shall be cleared of any asbestos debris.

(b) Lock-down. Where asbestos has been removed, encapsulant shall be applied to ensure binding of remaining fibers.

(c) The employer shall demonstrate by monitoring that the airborne fiber concentration is below the permissible exposure limits; or, at or below the airborne fiber level existing prior to the start of the removal, demolition, or renovation project; whichever level is lower.

(6) Class I requirements. The following engineering controls and work practices and procedures shall be used:

(a) All Class I work, including the installation and operation of the control system shall be supervised by a competent person as defined in WAC 296-62-07703;

(b) For all Class I jobs involving the removal of more than 25 linear or 10 square feet of thermal system insulation or surfacing material; for all other Class I jobs, where the employer cannot produce a negative exposure assessment pursuant to WAC 296-62-07709(3), or where employees are working in areas adjacent to the regulation area, while the Class I work is being performed, the employer shall use one of the following methods to ensure that airborne asbestos does not migrate from the regulated area:

(i) Critical barriers shall be placed over all the openings to the regulated area, except where activities are performed outdoors; or

(ii) The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area surveillance during each work shift at each boundary of the regulated area, showing no visible asbestos dust; and perimeter area monitoring showing that clearance levels contained in 40 CFR Part 763, Subpart E, of the EPA Asbestos in Schools Rule are met, or that perimeter area levels, measured by Phase Contrast Microscopy (PCM) are no more than background levels representing the same area before the asbestos work began. The results of such monitoring shall be made known to the employer no later than 24 hours from the end of the work shift represented by such monitoring. Exception: For work completed outdoors where employees are not working in areas adjacent to the regulated areas, (a) of this subsection is satisfied when the specific control methods in subsection (7) of this section are used;

(c) For all Class I jobs, HVAC systems shall be isolated in the regulated area by sealing with a double layer of 6 mil plastic or the equivalent;

(d) For all Class I jobs, impermeable dropcloths shall be placed on surfaces beneath all removal activity;

(e) For all Class I jobs, all objects within the regulated area shall be covered with impermeable dropcloths or plastic sheeting which is secured by duct tape or an equivalent;

(f) For all Class I jobs where the employer cannot produce a negative exposure assessment, or where exposure monitoring shows that a PEL is exceeded, the employer shall ventilate the regulated area to move contaminated air away from the breathing zone of employees toward a HEPA filtration or collection device.

(7) Specific control methods for Class I work. In addition, Class I asbestos work shall be performed using one or more of the following control methods pursuant to the limitations stated below:

(a) Negative pressure enclosure (NPE) systems: NPE systems may be used where the configuration of the work area does not make the erection of the enclosure infeasible, with the following specifications and work practices:

(i) Specifications:

(A) The negative pressure enclosure (NPE) may be of any configuration;

(B) At least 4 air changes per hour shall be maintained in the NPE;

(C) A minimum of -0.02 column inches of water pressure differential, relative to outside pressure, shall be maintained within the NPE as evidenced by manometric measurements;

(D) The NPE shall be kept under negative pressure throughout the period of its use; and

(E) Air movement shall be directed away from employees performing asbestos work within the enclosure, and toward a HEPA filtration or collection device.

(ii) Work practices:

(A) Before beginning work within the enclosure and at the beginning of each shift, the NPE shall be inspected for breaches and smoke-tested for leaks, and any leaks sealed.

(B) Electrical circuits in the enclosure shall be deactivated, unless equipped with ground-fault circuit interrupters.

(b) Glove bag systems may be used to remove PACM and/or ACM from straight runs of piping and elbows and other connections with the following specifications and work practices:

(i) Specifications:

(A) Glove bags shall be made of 6 mil thick plastic and shall be seamless at the bottom.

(B) Glove bags used on elbows and other connections must be designed for that purpose and used without modifications.

(ii) Work practices:

(A) Each glove bag shall be installed so that it completely covers the circumference of pipe or other structure where the work is to be done.

(B) Glove bags shall be smoke-tested for leaks and any leaks sealed prior to use.

(C) Glove bags may be used only once and may not be moved.

(D) Glove bags shall not be used on surfaces whose temperature exceeds 150°F.

(E) Prior to disposal, glove bags shall be collapsed by removing air within them using a HEPA vacuum.

(F) Before beginning the operation, loose and friable material adjacent to the glove bag/box operation shall be wrapped and sealed in two layers of six mil plastic or otherwise rendered intact.

(G) Where system uses attached waste bag, such bag shall be connected to collection bag using hose or other material which shall withstand pressure of ACM waste and water without losing its integrity.

(H) Sliding valve or other device shall separate waste bag from hose to ensure no exposure when waste bag is disconnected.

(I) At least two persons shall perform Class I glove bag removal operations.

(c) Negative pressure glove bag systems. Negative pressure glove bag systems may be used to remove ACM or PACM from piping.

(i) Specifications: In addition to specifications for glove bag systems above, negative pressure glove bag systems shall attach HEPA vacuum systems or other devices to bag during removal.

(ii) Work practices:

(A) The employer shall comply with the work practices for glove bag systems in this section.

(B) The HEPA vacuum cleaner or other device used during removal shall run continually during the operation until it is completed at which time the bag shall be collapsed prior to removal of the bag from the pipe.

(C) Where a separate waste bag is used along with a collection bag and discarded after one use, the collection bag may be reused if rinsed clean with amended water before reuse.

(d) Negative pressure glove box systems: Negative pressure glove boxes may be used to remove ACM or PACM from pipe runs with the following specifications and work practices:

(i) Specifications:

(A) Glove boxes shall be constructed with rigid sides and made from metal or other material which can withstand the weight of the ACM and PACM and water used during removal.

(B) A negative pressure generator shall be used to create negative pressure in the system.

(C) An air filtration unit shall be attached to the box.

(D) The box shall be fitted with gloved apertures.

(E) An aperture at the base of the box shall serve as a bagging outlet for waste ACM and water.

(F) A back-up generator shall be present on site.

(G) Waste bags shall consist of 6 mil thick plastic double-bagged before they are filled or plastic thicker than 6 mil.

(ii) Work practices:

(A) At least two persons shall perform the removal.

(B) The box shall be smoke-tested for leaks and any leaks sealed prior to each use.

(C) Loose or damaged ACM adjacent to the box shall be wrapped and sealed in two layers of 6 mil plastic prior to the job, or otherwise made intact prior to the job.

(D) A HEPA filtration system shall be used to maintain pressure barrier in box.

(e) Water spray process system. A water spray process system may be used for removal of ACM and PACM from cold line piping if, employees carrying out such process have completed a 40-hour separate training course in its use, in addition to training required for employees performing Class I work. The system shall meet the following specifications and shall be performed by employees using the following work practices:

(i) Specifications:

(A) Piping shall be surrounded on 3 sides by rigid framing.

(B) A 360 degree water spray, delivered through nozzles supplied by a high pressure separate water line, shall be formed around the piping.

(C) The spray shall collide to form a fine aerosol which provides a liquid barrier between workers and the ACM and PACM.

(ii) Work practices:

(A) The system shall be run for at least 10 minutes before removal begins.

(B) All removal shall take place within the water barrier.

(C) The system shall be operated by at least three persons, one of whom shall not perform removal, but shall check equipment, and ensure proper operation of the system.

(D) After removal, the ACM and PACM shall be bagged while still inside the water barrier.

(f) A small walk-in enclosure which accommodates no more than two persons (mini-enclosure) may be used if the disturbance or removal can be completely contained by the enclosure with the following specifications and work practices:

(i) Specifications:

(A) The fabricated or job-made enclosure shall be constructed of 6 mil plastic or equivalent.

(B) The enclosure shall be placed under negative pressure by means of a HEPA filtered vacuum or similar ventilation unit.

(C) Change room. A small change room made of 6-mil-thick polyethylene plastic should be contiguous to the mini-enclosure, and is necessary to allow the worker to vacuum off his/her protective coveralls and remove them before leaving the work area. While inside the enclosure, the worker should wear Tyvek disposable coveralls and use the appropriate HEPA-filtered dual cartridge respiratory protection. The advantages of mini-enclosures are that they limit the spread of asbestos contamination, reduce the potential exposure of bystanders and other workers who may be working in adjacent areas, and are quick and easy to install. The disadvantage of mini-enclosures is that they may be too small to contain the equipment necessary to create a negative-pressure within the enclosure; however, the double layer of plastic sheeting will serve to restrict the release of asbestos fibers to the area outside the enclosure.

(ii) Work practices:

(A) Before use, the mini-enclosure shall be inspected for leaks and smoke-tested to detect breaches, and any breaches sealed.

(B) Before reuse, the interior shall be completely washed with amended water and HEPA-vacuumed.

(C) During use, air movement shall be directed away from the employee's breathing zone within the mini-enclosure.

(8) Alternative control methods for Class I work. Class I work may be performed using a control method which is not referenced in subsection (2)(a) through (3)(e) of this section, or which modifies a control method referenced in subsection (2)(a) through (3)(e) of this section, if the following provisions are complied with:

(a) The control method shall enclose, contain or isolate the processes or source of airborne asbestos dust, or otherwise capture or redirect such dust before it enters the breathing zone of employees.

(b) A certified industrial hygienist or licensed professional engineer who is also qualified as a project designer as defined in WAC 296-62-07703, shall evaluate the work area, the projected work practices and the engineering controls and shall certify in writing that the planned control method is adequate to reduce direct and indirect employee exposure to below the PELs under worst-case conditions of use, and that the planned control method will prevent asbestos contamination outside the regulated area, as measured by clearance sampling which meets the requirements of EPA's Asbestos in Schools rule issued under AHERA, or perimeter monitoring which meets the criteria in subsection (6)(b)(ii) of this section. Where the TSI or surfacing material to be removed is 25 linear or 10 square feet or less, the evaluation required in subsection (8)(b) of this section may be performed by a competent person.

(c) Before work which involves the removal of more than 25 linear or 10 square feet of thermal system insulation or surfacing material is begun using an alternative method which has been the subject of subsection (2)(a) through (3)(e) of this section required evaluation and certification, the employer shall send a copy of such evaluation and certification to the Department of Labor and Industries, Asbestos Certification Program, P.O. Box 44614, Olympia, Washington 98504-4614. The submission shall not constitute approval by WISHA.

(9) Work practices and engineering controls for Class II work.

(a) All Class II work shall be supervised by a competent person as defined in WAC 296-62-07703.

(b) For all indoor Class II jobs, where the employer has not produced a negative exposure assessment pursuant to WAC 296-62-07709(3), or where during the job, changed conditions indicate there may be exposure above the PEL or where the employer does not remove the ACM in a substantially intact state, the employer shall use one of the following methods to ensure that airborne asbestos does not migrate from the regulated area:

(i) Critical barriers shall be placed over all openings to the regulated area; or

(ii) The employer shall use another barrier or isolation method which prevents the migration of airborne asbestos from the regulated area, as verified by perimeter area monitoring or clearance monitoring which meets the criteria set out in subsection (6)(b)(ii) of this section; or

(iii) Impermeable dropcloths shall be placed on surfaces beneath all removal activity.

(c) (Reserved.)

(d) All Class II asbestos work shall be performed using the work practices and requirements set out above in subsection (9)(a) and (b) of this section.

(10) Additional controls for Class II work. Class II asbestos work shall also be performed by complying with the work practices and controls designated for each type of asbestos work to be performed, set out in this paragraph. Where more than one control method may be used for a type

of asbestos work, the employer may choose one or a combination of designated control methods. Class II work also may be performed using a method allowed for Class I work, except that glove bags and glove boxes are allowed if they fully enclose the Class II material to be removed.

(a) For removing vinyl and asphalt flooring materials which contain ACM or for which in buildings constructed no later than 1980, the employer has not verified the absence of ACM pursuant to WAC 296-62-07712 (10)(a)(ix). The employer shall ensure that employees comply with the following work practices and that employees are trained in these practices pursuant to WAC 296-62-07722.

(i) Flooring or its backing shall not be sanded.

(ii) Vacuums equipped with HEPA filter, disposable dust bag, and metal floor tool (no brush) shall be used to clean floors.

(iii) Resilient sheeting shall be removed by cutting with wetting of the snip point and wetting during delamination. Rip-up of resilient sheet floor material is prohibited.

(iv) All scraping of residual adhesive and/or backing shall be performed using wet methods.

(v) Dry sweeping is prohibited.

(vi) Mechanical chipping is prohibited unless performed in a negative pressure enclosure which meets the requirements of subsection (7)(a) of this section.

(vii) Tiles shall be removed intact, unless the employer demonstrates that intact removal is not possible.

(viii) When tiles are heated and can be removed intact, wetting may be omitted.

(ix) Resilient flooring material including associated mastic and backing shall be assumed to be asbestos-containing unless an industrial hygienist determines that it is asbestos-free using recognized analytical techniques.

(b) For removing roofing material which contains ACM the employer shall ensure that the following work practices are followed:

(i) Roofing material shall be removed in an intact state to the extent feasible.

(ii) Wet methods shall be used to remove roofing materials that are not intact, or that will be rendered not intact during removal, unless such wet methods are not feasible or will create safety hazards.

(iii) Cutting machines shall be continuously misted during use, unless a competent person determines that misting substantially decreases worker safety.

(iv) When removing built-up roofs with asbestos-containing roofing felts and an aggregate surface using a power roof cutter, all dust resulting from the cutting operation shall be collected by a HEPA dust collector, or shall be HEPA vacuumed by vacuuming along the cut line. When removing built-up roofs with asbestos-containing roofing felts and a smooth surface using a power roof cutter, the dust resulting from the cutting operation shall be collected either by a HEPA dust collector or HEPA vacuuming along the cut line, or by gently sweeping and then carefully and completely wiping up the still wet dust and debris left along the cut line. The dust and debris shall be immediately bagged or placed in covered containers.

(v) Asbestos-containing material that has been removed from a roof shall not be dropped or thrown to the ground.

Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist:

(A) Any ACM that is not intact shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift. While the material remains on the roof it shall either be kept wet, placed in an impermeable waste bag, or wrapped in plastic sheeting.

(B) Intact ACM shall be lowered to the ground as soon as is practicable, but in any event no later than the end of the work shift.

(vi) Upon being lowered, unwrapped material shall be transferred to a closed receptacle in such manner so as to preclude the dispersion of dust.

(vii) Roof level heating and ventilation air intake sources shall be isolated or the ventilation system shall be shut down.

(viii) Notwithstanding any other provision of this section, removal or repair of sections of intact roofing less than 25 square feet in area does not require use of wet methods or HEPA vacuuming as long as manual methods which do not render the material nonintact are used to remove the material and no visible dust is created by the removal method used. In determining whether a job involves less than 25 square feet, the employer shall include all removal and repair work performed on the same roof on the same day.

(c) When removing cementitious asbestos-containing siding and shingles or transite panels containing ACM on building exteriors (other than roofs, where subsection (10)(b) of this section applies) the employer shall ensure that the following work practices are followed:

(i) Cutting, abrading or breaking siding, shingles, or transite panels, shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release cannot be used.

(ii) Each panel or shingle shall be sprayed with amended water prior to removal.

(iii) Unwrapped or unbagged panels or shingles shall be immediately lowered to the ground via covered dust-tight chute, crane or hoist, or placed in an impervious waste bag or wrapped in plastic sheeting and lowered to the ground no later than the end of the work shift.

(iv) Nails shall be cut with flat, sharp instruments.

(d) When removing gaskets containing ACM, the employer shall ensure that the following work practices are followed:

(i) If a gasket is visibly deteriorated and unlikely to be removed intact, removal shall be undertaken within a glove bag as described in subsection (7)(b) of this section.

(ii) (Reserved.)

(iii) The gasket shall be immediately placed in a disposal container.

(iv) Any scraping to remove residue must be performed wet.

(e) When performing any other Class II removal of asbestos-containing material for which specific controls have not been listed in subsection (10) of this section, the employer shall ensure that the following work practices are complied with.

(i) The material shall be thoroughly wetted with amended water prior to and during its removal.

(ii) The material shall be removed in an intact state unless the employer demonstrates that intact removal is not possible.

(iii) Cutting, abrading or breaking the material shall be prohibited unless the employer can demonstrate that methods less likely to result in asbestos fiber release are not feasible.

(iv) Asbestos-containing material removed, shall be immediately bagged or wrapped, or kept wet until transferred to a closed receptacle, no later than the end of the work shift.

(f) Alternative work practices and controls. Instead of the work practices and controls listed in subsection (10) of this section, the employer may use different or modified engineering and work practice controls if the following provisions are complied with.

(i) The employer shall demonstrate by data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used, that employee exposure will not exceed the PELs under any anticipated circumstances.

(ii) A competent person shall evaluate the work area, the projected work practices and the engineering controls, and shall certify in writing, that the different or modified controls are adequate to reduce direct and indirect employee exposure to below the PELs under all expected conditions of use and that the method meets the requirements of this standard. The evaluation shall include and be based on data representing employee exposure during the use of such method under conditions which closely resemble the conditions under which the method is to be used for the current job, and by employees whose training and experience are equivalent to employees who are to perform the current job.

(11) Work practices and engineering controls for Class III asbestos work. Class III asbestos work shall be conducted using engineering and work practice controls which minimize the exposure to employees performing the asbestos work and to bystander employees.

(a) The work shall be performed using wet methods.

(b) To the extent feasible, the work shall be performed using local exhaust ventilation.

(c) Where the disturbance involves drilling, cutting, abrading, sanding, chipping, braking, or sawing of thermal system insulation or surfacing material, the employer shall use impermeable dropcloths, and shall isolate the operation using mini-enclosures or glove bag systems pursuant to subsection (7) of this section or another isolation method.

(d) Where the employer does not produce a "negative exposure assessment" for a job, or where monitoring results show the PEL has been exceeded, the employer shall contain the area using impermeable dropcloths and plastic barriers or their equivalent, or shall isolate the operation using a control system listed in and in compliance with subsection (7) of this section.

(e) Employees performing Class III jobs, which involve the disturbance of thermal system insulation or surfacing material, or where the employer does not produce a "negative exposure assessment" or where monitoring results show a PEL has been exceeded, shall wear respirators which are selected, used and fitted pursuant to provisions of WAC 296-62-07715.

(12) Class IV asbestos work. Class IV asbestos jobs shall be conducted by employees trained pursuant to the asbestos awareness training program set out in WAC 296-62-07722. In addition, all Class IV jobs shall be conducted in conformity with the requirements set out in this section, mandating wet methods, HEPA vacuums, and prompt clean up of debris containing ACM and PACM.

(a) Employees cleaning up debris and waste in a regulated area where respirators are required shall wear respirators which are selected, used and fitted pursuant to provisions of WAC 296-62-07715.

(b) Employers of employees who clean up waste and debris in, and employers in control of, areas where friable thermal system insulation or surfacing material is accessible, shall assume that such waste and debris contain asbestos.

(13) Alternative methods of compliance for installation, removal, repair, and maintenance of certain roofing and pipeline coating materials. Notwithstanding any other provision of this section, an employer who complies with all provisions of subsection (10)(a) and (b) of this section when installing, removing, repairing, or maintaining intact pipeline asphaltic wrap, or roof cements, mastics, coatings, or flashings which contain asbestos fibers encapsulated or coated by bituminous or resinous compounds shall be deemed to be in compliance with this section. If an employer does not comply with all provisions of this subsection (13), or if during the course of the job the material does not remain intact, the provisions of subsection (10) of this section apply instead of this subsection (13).

(a) Before work begins and as needed during the job, a competent person who is capable of identifying asbestos hazards in the workplace and selecting the appropriate control strategy for asbestos exposure, and who has the authority to take prompt corrective measures to eliminate such hazards, shall conduct an inspection of the worksite and determine that the roofing material is intact and will likely remain intact.

(b) All employees performing work covered by this subsection (13) shall be trained in a training program that meets the requirements of WAC 296-62-07722.

(c) The material shall not be sanded, abraded, or ground. Manual methods which do not render the material nonintact shall be used.

(d) Material that has been removed from a roof shall not be dropped or thrown to the ground. Unless the material is carried or passed to the ground by hand, it shall be lowered to the ground via covered, dust-tight chute, crane or hoist. All such material shall be removed from the roof as soon as is practicable, but in any event no later than the end of the work shift.

(e) Where roofing products which have been labeled as containing asbestos pursuant to WAC 296-62-07721, installed on nonresidential roofs during operations covered by this subsection (13), the employer shall notify the building owner of the presence and location of such materials no later than the end of the job.

(f) All removal or disturbance of pipeline asphaltic wrap shall be performed using wet methods.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060, 97-19-014, § 296-62-07712, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-

07712, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-21-018 (Order 89-10), § 296-62-07712, filed 10/10/89, effective 11/24/89; 89-11-035 (Order 89-03), § 296-62-07712, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07712, filed 11/30/87.]

WAC 296-62-07713 Methods of compliance for asbestos activities in general industry. (1) Engineering controls and work practices.

(a) The employer shall institute engineering controls and work practices to reduce and maintain employee exposure to or below the permissible exposure limits prescribed in WAC 296-62-07705, except to the extent that such controls are not feasible. Engineering controls and work practices include but are not limited to the following:

(i) Local exhaust ventilation equipped with HEPA filter dust collection systems;

(ii) Vacuum cleaners equipped with HEPA filters;

(iii) Enclosure or isolation of processes producing asbestos dust;

(iv) Use of wet methods, wetting agents, or removal encapsulants to control employee exposures during asbestos handling, mixing, removal, cutting, application, and cleanup;

(v) Prompt disposal of wastes contaminated with asbestos in leak-tight containers; or

(vi) Use of work practices or other engineering controls that the director can show to be feasible.

(b) Wherever the feasible engineering controls and work practices that can be instituted are not sufficient to reduce employee exposure to or below the permissible exposure limits prescribed in WAC 296-62-07705, the employer shall use them to reduce employee exposure to the lowest levels achievable by these controls and shall supplement them by the use of respiratory protection that complies with the requirements of WAC 296-62-07715.

(c) For the following operations, wherever feasible engineering controls and work practices that can be instituted are not sufficient to reduce the employee exposure to or below the permissible exposure limits prescribed in WAC 296-62-07705, the employer shall use them to reduce employee exposure to or below 0.5 fiber per cubic centimeter of air (as an eight-hour time-weighted average) or 2.5 fibers per cubic centimeter of air for 30 minutes (short-term exposure), and shall supplement them by the use of any combination of respiratory protection that complies with the requirements of WAC 296-62-07715, work practices and feasible engineering controls that will reduce employee exposure to or below the permissible exposure limits prescribed in WAC 296-62-07705: Coupling cutoff in primary asbestos cement pipe manufacturing; sanding in primary and secondary asbestos cement sheet manufacturing; grinding in primary and secondary friction product manufacturing; carding and spinning in dry textile processes; and grinding and sanding in primary plastics manufacturing.

(d) Local exhaust ventilation. Local exhaust ventilation and dust collection systems shall be designed, constructed, installed, and maintained in accordance with good practices such as those found in the American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, ANSI Z9.2-1979.

(e) Particular tools. All hand-operated and power-operated tools which would produce or release fibers of asbestos

so as to expose employees to levels in excess of the exposure limits prescribed in WAC 296-62-07705, such as, but not limited to, saws, scorers, abrasive wheels, and drills, shall be provided with local exhaust ventilation systems which comply with (d) of this subsection. High-speed abrasive disc saws that are not equipped with appropriate engineering controls shall not be used for work related to asbestos.

(f) Wet methods. Asbestos shall be handled, mixed, applied, removed, cut, scored, or otherwise worked in a wet saturated state to prevent the emission of airborne fibers unless the usefulness of the product would be diminished thereby.

(g) Particular products and operations. No asbestos cement, mortar, coating, grout, plaster, or similar material containing asbestos shall be removed from bags, cartons, or other containers in which they are shipped, without being either wetted, enclosed, or ventilated so as to prevent effectively the release of airborne fibers of asbestos.

(h) Compressed air. Compressed air shall not be used to remove asbestos or materials containing asbestos unless the compressed air is used in conjunction with an enclosed ventilation system designed to effectively capture the dust cloud created by the compressed air.

(2) Clean-up.

(a) After completion of asbestos removal, demolition, and renovation operations, all surfaces in and around the work area shall be cleared of any asbestos debris.

(b) Lock-down. Where asbestos has been removed, encapsulant shall be applied to ensure binding of remaining fibers.

(c) The employer shall demonstrate by monitoring that the airborne fiber concentration is below the permissible exposure limits; or, at or below the airborne fiber level existing prior to the start of the removal, demolition, or renovation project; whichever level is lower.

(3) Compliance program.

(a) Where either the time weighted average and/or excursion limit is exceeded, the employer shall establish and implement a written program to reduce employee exposure to or below the permissible exposure limits by means of engineering and work practice controls as required by subsection (1) of this section, and by the use of respiratory protection where required or permitted under this section.

(b) Such programs shall be reviewed and updated as necessary to reflect significant changes in the status of the employer's compliance program.

(c) Written programs shall be submitted upon request for examination and copying to the director, affected employees and designated employee representatives.

(d) The employer shall not use employee rotation as a means of compliance with the permissible exposure limits specified in WAC 296-62-07705.

(4) Specific compliance methods for brake and clutch repair:

(a) Engineering controls and work practices for brake and clutch repair and service. During automotive brake and clutch inspection, disassembly, repair and assembly operations, the employer shall institute engineering controls and work practices to reduce employee exposure to materials containing asbestos using a negative pressure enclosure/

HEPA vacuum system method or low pressure/wet cleaning method which meets the detailed requirements set out in Appendix F to this section. The employer may also comply using an equivalent method which follows written procedures which the employer demonstrates can achieve results equivalent to Method A in Appendix F to this section. For facilities in which no more than 5 pair of brakes or 5 clutches are inspected, disassembled, repaired, or assembled per week, the method set forth in Appendix F to this section may be used.

(b) The employer may also comply by using an equivalent method which follows written procedures, which the employer demonstrates can achieve equivalent exposure reductions as do the two "preferred methods." Such demonstration must include monitoring data conducted under workplace conditions closely resembling the process, type of asbestos containing materials, control method, work practices and environmental conditions which the equivalent method will be used, or objective data, which document that under all reasonably foreseeable conditions of brake and clutch repair applications, the method results in exposure which are equivalent to the methods set out in Appendix F to this section.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07713, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 90-17-051 (Order 90-10), § 296-62-07713, filed 8/13/90, effective 9/24/90; 89-11-035 (Order 89-03), § 296-62-07713, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07713, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07713, filed 4/27/87.]

WAC 296-62-07715 Respiratory protection. (1) General. The employer shall provide respirators, and ensure that they are used, where required by WAC 296-62-077 through 296-62-07753. Respirators shall be used in the following circumstances:

(a) During the interval necessary to install or implement feasible engineering and work practice controls;

(b) In work operations, such as maintenance and repair activities, or other activities for which engineering and work practice controls are not feasible;

(c) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limits;

(d) In emergencies;

(e) In all regulated areas, except for construction activities which follow requirements set forth in WAC 296-62-07715 (1)(g);

(f) Whenever employee exposure exceeds the permissible exposure limits;

(g) During the following construction activities:

(i) During all Class I asbestos jobs;

(ii) During all Class II work where the ACM is not removed in a substantially intact state;

(iii) During all Class II and Class III work which is not performed using wet methods, provided, however, that respirators need not be worn during removal of ACM from sloped roofs when a negative exposure assessment has been made and the ACM is removed in an intact state;

(iv) During all Class II and Class III asbestos jobs where the employer does not produce a "negative exposure assessment";

(v) During all Class III jobs where TSI or surfacing ACM or PACM is being disturbed; and

(vi) During all Class IV work performed within regulated areas where employees performing other work are required to wear respirators.

(2) Respirator selection.

(a) Where respirators are used, the employer shall select and provide, at no cost to the employee, the appropriate respirator as specified in Table 1 of this section or in WAC 296-62-07715(2), and shall ensure that the employee uses the respirator provided.

(b) The employer shall select respirators from among those jointly approved as being acceptable for protection by the Mine Safety and Health Administration (MSHA) and the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(c) The employer shall provide a tight fitting powered, air-purifying respirator in lieu of any negative pressure respirator specified in Table 1 of this section whenever:

(i) An employee chooses to use this type of respirator; and

(ii) This respirator will provide adequate protection to the employee.

(d) The employer shall inform any employee required to wear a respirator under this subsection that the employee may require the employer to provide a powered air purifying respirator in lieu of a negative pressure respirator.

(e) In addition to the selection criterion below, the employer shall provide a half-mask air purifying respirator, other than a disposable respirator, equipped with high efficiency filters whenever the employee performs the following activities: Class II and III asbestos jobs where the employer does not produce a negative exposure assessment; and Class III jobs where TSI or surfacing ACM or PACM is being disturbed.

TABLE 1—RESPIRATORY PROTECTION FOR ASBESTOS FIBERS

Airborne concentration of asbestos or conditions of use	Required respirator. (See Note a.)
Not in excess of 1 f/cc (10 X PEL), or otherwise as required independent of exposure Not in excess of 5 f/cc (50 X PEL)	Half-mask air-purifying respirator other than a disposable respirator, equipped with high efficiency filters. (See Note b.)
Not in excess of 10 f/cc (100 X PEL)	Full facepiece air-purifying respirator equipped with high efficiency filters. Any powered air-purifying respirator equipped with high efficiency filters or any supplied-air respirator operated in continuous flow mode.
Not in excess of 100 f/cc (1,000 X PEL)	Full facepiece supplied-air respirator operated in pressure demand mode.
Greater than 100 f/cc (1,000 X PEL) or unknown concentration	Full facepiece supplied-air respirator operated in pressure demand mode, equipped with an auxiliary positive pressure self-contained breathing apparatus or HEPA filter egress cartridges. (See Note c.)

Note:

- a. Respirators assigned for higher environmental concentrations may be used at lower concentrations.
- b. A high-efficiency filter means a filter that is capable of trapping and retaining at least 99.97 percent of all monodispersed particles of 0.3 micrometers mean aerodynamic diameter or larger.
- c. See subsection (5)(c) of this section for fit testing requirements.

(3) Special respiratory protection requirements.

(a) Unless specifically identified in this subsection, respirator selection for asbestos removal, demolition, and renovation operations shall be in accordance with Table 1 of subsection (2) of this section. The employer shall provide and require to be worn, at no cost to the employee, a full facepiece supplied-air respirator operated in the pressure demand mode equipped with either an auxiliary positive pressure self-contained breathing apparatus or a HEPA filter egress cartridge, to employees engaged in the following asbestos operations:

(i) Inside negative pressure enclosures used for removal, demolition, and renovation of friable asbestos from walls, ceilings, vessels, ventilation ducts, elevator shafts, and other structural members, but does not include pipes or piping systems; or

(ii) Any dry removal of asbestos.

(b) For all Class I work excluded or not specified in (a)(i) and (ii) of this subsection, the employer shall provide a tight-fitting powered air purifying respirator equipped with high-efficiency filters or a full facepiece supplied-air respirator operated in the pressure demand mode equipped with HEPA filter egress cartridges or an auxiliary positive pressure self-contained breathing apparatus for all employees within the regulated area where asbestos work is being performed for which a negative exposure assessment has not been produced and, the exposure assessment indicates the exposure level will not exceed 1 f/cc as an 8-hour time weighted average. A full facepiece supplied-air respirator operated in the pressure demand mode equipped with an auxiliary positive pressure self-contained breathing apparatus, or a HEPA filter egress cartridge, shall be provided under such conditions, if the

exposure assessment indicates exposure levels above 1 f/cc as an 8-hour time weighted average.

EXCEPTION: In lieu of the supplied-air respirator required by subsection (3) of this section, an employer may provide and require to be worn, at no cost to the employee, a full facepiece supplied-air respirator operated in the continuous flow mode equipped with either an auxiliary positive pressure self-contained breathing apparatus or a back-up HEPA filter egress cartridge where daily and historical personal monitoring data indicates the concentration of asbestos fibers is not reasonably expected to exceed 10 f/cc. The continuous flow respirator shall be operated at a minimum air flow rate of six cubic feet per minute at the facepiece using respirable air supplied in accordance with WAC 296-62-07111.

(4) Respirator program.

(a) Where respiratory protection is used, the employer shall institute a respirator program in accordance with WAC 296-62-071.

(b) The employer shall permit each employee who uses a filter respirator to change the filter elements whenever an increase in breathing resistance is detected and shall maintain an adequate supply of filter elements for this purpose.

(c) Employees who wear respirators shall be permitted to leave work areas to wash their faces and respirator facepieces whenever necessary to prevent skin irritation associated with respirator use.

(d) No employee shall be assigned to tasks requiring the use of respirators if, based upon his or her most recent examination, an examining physician determines that the employee will be unable to function normally wearing a respirator, or that the safety or health of the employee or other employees will be impaired by the use of a respirator. Such employee shall be assigned to another job or given the opportunity to transfer to a different position whose duties he or she is able to perform with the same employer, in the same geographical area and with the same seniority, status, and rate of pay the employee had just prior to such transfer, if such a different position is available.

(5) Respirator fit testing.

(a) The employer shall ensure that the respirator issued to the employee exhibits the least possible facepiece leakage and that the respirator is fitted properly.

(b) For each employee wearing negative pressure respirators, employers shall perform either quantitative or qualitative face fit tests at the time of initial fitting and at least every six months thereafter. The qualitative fit tests may be used only for testing the fit of half-mask respirators where they are permitted to be worn, and shall be conducted in accordance with WAC 296-62-07739, Appendix C. The tests shall be used to select facepieces that provide the required protection as prescribed in Table 1 of this section.

(c) Any supplied-air respirator facepiece equipped with a back-up HEPA filter egress cartridge shall be quantitatively fit tested with the air supply disconnected at the time of initial fitting and at least every six months thereafter. The quantitative fit tests shall be conducted using the procedures described in WAC 296-62-07739(2), Appendix C, for negative pressure respirators.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07715, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-07715, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07715, filed 1/10/91, effective

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2/12/91; 89-11-035 (Order 89-03), § 296-62-07715, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07715, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07715, filed 4/27/87.]

WAC 296-62-07717 Protective work clothing and equipment. (1) Provision and use. If an employee is exposed to asbestos above the permissible exposure limits, or where the possibility of eye irritation exists, or for which a required negative exposure assessment is not produced and for any employee performing Class I operations, the employer shall provide at no cost to the employee and require that the employee uses appropriate protective work clothing and equipment such as, but not limited to:

(a) Coveralls or similar full-body work clothing;

(b) Gloves, head coverings, and foot coverings; and

(c) Face shields, vented goggles, or other appropriate protective equipment which complies with WAC 296-24-07801.

(2) Removal and storage.

(a) The employer shall ensure that employees remove work clothing contaminated with asbestos only in change rooms provided in accordance with WAC 296-62-07719(1).

(b) The employer shall ensure that no employee takes contaminated work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.

(c) Contaminated clothing. Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and be labeled in accordance with WAC 296-62-07721.

(d) Containers of contaminated protective devices or work clothing which are to be taken out of change rooms or the workplace for cleaning, maintenance, or disposal, shall bear labels in accordance with WAC 296-62-07721(6).

(3) Cleaning and replacement.

(a) The employer shall clean, launder, repair, or replace protective clothing and equipment required by this paragraph to maintain their effectiveness. The employer shall provide clean protective clothing and equipment at least weekly to each affected employee.

(b) The employer shall prohibit the removal of asbestos from protective clothing and equipment by blowing or shaking.

(c) Laundering of contaminated clothing shall be done so as to prevent the release of airborne fibers of asbestos in excess of the permissible exposure limits prescribed in WAC 296-62-07705.

(d) Any employer who gives contaminated clothing to another person for laundering shall inform such person of the requirement in (c) of this subsection to effectively prevent the release of airborne fibers of asbestos in excess of the permissible exposure limits.

(e) The employer shall inform any person who launders or cleans protective clothing or equipment contaminated with asbestos of the potentially harmful effects of exposure to asbestos.

(f) Contaminated clothing shall be transported in sealed impermeable bags, or other closed, impermeable containers, and labeled in accordance with WAC 296-62-07721.

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(4) Inspection of protective clothing for construction and shipyard work.

(a) The competent person shall examine worksuits worn by employees at least once per workshift for rips or tears that may occur during performance of work.

(b) When rips or tears are detected while an employee is working, rips and tears shall be immediately mended, or the worksuit shall be immediately replaced.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07717, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-07717, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07717, filed 7/20/94, effective 9/20/94; 89-11-035 (Order 89-03), § 296-62-07717, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07717, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07717, filed 4/27/87.]

WAC 296-62-07719 Hygiene facilities and practices.

(1) Change rooms.

(a) The employer shall provide clean change rooms for employees required to work in regulated areas or required by WAC 296-62-07717(1) to wear protective clothing.

Exception: In lieu of the change area requirement specified in this subsection, the employer may permit employees in Class III and Class IV asbestos work, to clean their protective clothing with a portable HEPA-equipped vacuum before such employees leave the area where maintenance was performed.

(b) The employer shall ensure that change rooms are in accordance with WAC 296-24-120, and are equipped with two separate lockers or storage facilities, so separated as to prevent contamination of the employee's street clothes from his/her protective work clothing and equipment.

(2) Showers.

(a) The employer shall ensure that employees who work in negative pressure enclosures required by WAC 296-62-07712, or who work in areas where their airborne exposure is above the permissible exposure limits prescribed in WAC 296-62-07705, shower at the end of the work shift.

(b) The employer shall provide shower facilities which comply with WAC 296-24-12009(3).

(c) The employer shall ensure that employees who are required to shower pursuant to (a) of this subsection do not leave the workplace wearing any clothing or equipment worn during the work shift.

(3) Special requirements in addition to the other provisions of WAC 296-62-07719 for construction work defined in WAC 296-155-012 and for all shipyard work defined in WAC 296-304-010.

(a) Requirements for employees performing Class I asbestos jobs involving over 25 linear or 10 square feet of TSI or surfacing ACM and PACM.

(i) Decontamination areas: The employer shall establish a decontamination area that is adjacent and connected to the regulated area for the decontamination of such employees. The decontamination area shall consist of an equipment room, shower area, and clean room in series. The employer shall ensure that employees enter and exit the regulated area through the decontamination area.

(A) Equipment room. The equipment room shall be supplied with impermeable, labeled bags and containers for the

containment and disposal of contaminated protective equipment.

(B) Shower area. Shower facilities shall be provided which comply with WAC 296-24-12009(3), unless the employer can demonstrate that they are not feasible. The showers shall be adjacent both to the equipment room and the clean room, unless the employer can demonstrate that this location is not feasible. Where the employer can demonstrate that it is not feasible to locate the shower between the equipment room and the clean room, or where the work is performed outdoors, the employers shall ensure that employees:

(I) Remove asbestos contamination from their worksuits in the equipment room using a HEPA vacuum before proceeding to a shower that is not adjacent to the work area; or

(II) Remove their contaminated worksuits in the equipment room, then don clean worksuits, and proceed to a shower that is not adjacent to the work area.

(C) Clean change room. The clean room shall be equipped with a locker or appropriate storage container for each employee's use.

(ii) Decontamination area entry procedures. The employer shall ensure that employees:

(A) Enter the decontamination area through the clean room;

(B) Remove and deposit street clothing within a locker provided for their use; and

(C) Put on protective clothing and respiratory protection before leaving the clean room.

(D) Before entering the regulated area, the employer shall ensure that employees pass through the equipment room.

(iii) Decontamination area exit procedures. The employer shall ensure that:

(A) Before leaving the regulated area, employees shall remove all gross contamination and debris from their protective clothing;

(B) Employees shall remove their protective clothing in the equipment room and deposit the clothing in labeled impermeable bags or containers;

(C) Employees shall not remove their respirators in the equipment room;

(D) Employees shall shower prior to entering the clean room. When taking a shower, employees shall be fully wetted, including the face and hair, prior to removing the respirators;

(E) After showering, employees shall enter the clean room before changing into street clothes.

(b) Requirements for Class I work involving less than 25 linear or 10 square feet of TSI or surfacing ACM and PACM, and for Class II and Class III asbestos work operations where exposures exceed a PEL or where there is no negative exposure assessment produced before the operation.

(i) The employer shall establish an equipment room or area that is adjacent to the regulated area for the decontamination of employees and their equipment which is contaminated with asbestos which shall consist of an area covered by a impermeable drop cloth on the floor or horizontal working surface.

(ii) The area must be of sufficient size as to accommodate cleaning of equipment and removing personal protective

equipment without spreading contamination beyond the area (as determined by visible accumulations).

(iii) Work clothing must be cleaned with a HEPA vacuum before it is removed.

(iv) All equipment and surfaces of containers filled with ACM must be cleaned prior to removing them from the equipment room or area.

(v) The employer shall ensure that employees enter and exit the regulated area through the equipment room or area.

(c) Requirements for Class IV work. Employers shall ensure that employees performing Class IV work within a regulated area comply with hygiene practice required of employees performing work which has a higher classification within that regulated area. Otherwise employers of employees cleaning up debris and material which is TSI or surfacing ACM or identified as PACM shall provide decontamination facilities for such employees which are required by WAC 296-62-07719 (3)(b).

(d) Decontamination area for personnel shall not be used for the transportation of asbestos debris.

(e) Waste load-out procedure. The waste load-out area as required by WAC 296-62-07723 shall be used as an area for final preparation and external decontamination of waste containers, as a short term storage area for bagged waste, and as a port for transporting waste. The employer shall ensure waste containers be free of all gross contaminated material before removal from the negative-pressure enclosure. Gross contamination shall be wiped, scraped off, or washed off containers before they are placed into a two chamber air lock which is adjacent to the negative-pressure enclosure. In the first chamber, the exterior of the waste container shall be decontaminated or placed within a second waste container, and then it shall be moved into the second chamber of the air lock for temporary storage or transferred outside of the regulated area. The second waste container shall not be reused unless thoroughly decontaminated.

(4) Lunchrooms.

(a) The employer shall provide lunchroom facilities for employees who work in areas where their airborne exposure is above the time weighted average and/or excursion limit.

(b) The employer shall ensure that lunchroom facilities have a positive pressure, filtered air supply, and are readily accessible to employees.

(c) The employer shall ensure that employees who work in areas where their airborne exposure is above the time weighted average and/or excursion limit, wash their hands and faces prior to eating, drinking, or smoking.

(d) The employer shall ensure that employees do not enter lunchroom facilities with protective work clothing or equipment unless surface asbestos fibers have been removed from the clothing or equipment by vacuuming or other method that removes dust without causing the asbestos to become airborne.

(5) Smoking in work areas. The employer shall ensure that employees do not smoke in work areas where they are occupationally exposed to asbestos because of activities in that work area.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07719, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07719, filed 1/10/91, effective 2/12/91; 89-11-035 (Order 89-03), § 296-62-07719, filed

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5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07719, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07719, filed 4/27/87.]

WAC 296-62-07721 Communication of hazards to employees. (1) Communication of hazards to employees. General industry requirements.

(a) Introduction. This section applies to the communication of information concerning asbestos hazards in general industry. Asbestos exposure in industry occurs in a wide variety of industrial and commercial settings. Employees who manufacture asbestos-containing products may be exposed to asbestos fibers. Employees who repair and replace automotive brakes and clutches may be exposed to asbestos fibers. In addition, employees engaged in housekeeping activities in industrial facilities with asbestos product manufacturing operations, and in public and commercial buildings with installed asbestos-containing materials may be exposed to asbestos fibers. It should be noted that employees who perform housekeeping activities during and after construction activities are covered by asbestos construction work requirements in WAC 296-62-077. Housekeeping employees, regardless of industry designation, should know whether building components they maintain may expose them to asbestos. Building owners are often the only and/or best source of information concerning the presence of previously installed asbestos-containing building materials. Therefore they, along with employers of potentially exposed employees, are assigned specific information conveying and retention duties under this section.

(b) Installed asbestos-containing material. Employers and building owners are required to treat installed TSI and sprayed-on and troweled-on surfacing materials as ACM for the purposes of this standard. These materials are designated "presumed ACM or PACM," and are defined in WAC 296-62-07703. Asphalt and vinyl flooring installed no later than 1980 also shall be treated as asbestos-containing. The employer or building owner may demonstrate that PACM and flooring materials do not contain asbestos by complying with WAC 296-62-07712 (10)(a)(ix).

(c) Duties of employers and building and facility owners.

(i) Building and facility owners shall determine the presence, location, and quantity of ACM and/or PACM at the worksite. Employers and building and facility owners shall exercise due diligence in complying with these requirements to inform employers and employees about the presence and location of ACM and PACM.

(ii) Before authorizing or allowing any construction, renovation, remodeling, maintenance, repair, or demolition project, an owner or owner's agent shall perform, or cause to be performed, a good faith inspection to determine whether materials to be worked on or removed contain asbestos. The inspection shall be documented by a written report maintained on file and made available upon request to the director.

(A) The good faith inspection shall be conducted by an accredited inspector.

(B) Such good faith inspection is not required if the owner or owner's agent is reasonably certain that asbestos will not be disturbed by the project or the owner or owner's agent assumes that the suspect material contains asbestos and

handles the material in accordance with WAC 296-62-07701 through 296-62-07753.

(iii) The owner or owner's agent shall provide, to all contractors submitting a bid to undertake any construction, renovation, remodeling, maintenance, repair, or demolition project, the written statement either of the reasonable certainty of nondisturbance of asbestos or of assumption of the presence of asbestos. Contractors shall be provided with the written report before they apply or bid to work.

(iv) Any owner or owner's agent who fails to comply with (c)(ii) and (iii) of this subsection shall be subject to a mandatory fine of not less than two hundred fifty dollars for each violation. Each day the violation continues shall be considered a separate violation. In addition, any construction, renovation, remodeling, maintenance, repair, or demolition which was started without meeting the requirements of this section shall be halted immediately and cannot be resumed before meeting such requirements.

(v) Building and facility owners shall inform employers of employees, and employers shall inform employees who will perform housekeeping activities in areas which contain ACM and/or PACM of the presence and location of ACM and/or PACM in such areas which may be contacted during such activities.

(vi) Upon written or oral request, building or facility owners shall make a copy of the written report required in this section available to the department of labor and industries and the collective bargaining representatives or employee representatives of any employee who may be exposed to any asbestos or asbestos-containing materials. A copy of the written report shall be posted conspicuously at the location where employees report to work.

(vii) Building and facility owners shall maintain records of all information required to be provided pursuant to this section and/or otherwise known to the building owner concerning the presence, location and quantity of ACM and PACM in the building/facility. Such records shall be kept for the duration of ownership and shall be transferred to successive owners.

(2) Communication of hazards to employees. Requirements for construction and shipyard employment activities.

(a) Introduction. This section applies to the communication of information concerning asbestos hazards in construction and shipyard employment activities. Most asbestos-related construction and shipyard activities involve previously installed building materials. Building/vessel owners often are the only and/or best sources of information concerning them. Therefore, they, along with employers of potentially exposed employees, are assigned specific information conveying and retention duties under this section. Installed Asbestos Containing Building/Vessel Material: Employers and building/vessel owners shall identify TSI and sprayed or troweled on surfacing materials as asbestos-containing unless the employer, by complying with WAC 296-62-07721(3) determines it is not asbestos containing. Asphalt or vinyl flooring/decking material installed in buildings or vessels no later than 1980 shall also be considered as asbestos containing unless the employer/owner, pursuant to WAC 296-62-07712 (10)(a)(ix) determines it is not asbestos containing. If the employer or building/vessel owner has actual knowledge

or should have known, through the exercise of due diligence, that materials other than TSI and sprayed-on or troweled-on surfacing materials are asbestos containing, they shall be treated as such. When communicating information to employees pursuant to this standard, owners and employers shall identify "PACM" as ACM. Additional requirements relating to communication of asbestos work on multi-employer worksites are set out in WAC 296-62-07706.

(b) Duties of building/vessel and facility owners.

(i) Before work subject to this section is begun, building/vessel and facility owners shall identify the presence, location and quantity of ACM, and/or PACM at the work site. All thermal system insulation and sprayed on or troweled on surfacing materials in buildings/vessels or substrates constructed no later than 1980 shall be identified as PACM. In addition, resilient flooring/decking material installed no later than 1980 shall also be identified as asbestos containing.

(ii) Before authorizing or allowing any construction, renovation, remodeling, maintenance, repair, or demolition project, a building/vessel and facility owner or owner's agent shall perform, or cause to be performed, a good faith inspection to determine whether materials to be worked on or removed contain asbestos. The inspection shall be documented by a written report maintained on file and made available upon request to the director.

(A) The good faith inspection shall be conducted by an accredited inspector.

(B) Such good faith inspection is not required if the building/vessel and facility owner or owner's agent assumes that the suspect material contains asbestos and handles the material in accordance with WAC 296-62-07701 through 296-62-07753 or if the owner or the owner's agent is reasonably certain that asbestos will not be distributed by the project.

(iii) The building/vessel and facility owner or owner's agent shall provide, to all contractors submitting a bid to undertake any construction, renovation, remodeling, maintenance, repair, or demolition project, the written statement either of the reasonable certainty of nondisturbance of asbestos or of assumption of the presence of asbestos. Contractors shall be provided the written report before they apply or bid on work.

(iv) Any building/vessel and facility owner or owners agent who fails to comply with WAC 296-62-07719 (2)(b)(ii) and (iii) shall be subject to a mandatory fine of not less than two hundred fifty dollars for each violation. Each day the violation continues shall be considered a separate violation. In addition, any construction, renovation, remodeling, maintenance, repair, or demolition which was started without meeting the requirements of this section shall be halted immediately and cannot be resumed before meeting such requirements.

(v) Upon written or oral request, building/vessel and facility owner or owner's agent shall make a copy of the written report required in this section available to the department of labor and industries and the collective bargaining representatives or employee representatives of any employee who may be exposed to any asbestos or asbestos-containing mate-

rials. A copy of the written report shall be posted conspicuously at the location where employees report to work.

(vi) Building/vessel and facility owner or owner's agent shall notify in writing the following persons of the presence, location and quantity of ACM or PACM, at work sites in their buildings/facilities/vessels.

(A) Prospective employers applying or bidding for work whose employees reasonably can be expected to work in or adjacent to areas containing such material;

(B) Employees of the owner who will work in or adjacent to areas containing such material;

(C) On multi-employer worksites, all employers of employees who will be performing work within or adjacent to areas containing such materials;

(D) Tenants who will occupy areas containing such materials.

(c) Duties of employers whose employees perform work subject to this standard in or adjacent to areas containing ACM and PACM. Building/vessel and facility owner or owner's agents whose employees perform such work shall comply with these provisions to the extent applicable.

(i) Before work subject to this standard is begun, building/vessel and facility owner or owner's agents shall determine the presence, location, and quantity of ACM and/or PACM at the work site pursuant to WAC 296-62-07721 (2)(b).

(ii) Before work under this standard is performed employers of employees who will perform such work shall inform the following persons of the location and quantity of ACM and/or PACM present at the work site and the precautions to be taken to insure that airborne asbestos is confined to the area.

(A) Owners of the building/vessel or facility;

(B) Employees who will perform such work and employers of employees who work and/or will be working in adjacent areas;

(iii) Upon written or oral request, a copy of the written report required in this section shall be made available to the department of labor and industries and the collective bargaining representatives or employee representatives of any employee who may be exposed to any asbestos or asbestos-containing materials. A copy of the written report shall be posted conspicuously at the location where employees report to work.

(iv) Within 10 days of the completion of such work, the employer whose employees have performed work subject to this standard, shall inform the building/vessel or facility owner and employers of employees who will be working in the area of the current location and quantity of PACM and/or ACM remaining in the former regulated area and final monitoring results, if any.

(d) In addition to the above requirements, all employers who discover ACM and/or PACM on a work site shall convey information concerning the presence, location and quantity of such newly discovered ACM and/or PACM to the owner and to other employers of employees working at the work site, within 24 hours of the discovery.

(e) No contractor may commence any construction, renovation, remodeling, maintenance, repair, or demolition project without receiving a copy of the written response or

statement required by WAC 296-62-07721 (2)(b). Any contractor who begins any project without the copy of the written report or statement shall be subject to a mandatory fine of not less than two hundred fifty dollars per day. Each day the violation continues shall be considered a separate violation.

(3) Criteria to rebut the designation of installed material as PACM.

(a) At any time, an employer and/or building/vessel owner may demonstrate, for purposes of this standard, that PACM does not contain asbestos. Building/vessel owners and/or employers are not required to communicate information about the presence of building material for which such a demonstration pursuant to the requirements of (b) of this subsection has been made. However, in all such cases, the information, data and analysis supporting the determination that PACM does not contain asbestos, shall be retained pursuant to WAC 296-62-07727.

(b) An employer or owner may demonstrate that PACM does not contain asbestos by the following:

(i) Having a completed inspection conducted pursuant to the requirements of AHERA (40 CFR Part 763, Subpart E) which demonstrates that the material is not ACM;

(ii) Performing tests of the material containing PACM which demonstrate that no asbestos is present in the material. Such tests shall include analysis of bulk samples collected in the manner described in 40 CFR 763.86. The tests, evaluation and sample collection shall be conducted by an accredited inspector. Analysis of samples shall be performed by persons or laboratories with proficiency demonstrated by current successful participation in a nationally recognized testing program such as the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute for Standards and Technology (NIST) or the Round Robin for bulk samples administered by the American Industrial Hygiene Associate (AIHA), or an equivalent nationally recognized Round Robin testing program.

(4) At the entrance to mechanical rooms/areas in which employees reasonably can be expected to enter and which contain TSI or surfacing ACM and PACM, the building/vessel and facility owner or owner's agent shall post signs which identify the material which is present, its location, and appropriate work practices which, if followed, will ensure that ACM and/or PACM will not be disturbed. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

(5) Warning signs.

(a) Warning signs that demarcate the regulated area shall be provided and displayed at each location where a regulated area is required. In addition, warning signs shall be posted at all approaches to regulated areas and be posted at such a distance from such a location that an employee may read the signs and take necessary protective steps before entering the area marked by the signs.

(b) The warning signs required by (a) of this subsection shall bear the following information:

DANGER
ASBESTOS
CANCER AND LUNG DISEASE HAZARD
AUTHORIZED PERSONNEL ONLY
RESPIRATORS AND PROTECTIVE CLOTHING ARE REQUIRED IN
THIS AREA

(c) The employer shall ensure that employees working in and contiguous to regulated areas comprehend the warning signs required to be posted by (a) of this subsection. Means to ensure employee comprehension may include the use of foreign languages, pictographs, and graphics.

(6) Warning labels.

(a) Warning labels shall be affixed to all products containing asbestos including raw materials, mixtures, scrap, waste, debris, and other products containing asbestos fibers, and to their containers including waste containers. Where feasible, installed asbestos products shall contain a visible label.

(b) Labels shall be printed in large, bold letters on a contrasting background.

(c) The labels shall comply with the requirements of WAC 296-62-05411, and shall include the following information:

DANGER
CONTAINS ASBESTOS FIBERS
AVOID CREATING DUST
CANCER AND LUNG DISEASE HAZARD
AVOID BREATHING AIRBORNE ASBESTOS FIBERS

(7) The provisions for labels required by subsection (6)(a) of this section or for material safety data sheets required by subsection (8) of this section do not apply where:

(a) Asbestos fibers have been modified by a bonding agent, coating, binder, or other material, provided that the manufacturer can demonstrate that during any reasonably foreseeable use, handling, storage, disposal, processing, or transportation, no airborne concentrations of fibers of asbestos in excess of the excursion limit will be released; or

(b) Asbestos is present in a product in concentrations less than 0.1 percent by weight.

(8) Material safety data sheets. Employers who are manufacturers or importers of asbestos, or asbestos products shall comply with the requirements regarding development of material safety data sheets as specified in WAC 296-62-05413, except as provided by subsection (7) of this section.

(9) When a building/vessel owner/or employer identifies previously installed PACM and/or ACM, labels or signs shall be affixed or posted so that employees will be notified of what materials contain PACM and/or ACM. The employer shall attach such labels in areas where they will clearly be noticed by employees who are likely to be exposed, such as at the entrance to mechanical rooms/areas. Signs required by subsection (5)(a) of this section may be posted in lieu of labels so long as they contain information required for labeling. The employer shall ensure, to the extent feasible, that employees who come in contact with these signs can comprehend them. Means to ensure employee comprehension may include the use of foreign languages, pictographs, graphics, and awareness training.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07721, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-07721, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 93-01-005 (Order 92-20), § 296-62-07721, filed 12/2/92, effective 1/15/93; 91-03-044 (Order 90-18), § 296-62-07721, filed 1/10/91, effective 2/12/91; 89-21-018 (Order 89-10), § 296-62-07721, filed 10/10/89, effective 11/24/89; 89-11-035 (Order 89-03), § 296-62-07721, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07721, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07721, filed 4/27/87.]

WAC 296-62-07722 Employee information and training. (1) Certification.

(a) All individuals working or supervising asbestos projects, as defined in WAC 296-65-003 shall be certified as required by WAC 296-65-010, 296-65-012, and 296-65-030.

(b) In cases where certification requirements of chapter 296-65 WAC do not apply, all employees shall be trained according to provisions of this section regardless of their exposure levels.

(2) Training shall be provided prior to or at the time of initial assignment, unless the employee has received equivalent training within the previous twelve months, and at least annually thereafter.

(3) Training for employees performing Class I and Class II operations.

(a) Training for Class I and Class II operations shall be the certified asbestos worker training specified in WAC 296-65-003, 296-65-010, and 296-65-030.

(b) Exceptions. For employees whose Class II work with intact asbestos-containing materials involves only the removal and/or disturbance of one generic category of intact building/vessel material, such as intact roofing material, bituminous or asphaltic pipeline coating, intact flooring/decking material, siding materials and ceiling tiles, or transite panels, such employers are required to train employees who perform such work by providing a training course which includes as a minimum all elements of subsection (5) of this section and in addition the specific work practices and engineering controls set forth in WAC 296-62-07712 and 296-62-07713 which specifically relate to that material category. Such course shall include "hands-on" training, and shall take at least 8 hours.

(i) For Class II operations involving intact materials not specified in (b) of this subsection, training shall include the requirements of (b) of this subsection and specific work practices and engineering controls specified in WAC 296-62-07712 which specifically relates to the category of material being removed, and shall include hands-on training in the work practices applicable to each category of material the employee removes and each removal method that the employee uses.

(ii) Employees performing Class II operations that require the use of critical barriers (or equivalent isolation methods) and/or negative pressure enclosures, shall be certified as required by WAC 296-65-010, 296-65-012, and 296-65-030.

(4) Training for Class III and IV operations.

(a) Training for employees performing Class III and IV operations shall be the certified asbestos worker training specified in WAC 296-65-003, 296-65-001, and 296-65-030.

(b) Training for Class III asbestos work exempted from certification requirements in chapter 296-65 WAC, safety

standards for asbestos removal and encapsulation shall be the equivalent in curriculum and training method to the 16-hour operations and maintenance course developed by EPA for maintenance and custodial workers who conduct activities that will result in the disturbance of ACM. (See 40 CFR 763.92(a)(2).) Such course shall include "hands-on" training in the use of respiratory protection and work practices and shall take at least 16 hours.

(c) Training for Class IV asbestos work exempted from certification requirements in chapter 296-65 WAC, safety standards for asbestos removal and encapsulation shall be the equivalent in curriculum and training method to the awareness training course developed by EPA for maintenance and custodial workers who work in buildings containing asbestos-containing material. (See 40 CFR 763.92(a)(1).) Such course shall include available information concerning the locations of PACM an ACM, and asbestos-containing flooring material, or flooring material where the absence of asbestos has not been certified; and instruction in recognition of damage, deterioration, and delamination of asbestos-containing building materials. Such a course shall take at least 2 hours.

(5) The training program shall be conducted in a manner which the employee is able to understand. The employer shall ensure that each employee is informed of the following:

- (a) The health effects associated with asbestos exposure;
- (b) The relationship between smoking and exposure to asbestos producing lung cancer;
- (c) Methods of recognizing asbestos and quantity, location, manner of use, release (including the requirements of WAC 296-62-07721 (1)(c) and (2)(b) to presume certain building materials contain asbestos), and storage of asbestos and the specific nature of operations which could result in exposure to asbestos;
- (d) The engineering controls and work practices associated with the employee's job assignment;
- (e) The specific procedures implemented to protect employees from exposure to asbestos, such as appropriate work practices, housekeeping procedures, hygiene facilities, decontamination procedures, emergency and clean-up procedures (including where Class III and IV work is performed, the contents "Managing Asbestos In Place" (EPA 20T-2003, July 1990) or its equivalent in content), personal protective equipment to be used, waste disposal procedures, and any necessary instructions in the use of these controls and procedures;

(f) The purpose, proper use, and limitations of respirators and protective clothing;

(g) The purpose and a description of the medical surveillance program required by WAC 296-62-07725;

(h) The content of this standard, including appendices;

(i) The names, addresses and phone numbers of public health organizations which provide information, materials, and/or conduct programs concerning smoking cessation. The employer may distribute the list of such organizations contained in Appendix I, to comply with this requirement; and

(j) The requirements for posting signs and affixing labels and the meaning of the required legends for such signs and labels.

(6) The employer shall also provide, at no cost to employees who perform housekeeping operations in a facility which contains ACM or PACM, an asbestos awareness training course, which shall at a minimum contain the following elements: Health effects of asbestos, locations of ACM and PACM in the building/facility, recognition of ACM and PACM damage and deterioration, requirements in this standard relating to housekeeping, and proper response to fiber release episodes, to all employees who are or will work in areas where ACM and/or PACM is present. Each such employee shall be so trained at least once a year.

(7) Access to information and training materials.

(a) The employer shall make a copy of this standard and its appendices readily available without cost to all affected employees.

(b) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.

(c) The employer shall inform all employees concerning the availability of self-help smoking cessation program material. Upon employee request, the employer shall distribute such material, consisting of NIH Publication No. 89-1647, or equivalent self-help material, which is approved or published by a public health organization listed in Appendix I, WAC 296-62-07751.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07722, filed 12/17/96, effective 3/1/97.]

WAC 296-62-07723 Housekeeping. (1) All surfaces shall be maintained as free as practicable of accumulations of dusts and waste containing asbestos.

(2) All spills and sudden releases of material containing asbestos shall be cleaned up as soon as possible.

(3) Surfaces contaminated with asbestos may not be cleaned by the use of compressed air.

(4) Vacuuming. HEPA-filtered vacuuming equipment shall be used for vacuuming. The equipment shall be used and emptied in a manner which minimizes the reentry of asbestos into the workplace.

(5) Shoveling, dry sweeping, and dry clean-up of asbestos may be used only where vacuuming and/or wet cleaning are not feasible.

(6) Waste disposal. Waste, scrap, debris, bags, containers, equipment, and clothing contaminated with asbestos consigned for disposal, shall be collected and disposed of in sealed impermeable bags, or other closed, impermeable containers. To avoid breakage, bags shall be at least six mils in thickness and shall not be dragged or slid across rough or abrasive surfaces.

(7) Waste removal. Whenever a negative-pressure enclosure is required by WAC 296-62-07712, the employer whenever feasible, shall establish a waste-load-out area that is adjacent and connected to the negative-pressure enclosure, constructed of a two chamber air lock, for the decontamination and removal of asbestos debris.

(8) Deterioration. Asbestos and asbestos containing material which has become damaged or deteriorated shall be repaired, enclosed, encapsulated, or removed.

(9) Care of asbestos-containing flooring/decking material.

(a) Sanding of asbestos-containing floor/deck material is prohibited.

(b) Stripping of finishes shall be conducted using low abrasion pads at speeds lower than 300 rpm and wet methods.

(c) Burnishing or dry buffing may be performed only on asbestos-containing flooring/decking which has sufficient finish so that the pad cannot contact the asbestos-containing material.

(d) Dust and debris in an area containing TSI or surfacing ACM/PACM or visibly deteriorated ACM, shall not be dusted or swept dry, or vacuumed without using a HEPA filter.

(10) Waste and debris and accompanying dust in an area containing accessible thermal system insulation or surfacing material or visibly deteriorated ACM:

(a) Shall not be dusted or swept dry, or vacuumed without using a HEPA filter;

(b) Shall be promptly cleaned up and disposed of in leak tight containers.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07723, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07723, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07723, filed 4/27/87.]

WAC 296-62-07725 Medical surveillance. (1) General.

(a) Employees covered. The employer shall institute a medical surveillance program for all employees who are or will be exposed to airborne concentrations of fibers of asbestos at or above the permissible exposure limits. Exception.

Employers in the construction or shipyard industries shall institute a medical surveillance program for all employees who for a combined total of 30 or more days per year are engaged in Class I, II, and III work, or are exposed at or above the permissible exposure limit for combined 30 days or more per year; or who are required by the standard to wear negative pressure respirators. For the purpose of this subsection, any day in which an employee engaged in Class II or III work or a combination thereof for one hour or less (taking into account the entire time spent on the removal operation, including cleanup), and, while doing so adheres to the work practices specified in this standard, shall not be counted.

(b) Examination by a physician.

(i) The employer shall ensure that all medical examinations and procedures are performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee and at a reasonable time and place.

(ii) Persons other than licensed physicians, who administer the pulmonary function testing required by this section, shall complete a training course in spirometry sponsored by an appropriate academic or professional institution.

(2) Placement examinations.

(a) Except as provided by WAC 296-62-07725 (1)(a), before an employee is assigned to an occupation exposed to airborne concentrations of asbestos, a preplacement medical examination shall be provided or made available by the employer. Examinations administered using the thirty or more days per year criteria of WAC 296-62-07725 (1)(a) shall be given within ten working days following the thirtieth day of exposure. Examinations must be given prior to assign-

ment of employees to areas where negative-pressure respirators are worn.

(b) All examinations shall include, as a minimum, a medical and work history: A complete physical examination of all systems with special emphasis on the pulmonary, cardiovascular, and gastrointestinal systems; completion of the respiratory disease standardized questionnaire in WAC 296-62-07741, Appendix D, Part 1; a chest roentgenogram (posterior-anterior 14x17 inches); pulmonary function tests to include forced vital capacity (FVC) and forced expiratory volume at 1 second (FEV_{1.0}); and any additional tests deemed appropriate by the examining physician. Interpretation and classification of chest roentgenograms shall be conducted in accordance with WAC 296-62-07743, Appendix E.

(3) Periodic examinations.

(a) Periodic medical examinations shall be made available annually.

(b) The scope of the medical examination shall be in conformance with the protocol established in subsection (2)(b) of this section, except that the frequency of chest roentgenograms shall be conducted in accordance with Table 2 of this section, and the abbreviated standardized questionnaire contained in WAC 296-62-07741, Appendix D, Part 2, shall be administered to the employee.

TABLE 2—FREQUENCY OF CHEST ROENTGENOGRAMS

Years since first exposure	Age of employee		
	15 to 35	35+ to 45	45+
0 to 10	Every 5 years	Every 5 years	Every 5 years.
10+	Every 5 years	Every 2 years	Every 1 year.

(c) If the examining physician determines that any of the examinations should be provided more frequently than specified, the employer shall provide such examinations to affected employees at the frequencies specified by the physician.

(4) Termination of employment examinations.

(a) The employer shall provide, or make available, a termination of employment medical examination for any employee who has been exposed to airborne concentrations of fibers of asbestos at or above the permissible exposure limits.

(b) The medical examination shall be in accordance with the requirements of the periodic examinations stipulated in subsection (3) of this section, and shall be given within thirty calendar days before or after the date of termination of employment.

(5) Recent examinations. No medical examination is required of any employee, if adequate records show that the employee has been examined in accordance with subsection (2), (3), or (4) of this section within the past one-year period.

(6) Information provided to the physician. The employer shall provide the following information to the examining physician:

(a) A copy of this standard and Appendices D, E, and H of WAC 296-62-07741, 296-62-07743, and 296-62-07749 respectively.

(b) A description of the affected employee's duties as they relate to the employee's exposure.

(c) The employee's representative exposure level or anticipated exposure level.

(d) A description of any personal protective and respiratory equipment used or to be used.

(e) Information from previous medical examinations of the affected employee that is not otherwise available to the examining physician.

(7) Physician's written opinion.

(a) The employer shall obtain a written signed opinion from the examining physician. This written opinion shall contain the results of the medical examination and shall include:

(i) The physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of material health impairment from exposure to asbestos;

(ii) Any recommended limitations on the employee or upon the use of personal protective equipment such as clothing or respirators;

(iii) A statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions resulting from asbestos exposure that require further explanation or treatment; and

(iv) A statement that the employee has been informed by the physician of the increased risk of lung cancer attributable to the combined effect of smoking and asbestos exposure.

(b) The employer shall instruct the physician not to reveal in the written opinion given to the employer specific findings or diagnoses unrelated to occupational exposure to asbestos.

(c) The employer shall provide a copy of the physician's written opinion to the affected employee within thirty days from its receipt.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07725, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-07725, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07725, filed 1/10/91, effective 2/12/91; 89-11-035 (Order 89-03), § 296-62-07725, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07725, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07725, filed 4/27/87.]

WAC 296-62-07727 Recordkeeping. (1) Exposure measurements.

(a) The employer shall keep an accurate record of all measurements taken to monitor employee exposure to asbestos as prescribed in WAC 296-62-07709.

(b) This record shall include at least the following information:

(i) Name of employer;

(ii) Name of person conducting monitoring;

(iii) The date of measurement;

(iv) Address of operation or activity;

(v) Description of the operation or activity involving exposure to asbestos that is being monitored;

(vi) Personal or area sample;

(vii) Name, Social Security number, and exposure level of the employees whose exposures are represented;

(viii) Type of protective devices worn, if any;

(ix) Pump calibration date and flow rate;

(x) Total volume of air sampled;

(xi) Name and address of analytical laboratory;

(xii) Number, duration, and results (f/cc) of samples taken;

(xiii) Date of analysis; and

(xiv) Sampling and analytical methods used and evidence of their accuracy.

(c) The employer shall maintain this record for the duration of employment plus thirty years, in accordance with WAC 296-62-052.

(2) Objective data for exempted operations.

(a) Where the processing, use, or handling of products made from or containing asbestos is exempted from other requirements of this section under WAC 296-62-07709 (2)(c), the employer shall establish and maintain an accurate record of objective data reasonably relied upon in support of the exemption.

(b) The record shall include at least the following:

(i) The product qualifying for exemption;

(ii) The source of the objective data;

(iii) The testing protocol, results of testing, and/or analysis of the material for the release of asbestos;

(iv) A description of the operation exempted and how the data support the exemption; and

(v) Other data relevant to the operations, materials, processing, or employee exposures covered by the exemption.

(c) The employer shall maintain this record for the duration of the employer's reliance upon such objective data.

Note: The employer may utilize the services of competent organizations such as industry trade associations and employee associations to maintain the records required by this section.

(3) Medical surveillance.

(a) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance by WAC 296-62-07725 (1)(a), in accordance with WAC 296-62-052.

(b) The record shall include at least the following information:

(i) The name and Social Security number of the employee;

(ii) Physician's written opinions;

(iii) Any employee medical complaints related to exposure to asbestos;

(iv) A copy of the information provided to the physician as required by WAC 296-62-07725(6); and

(v) A copy of the employee's medical examination results, including the medical history, questionnaire responses, results of any tests, and physicians recommendations.

(c) The employer shall ensure that this record is maintained for the duration of employment plus thirty years, in accordance with WAC 296-62-052.

(4) Training. The employer shall maintain all employee training records for one year beyond the last date of employment of that employee.

(5) Availability.

(a) The employer, upon written request, shall make all records required to be maintained by this section available to the director for examination and copying.

(b) The employer, upon request, shall make any exposure records required by subsection (1) of this section avail-

able for examination and copying to affected employees, former employees, designated representatives, and the director, in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(c) The employer, upon request, shall make employee medical records required by subsection (2) of this section available for examination and copying to the subject employee, to anyone having the specific written consent of the subject employee, and the director, in accordance with WAC 296-62-052.

(6) Transfer of records.

(a) The employer shall comply with the requirements concerning transfer of records set forth in WAC 296-62-05215.

(b) Whenever the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director at least ninety days prior to disposal of records and, upon request, transmit them to the director.

(7) Data to rebut PACM. Where the building owner and employer have relied on data to demonstrate that PACM is not asbestos-containing, such data shall be maintained for as long as they are relied upon to rebut the presumption.

(8) Records of required notifications. Where the building owner has communicated and received information concerning the identification, location and quantity of ACM and PACM, written records of such notifications and their content shall be maintained by the building owner for the duration of ownership and shall be transferred to successive owners of such buildings/facilities.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07727, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07727, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07727, filed 4/27/87.]

WAC 296-62-07728 Competent person. (1) General. For all construction and shipyard work covered by this standard, the employer shall designate a competent person, having the qualifications and authorities for ensuring worker safety and health as required by chapter 296-155 WAC.

(2) Required inspections by the competent person. WAC 296-155-110(9) which requires health and safety prevention programs to provide for frequent and regular inspections on the job sites, materials, and equipment to be made by the competent person, is incorporated.

(3) Additional inspections. In addition, the competent person shall make frequent and regular inspections of the job sites in order to perform the duties set out below in this section. For Class I jobs, on-site inspections shall be made at least once during each work shift, and at any time at employee request. For Class II and III jobs, on-site inspections shall be made at intervals sufficient to assess whether conditions have changed, and at any reasonable time at employee request.

(4) On all worksites where employees are engaged in Class I or II asbestos work, the competent person designated in accordance with WAC 296-62-07712 shall perform or supervise the following duties, as applicable:

(a) Set up the regulated area, enclosure, or other containment;

(b) Ensure (by on-site inspection) the integrity of the enclosure or containment;

(c) Set up procedures to control entry and exit from the enclosure and/or area;

(d) Supervise all employee exposure monitoring required by this section and ensure that it is conducted as required by WAC 296-62-07709;

(e) Ensure that employees working within the enclosure and/or using glovebags wear protective clothing and respirators as required by WAC 296-62-07715 and 296-62-07717;

(f) Ensure through on-site supervision, that employees set up and remove engineering controls, use work practices and personal protective equipment in compliance with all requirements;

(g) Ensure that employees use the hygiene facilities and observe the decontamination procedures specified in WAC 296-62-07719;

(h) Ensure that through on-site inspection engineering controls are functioning properly and employees are using proper work practices; and

(i) Ensure that notification requirements in WAC 296-62-07721 are met.

(5) Training for competent person.

(a) For Class I and II asbestos work the competent person shall be trained in all aspects of asbestos removal and handling, including: Abatement, installation, removal and handling, the contents of this standard, the identification of asbestos, removal procedures where appropriate, and other practices for reducing the hazard. Such training shall be the certified asbestos supervisor training specified in WAC 296-65-003, 296-65-012, and 296-65-030.

(b) For Class III and IV asbestos work:

(i) The competent person shall be certified as an asbestos supervisor as prescribed in WAC 296-65-012 and 296-65-030 for Class III and IV work involving 3 square feet or 3 linear feet or more of asbestos containing material.

(ii) For Class III and IV asbestos work involving less than 3 square feet or 3 linear feet of asbestos containing material, and asbestos work exempted from certification requirements in chapter 296-65 WAC, the competent person shall be trained in aspects of asbestos handling appropriate for the nature of the work, to include procedures for setting up glove bags and mini-enclosures, practices for reducing asbestos exposures, use of wet methods, the contents of this standard, and the identification of asbestos. Such training shall include successful completion of a course equivalent in curriculum and training method to the 16-hour Operations and Maintenance course developed by EPA for maintenance and custodial workers (see 40 CFR 763.92 (a)(2)) or its equivalent in stringency, content and length.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-19-014, § 296-62-07728, filed 9/5/97, effective 11/5/97; 97-01-079, § 296-62-07728, filed 12/17/96, effective 3/1/97.]

WAC 296-62-07733 Appendices. (1) Appendices A, C, D, E, and F to this part are incorporated as part of this section and the contents of these appendices are mandatory.

(2) Appendices B, G, H, I, J and K to this part are informational and are not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07733, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07733, filed 1/10/91, effective 2/12/91; 87-24-051 (Order 87-24), § 296-62-07733, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07733, filed 4/27/87.]

WAC 296-62-07735 Appendix A—WISHA reference method—Mandatory. This mandatory appendix specifies the procedure for analyzing air samples for asbestos, tremolite, anthophyllite, and actinolite and specifies quality control procedures that must be implemented by laboratories performing the analysis. The sampling and analytical methods described below represent the elements of the available monitoring methods (such as Appendix B to this section, the most current version of the WISHA method ID-60, or the most current version of the NIOSH 7400 method) which WISHA considers to be essential to achieve adequate employee exposure monitoring while allowing employers to use methods that are already established within their organizations. All employers who are required to conduct air monitoring under WAC 296-62-07709 are required to utilize analytical laboratories that use this procedure, or an equivalent method, for collecting and analyzing samples.

(1) Sampling and analytical procedure.

(a) The sampling medium for air samples shall be mixed cellulose ester filter membranes. These shall be designated by the manufacturer as suitable for asbestos, tremolite, anthophyllite, and actinolite counting. See below for rejection of blanks.

(b) The preferred collection device shall be the 25-mm diameter cassette with an open-faced 50-mm electrically conductive extension cowl. The 37-mm cassette may be used if necessary but only if written justification for the need to use the 37-mm filter cassette accompanies the sample results in the employee's exposure monitoring record. Do not reuse or reload cassettes for asbestos sample collection.

(c) An air flow rate between 0.5 liter/min and 2.5 liters/min shall be selected for the 25-mm cassette. If the 37-mm cassette is used, an air flow rate between 1 liter/min and 4.0 liters/min shall be selected.

(d) Where possible, a sufficient air volume for each air sample shall be collected to yield between one hundred and one thousand three hundred fibers per square millimeter on the membrane filter. If a filter darkens in appearance or if loose dust is seen on the filter, a second sample shall be started.

(e) Ship the samples in a rigid container with sufficient packing material to prevent dislodging the collected fibers. Packing material that has a high electrostatic charge on its surface (e.g., expanded polystyrene) cannot be used because such material can cause loss of fibers to the sides of the cassette.

(f) Calibrate each personal sampling pump before and after use with a representative filter cassette installed between the pump and the calibration devices.

(g) Personal samples shall be taken in the "breathing zone" of the employee (i.e., attached to or near the collar or lapel near the worker's face).

(h) Fiber counts shall be made by positive phase contrast using a microscope with an 8 to 10 X eyepiece and a 40 to 45

X objective for a total magnification of approximately 400 X and a numerical aperture of 0.65 to 0.75. The microscope shall also be fitted with a green or blue filter.

(i) The microscope shall be fitted with a Walton-Beckett eyepiece graticule calibrated for a field diameter of one hundred micrometers (+/-2 micrometers).

(j) The phase-shift detection limit of the microscope shall be about 3 degrees measured using the HSE phase shift test slide as outlined below.

(i) Place the test slide on the microscope stage and center it under the phase objective.

(ii) Bring the blocks of grooved lines into focus.

Note: The slide consists of seven sets of grooved lines (ca. 20 grooves to each block) in descending order of visibility from sets one to seven, seven being the least visible. The requirements for asbestos, tremolite, anthophyllite, and actinolite counting are that the microscope optics must resolve the grooved lines in set three completely, although they may appear somewhat faint, and that the grooved lines in sets six and seven must be invisible. Sets four and five must be at least partially visible but may vary slightly in visibility between microscopes. A microscope that fails to meet these requirements has either too low or too high a resolution to be used for asbestos, tremolite, anthophyllite, and actinolite counting.

(iii) If the image deteriorates, clean and adjust the microscope optics. If the problem persists, consult the microscope manufacturer.

(k) Each set of samples taken will include ten percent blanks or a minimum of two blanks. These blanks must come from the same lot as the filters used for sample collection. The field blank results shall be averaged and subtracted from the analytical results before reporting. Any samples represented by a blank having a fiber count in excess of the detection limit of the method being used shall be rejected.

(l) The samples shall be mounted by the acetone/triacetin method or a method with an equivalent index of refraction and similar clarity.

(m) Observe the following counting rules.

(i) Count only fibers equal to or longer than five micrometers. Measure the length of curved fibers along the curve.

(ii) Count all particles as asbestos, tremolite, anthophyllite, and actinolite that have a length-to-width ratio (aspect ratio) of three to one or greater.

(iii) Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of one. Fibers crossing the boundary once, having one end within the circle, shall receive the count of one-half. Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible outside the graticule area.

(iv) Count bundles of fibers as one fiber unless individual fibers can be identified by observing both ends of an individual fiber.

(v) Count enough graticule fields to yield 100 fibers. Count a minimum of 20 fields; stop counting at 100 fields regardless of fiber count.

(n) Blind recounts shall be conducted at the rate of ten percent.

(2) Quality control procedures.

(a) Intralaboratory program. Each laboratory and/or each company with more than one microscopist counting slides shall establish a statistically designed quality assurance program involving blind recounts and comparisons between microscopists to monitor the variability of counting by each microscopist and between microscopists. In a company with more than one laboratory, the program shall include all laboratories and shall also evaluate the laboratory-to-laboratory variability.

(b) Interlaboratory program.

(i) Each laboratory analyzing asbestos, tremolite, anthophyllite, and actinolite samples for compliance determination shall implement an interlaboratory quality assurance program that as a minimum includes participation of at least two other independent laboratories. Each laboratory shall participate in round robin testing at least once every six months with at least all the other laboratories in its interlaboratory quality assurance group. Each laboratory shall submit slides typical of its own work load for use in this program. The round robin shall be designed and results analyzed using appropriate statistical methodology.

(ii) All laboratories should participate in a national sample testing scheme such as the Proficiency Analytical Testing Program (PAT), the Asbestos Registry sponsored by the American Industrial Hygiene Association (AIHA).

(c) All individuals performing asbestos, tremolite, anthophyllite, and actinolite analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos, tremolite, anthophyllite, and actinolite dust or an equivalent course, recognized by the department.

(d) When the use of different microscopes contributes to differences between counters and laboratories, the effect of the different microscope shall be evaluated and the microscope shall be replaced, as necessary.

(e) Current results of these quality assurance programs shall be posted in each laboratory to keep the microscopists informed.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07735, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07735, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07735, filed 4/27/87.]

WAC 296-62-07737 Appendix B—Detailed procedure for asbestos sampling and analysis—Nonmandatory.

Air

Matrix:

WISHA Permissible Exposure Limits:

Time Weighted Average	0.1 fiber/cc
Excursion Level (30 minutes)	1.0 fiber/cc

Collection Procedure:

A known volume of air is drawn through a 25-mm diameter cassette containing a mixed-cellulose ester filter. The cassette must be equipped with an electrically conductive 50-mm extension cowl. The sampling time and rate are chosen to give a fiber density of between 100 to 1,300 fibers/mm² on the filter.

Recommended Sampling Rate 0.5 to 5.0 liters/minute (L/min)

Recommended Air Volumes:

Minimum	25 L
Maximum	2,400 L

Analytical Procedure: A portion of the sample filter is cleared and prepared for asbestos fiber counting by Phase Contrast Microscopy (PCM) at 400X. Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by WISHA. Similar products from other sources can be substituted.

Introduction.

This method describes the collection of airborne asbestos fibers using calibrated sampling pumps with mixed-cellulose ester (MCE) filters and analysis by phase contrast microscopy (PCM). Some terms used are unique to this method and are defined below:

Asbestos: A term for naturally occurring fibrous minerals. Asbestos includes chrysotile, crocidolite, amosite (cummingtonite-grunerite asbestos), tremolite asbestos, actinolite asbestos, anthophyllite asbestos, and any of these minerals that have been chemically treated and/or altered. The precise chemical formulation of each species will vary with the location from which it was mined. Nominal compositions are listed:

Chrysotile	Mg ₃ Si ₂ O ₅ (OH) ₄
Crocidolite	Na ₂ Fe ₃ ²⁺ +Fe ₂ ³⁺ +Si ₈ O ₂₂ (OH) ₂
Amosite	(Mg,Fe) ₇ Si ₈ O ₂₂ (OH) ₂
Tremolite-actinolite	Ca ₂ (Mg,Fe) ₅ Si ₈ O ₂₂ (OH) ₂
Anthophyllite	(Mg,Fe) ₇ Si ₈ O ₂₂ (OH) ₂

Asbestos Fiber: A fiber of asbestos which meets the criteria specified below for a fiber.

Aspect Ratio: The ratio of the length of a fiber to its diameter (e.g. 3:1, 5:1 aspect ratios).

Cleavage Fragments: Mineral particles formed by comminution of minerals, especially those characterized by parallel sides and a moderate aspect ratio (usually less than 20:1).

Detection Limit: The number of fibers necessary to be 95% certain that the result is greater than zero.

Differential Counting: The term applied to the practice of excluding certain kinds of fibers from the fiber count because they do not appear to be asbestos.

Fiber: A particle that is 5 μm or longer, with a length-to-width ratio of 3 to 1 or longer.

Field: The area within the graticule circle that is superimposed on the microscope image.

Set: The samples which are taken, submitted to the laboratory, analyzed, and for which, interim or final result reports are generated.

Tremolite, Anthophyllite, and Actinolite: The non-asbestos form of these minerals which meet the definition of a fiber. It includes any of these minerals that have been chemically treated and/or altered.

Walton-Beckett Graticule: An eyepiece graticule specifically designed for asbestos fiber counting. It consists of a circle with a projected diameter of 100 ± 2 μm (area of about

0.00785 mm²) with a crosshair having tic-marks at 3- μ m intervals in one direction and 5- μ m in the orthogonal direction. There are marks around the periphery of the circle to demonstrate the proper sizes and shapes of fibers. The disk is placed in one of the microscope eyepieces so that the design is superimposed on the field of view.

1. History.

(a) Early surveys to determine asbestos exposures were conducted using impinger counts of total dust with the counts expressed as million particles per cubic foot. The British Asbestos Research Council recommended filter membrane counting in 1969. In July 1969, the Bureau of Occupational Safety and Health published a filter membrane method for counting asbestos fibers in the United States. This method was refined by NIOSH and published as P & CAM 239. On May 29, 1971, OSHA specified filter membrane sampling with phase contrast counting for evaluation of asbestos exposures at work sites in the United States. The use of this technique was again required by OSHA in 1986. Phase contrast microscopy has continued to be the method of choice for the measurement of occupational exposure to asbestos.

(b) Principle. Air is drawn through a MCE filter to capture airborne asbestos fibers. A wedge shaped portion of the filter is removed, placed on a glass microscope slide and made transparent. A measured area (field) is viewed by PCM. All the fibers meeting a defined criteria for asbestos are counted and considered a measure of the airborne asbestos concentration.

(c) Advantages and Disadvantages

(i) There are four main advantages of PCM over other methods:

(A) The technique is specific for fibers. Phase contrast is a fiber counting technique which excludes non-fibrous particles from the analysis.

(B) The technique is inexpensive and does not require specialized knowledge to carry out the analysis for total fiber counts.

(C) The analysis is quick and can be performed on-site for rapid determination of air concentrations of asbestos fibers.

(D) The technique has continuity with historical epidemiological studies so that estimates of expected disease can be inferred from long-term determinations of asbestos exposures.

(ii) The main disadvantage of PCM is that it does not positively identify asbestos fibers. Other fibers which are not asbestos may be included in the count unless differential counting is performed. This requires a great deal of experience to adequately differentiate asbestos from non-asbestos fibers. Positive identification of asbestos must be performed by polarized light or electron microscopy techniques. A further disadvantage of PCM is that the smallest visible fibers are about 0.2 μ m in diameter while the finest asbestos fibers may be as small as 0.02 μ m in diameter. For some exposures, substantially more fibers may be present than are actually counted.

(d) Workplace Exposure. Asbestos is used by the construction industry in such products as shingles, floor tiles,

(1999 Ed.)

asbestos cement, roofing felts, insulation and acoustical products. Non-construction uses include brakes, clutch facings, paper, paints, plastics, and fabrics. One of the most significant exposures in the workplace is the removal and encapsulation of asbestos in schools, public buildings, and homes. Many workers have the potential to be exposed to asbestos during these operations. About 95% of the asbestos in commercial use in the United States is chrysotile. Crocidolite and amosite make up most of the remainder. Anthophyllite and tremolite or actinolite are likely to be encountered as contaminants in various industrial products.

(e) Physical Properties. Asbestos fiber possesses a high tensile strength along its axis, is chemically inert, non-combustible, and heat resistant. It has a high electrical resistance and good sound absorbing properties. It can be weaved into cables, fabrics or other textiles, and also matted into asbestos papers, felts, or mats.

2. Range and Detection Limit.

(a) The ideal counting range on the filter is 100 to 1,300 fibers/mm². With a Walton-Beckett graticule this range is equivalent to 0.8 to 10 fibers/field. Using NIOSH counting statistics, a count of 0.8 fibers/field would give an approximate coefficient of variation (CV) of 0.13.

(b) The detection limit for this method is 4.0 fibers per 100 fields or 5.5 fibers/mm². This was determined using an equation to estimate the maximum CV possible at a specific concentration (95% confidence) and a Lower Control Limit of zero. The CV value was then used to determine a corresponding concentration from historical CV vs fiber relationships. As an example:

$$\text{Lower Control Limit (95\% Confidence)} = AC - 1.645(CV)(AC)$$

Where:

$$\begin{aligned} AC &= \text{Estimate of the airborne fiber concentration} \\ &\quad (\text{fibers/cc}) \text{ Setting the Lower Control Limit} = 0 \\ &\quad \text{and solving for CV:} \\ 0 &= AC - 1.645(CV)(AC) \\ CV &= 0.61 \end{aligned}$$

This value was compared with CV vs. count curves. The count at which CV= 0.61 for Leidel-Busch counting statistics 8(i) or for an OSHA Salt Lake Technical Center (OSHA-SLTC) CV curve (see Appendix A for further information) was 4.4 fibers or 3.9 fibers per 100 fields, respectively. Although a lower detection limit of 4 fibers per 100 fields is supported by the OSHA-SLTC data, both data sets support the 4.5 fibers per 100 fields value.

3. Method Performance—Precision and Accuracy. Precision is dependent upon the total number of fibers counted and the uniformity of the fiber distribution on the filter. A general rule is to count at least 20 and not more than 100 fields. The count is discontinued when 100 fibers are counted, provided that 20 fields have already been counted. Counting more than 100 fibers results in only a small gain in precision. As the total count drops below 10 fibers, an accelerated loss of precision is noted. At this time, there is no known method to determine the absolute accuracy of the asbestos analysis. Results of samples prepared through the Proficiency Analytical Testing (PAT) Program and analyzed by the OSHA-

SLTC showed no significant bias when compared to PAT reference values. The PAT samples were analyzed from 1987 to 1989 (N=36) and the concentration range was from 120 to 1,300 fibers/mm².

4. Interferences. Fibrous substances, if present, may interfere with asbestos analysis. Some common fibers are:

- Fiber glass
- Anhydrite plant fibers gypsum
- Membrane structures
- Microorganisms
- Perlite veins.
- Some synthetic fibers.
- Sponge spicules and diatoms.
- Wollastonite.

The use of electron microscopy or optical tests such as polarized light, and dispersion staining may be used to differentiate these materials from asbestos when necessary.

5. Sampling.

(a) Equipment.

(i) Sample assembly. Conductive filter holder consisting of a 25-mm diameter, 3-piece cassette having a 50-mm long electrically conductive extension cowl. Backup pad, 25-mm, cellulose. Membrane filter, mixed-cellulose ester (MCE), 25-mm, plain, white, 0.8- to 1.2-µm pore size.

Notes: (A) DO NOT RE-USE CASSETTES.

(B) Fully conductive cassettes are required to reduce fiber loss to the sides of the cassette due to electrostatic attraction.

(C) Purchase filters which have been selected by the manufacturer for asbestos counting or analyze representative filters for fiber background before use. Discard the filter lot if more than 4 fibers/100 fields are found.

(D) To decrease the possibility of contamination, the sampling system (filter-backup pad-cassette) for asbestos is usually preassembled by the manufacturer.

(ii) Gel bands for sealing cassettes.

(iii) Sampling pump. Each pump must be a battery operated, self-contained unit small enough to be placed on the monitored employee and not interfere with the work being performed. The pump must be capable of sampling at 2.5 liters per minute (L/min) for the required sampling time.

(iv) Flexible tubing, 6-mm bore.

(v) Pump calibration. Stopwatch and bubble tube/burette or electronic meter.

(b) Sampling Procedure.

(i) Seal the point where the base and cowl of each cassette meet with a gel band or tape.

(ii) Charge the pumps completely before beginning.

(iii) Connect each pump to a calibration cassette with an appropriate length of 6-mm bore plastic tubing. Do not use luer connectors—the type of cassette specified above has built-in adapters.

(iv) Select an appropriate flow rate for the situation being monitored. The sampling flow rate must be between 0.5 and 5.0 L/min for personal sampling and is commonly set between 1 and 2 L/min. Always choose a flow rate that will not produce overloaded filters.

(v) Calibrate each sampling pump before and after sampling with a calibration cassette in-line (Note: This calibration cassette should be from the same lot of cassettes used for

sampling). Use a primary standard (e.g. bubble burette) to calibrate each pump. If possible, calibrate at the sampling site.

Note: If sampling site calibration is not possible, environmental influences may affect the flow rate. The extent is dependent on the type of pump used. Consult with the pump manufacturer to determine dependence on environmental influences. If the pump is affected by temperature and pressure changes, use the formula in Appendix B to this section to calculate the actual flow rate.

(vi) Connect each pump to the base of each sampling cassette with flexible tubing. Remove the end cap of each sample cassette and take each air sample open face. Assure that each sample cassette is held open side down in the employee's breathing zone during sampling. The distance from the nose/mouth of the employee to the cassette should be about 10 cm. Secure the cassette on the collar or lapel of the employee using spring clips or other similar devices.

(vii) A suggested minimum air volume when sampling to determine TWA compliance is 25 L. For Excursion Limit (30 min sampling time) evaluations, a minimum air volume of 48 L is recommended.

(viii) The most significant problem when sampling for asbestos is overloading the filter with non-asbestos dust. Suggested maximum air sample volumes for specific environments are:

Type of asbestos	Index of refraction
Chrysotile.	n=1.550.
Amosite.	n=1.670 r 1.680.
Crocidolite.	n=1.690.
Anthophyllite.	n=1.605 nd 1.620.
Tremolite.	n=1.605 and 1.620
Actinolite.	n=1.620

Caution: Do not overload the filter with dust. High levels of non-fibrous dust particles may obscure fibers on the filter and lower the count or make counting impossible. If more than about 25 to 30% of the field area is obscured with dust, the result may be biased low. Smaller air volumes may be necessary when there is excessive non-asbestos dust in the air. While sampling, observe the filter with a small flashlight. If there is a visible layer of dust on the filter, stop sampling, remove and seal the cassette, and replace with a new sampling assembly. The total dust loading should not exceed 1 mg.

(ix) Blank samples are used to determine if any contamination has occurred during sample handling. Prepare two blanks for the first 1 to 20 samples. For sets containing greater than 20 samples, prepare blanks as 10% of the samples. Handle blank samples in the same manner as air samples with one exception: Do not draw any air through the blank samples. Open the blank cassette in the place where the sample cassettes are mounted on the employee. Hold it open for about 30 seconds. Close and seal the cassette appropriately. Store blanks for shipment with the sample cassettes.

(x) Immediately after sampling, close and seal each cassette with the base and plastic plugs. Do not touch or puncture the filter membrane as this will invalidate the analysis.

(xi) Attach a seal (OSHA-21 or equivalent) around each cassette in such a way as to secure the end cap plug and base plug. Tape the ends of the seal together since the seal is not

long enough to be wrapped end-to-end. Also wrap tape around the cassette at each joint to keep the seal secure.

(c) Sample Shipment.

(i) Send the samples to the laboratory with paperwork requesting asbestos analysis. List any known fibrous interferences present during sampling on the paperwork. Also, note the workplace operation(s) sampled.

(ii) Secure and handle the samples in such that they will not rattle during shipment nor be exposed to static electricity. Do not ship samples in expanded polystyrene peanuts, vermiculite, paper shreds, or excelsior. Tape sample cassettes to sheet bubbles and place in a container that will cushion the samples without rattling.

(iii) To avoid the possibility of sample contamination, always ship bulk samples in separate mailing containers.

6. Analysis.

(a) Safety Precautions.

(i) Acetone is extremely flammable and precautions must be taken not to ignite it. Avoid using large containers or quantities of acetone. Transfer the solvent in a ventilated laboratory hood. Do not use acetone near any open flame. For generation of acetone vapor, use a spark free heat source.

(ii) Any asbestos spills should be cleaned up immediately to prevent dispersal of fibers. Prudence should be exercised to avoid contamination of laboratory facilities or exposure of personnel to asbestos. Asbestos spills should be cleaned up with wet methods and/or a High Efficiency Particulate-Air (HEPA) filtered vacuum.

Caution: Do not use a vacuum without a HEPA filter—It will disperse fine asbestos fibers in the air.

(b) Equipment.

(i) Phase contrast microscope with binocular or trinocular head.

(ii) Widefield or Huygenian 10X eyepieces (NOTE: The eyepiece containing the graticule must be a focusing eyepiece. Use a 40X phase objective with a numerical aperture of 0.65 to 0.75).

(iii) Kohler illumination (if possible) with green or blue filter.

(iv) Walton-Beckett Graticule, type G-22 with 100 ± 2 μ m projected diameter.

(v) Mechanical stage. A rotating mechanical stage is convenient for use with polarized light.

(vi) Phase telescope.

(vii) Stage micrometer with 0.01-mm subdivisions.

(viii) Phase-shift test slide, mark II (Available from PTR optics Ltd., and also McCrone).

(ix) Pre-cleaned glass slides, 25 mm X 75 mm. One end can be frosted for convenience in writing sample numbers, etc., or paste-on labels can be used.

(x) Cover glass #1-1/2.

(xi) Scalpel (#10, curved blade).

(xii) Fine tipped forceps.

(xiii) Aluminum block for clearing filter.

(xiv) Automatic adjustable pipette, 100-to 500- μ L.

(xv) Micropipette, 5 μ L.

(c) Reagents.

(i) Acetone (HPLC grade).

(ii) Triacetin (glycerol triacetate).

(iii) Lacquer or nail polish.

(d) Standard Preparation. A way to prepare standard asbestos samples of known concentration has not been developed. It is possible to prepare replicate samples of nearly equal concentration. This has been performed through the PAT program. These asbestos samples are distributed by the AIHA to participating laboratories. Since only about one-fourth of a 25-mm sample membrane is required for an asbestos count, any PAT sample can serve as a "standard" for replicate counting.

(e) Sample Mounting.

Note: See Safety Precautions in (6)(a) before proceeding. The objective is to produce samples with a smooth (non-grainy) background in a medium with a refractive index of approximately 1.46. The technique below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. An aluminum block or similar device is required for sample preparation.

See Safety Precautions in (6)(a) before proceeding. The objective is to produce samples with a smooth (non-grainy) background in a medium with a refractive index of approximately 1.46. The technique below collapses the filter for easier focusing and produces permanent mounts which are useful for quality control and interlaboratory comparison. An aluminum block or similar device is required for sample preparation.

(i) Heat the aluminum block to about 70°C. The hot block should not be used on any surface that can be damaged by either the heat or from exposure to acetone.

(ii) Ensure that the glass slides and cover glasses are free of dust and fibers.

(iii) Remove the top plug to prevent a vacuum when the cassette is opened. Clean the outside of the cassette if necessary. Cut the seal and/or tape on the cassette with a razor blade. Very carefully separate the base from the extension cowl, leaving the filter and backup pad in the base.

(iv) With a rocking motion cut a triangular wedge from the filter using the scalpel. This wedge should be one-sixth to one-fourth of the filter. Grasp the filter wedge with the forceps on the perimeter of the filter which was clamped between the cassette pieces. DO NOT TOUCH the filter with your finger. Place the filter on the glass slide sample side up. Static electricity will usually keep the filter on the slide until it is cleared.

(v) Place the tip of the micropipette containing about 200 μ L acetone into the aluminum block. Insert the glass slide into the receiving slot in the aluminum block. Inject the acetone into the block with slow, steady pressure on the plunger while holding the pipette firmly in place. Wait 3 to 5 seconds for the filter to clear, then remove the pipette and slide from the aluminum block.

(vi) Immediately (less than 30 seconds) place 2.5 to 3.5 μ L of triacetin on the filter (Note: Waiting longer than 30 seconds will result in increased index of refraction and decreased contrast between the fibers and the preparation. This may also lead to separation of the cover slip from the slide).

(vii) Lower a cover slip gently onto the filter at a slight angle to reduce the possibility of forming air bubbles. If more than 30 seconds have elapsed between acetone exposure and

triacetin application, glue the edges of the cover slip to the slide with lacquer or nail polish.

(viii) If clearing is slow, warm the slide for 15 min on a hot plate having a surface temperature of about 50°C to hasten clearing. The top of the hot block can be used if the slide is not heated too long.

(ix) Counting may proceed immediately after clearing and mounting are completed.

(f) Sample Analysis. Completely align the microscope according to the manufacturer's instructions. Then, align the microscope using the following general alignment routine at the beginning of every counting session and more often if necessary.

(i) Alignment.

(A) Clean all optical surfaces. Even a small amount of dirt can significantly degrade the image.

(B) Rough focus the objective on a sample.

(C) Close down the field iris so that it is visible in the field of view. Focus the image of the iris with the condenser focus. Center the image of the iris in the field of view.

(D) Install the phase telescope and focus on the phase rings. Critically center the rings. Misalignment of the rings results in astigmatism which will degrade the image.

(E) Place the phase-shift test slide on the microscope stage and focus on the lines. The analyst must see line set 3 and should see at least parts of 4 and 5 but, not see line set 6 or 6. A microscope/microscopist combination which does not pass this test may not be used.

(ii) Counting Fibers.

(A) Place the prepared sample slide on the mechanical stage of the microscope. Position the center of the wedge under the objective lens and focus upon the sample.

(B) Start counting from one end of the wedge and progress along a radial line to the other end (count in either direction from perimeter to wedge tip). Select fields randomly, without looking into the eyepieces, by slightly advancing the slide in one direction with the mechanical stage control.

(C) Continually scan over a range of focal planes (generally the upper 10 to 15 μm of the filter surface) with the fine focus control during each field count. Spend at least 5 to 15 seconds per field.

(D) Most samples will contain asbestos fibers with fiber diameters less than 1 μ . Look carefully for faint fiber images. The small diameter fibers will be very hard to see. However, they are an important contribution to the total count.

(E) Count only fibers equal to or longer than 5 μ . Measure the length of curved fibers along the curve.

(F) Count fibers which have a length to width ratio of 3:1 or greater.

(G) Count all the fibers in at least 20 fields. Continue counting until either 100 fibers are counted or 100 fields have been viewed; whichever occurs first. Count all the fibers in the final field.

(H) Fibers lying entirely within the boundary of the Walton-Beckett graticule field shall receive a count of 1. Fibers crossing the boundary once, having one end within the circle shall receive a count of 1/2. Do not count any fiber that crosses the graticule boundary more than once. Reject and do not count any other fibers even though they may be visible

outside the graticule area. If a fiber touches the circle, it is considered to cross the line.

(I) Count bundles of fibers as one fiber unless individual fibers can be clearly identified and each individual fiber is clearly not connected to another counted fiber.

(J) Record the number of fibers in each field in a consistent way such that filter non-uniformity can be assessed.

(K) Regularly check phase ring alignment.

(L) When an agglomerate (mass of material) covers more than 25% of the field of view, reject the field and select another. Do not include it in the number of fields counted.

(M) Perform a "blind recount" of 1 in every 10 filter wedges (slides). Re-label the slides using a person other than the original counter.

(g) Fiber Identification. As previously mentioned in (1)(c), PCM does not provide positive confirmation of asbestos fibers. Alternate differential counting techniques should be used if discrimination is desirable. Differential counting may include primary discrimination based on morphology, polarized light analysis of fibers, or modification of PCM data by Scanning Electron or Transmission Electron Microscopy. A great deal of experience is required to routinely and correctly perform differential counting. It is discouraged unless it is legally necessary. Then, only if a fiber is obviously not asbestos should it be excluded from the count. Further discussion of this technique can be found in reference 8(j). If there is a question whether a fiber is asbestos or not, follow the rule: "WHEN IN DOUBT, COUNT."

(h) Analytical Recommendations—Quality Control System.

(i) All individuals performing asbestos analysis must have taken the NIOSH course for sampling and evaluating airborne asbestos or an equivalent course.

(ii) Each laboratory engaged in asbestos counting shall set up a slide trading arrangement with at least two other laboratories in order to compare performance and eliminate inbreeding of error. The slide exchange occurs at least semi-annually. The round robin results shall be posted where all analysts can view individual analyst's results.

(iii) Each laboratory engaged in asbestos counting shall participate in the Proficiency Analytical Testing Program, the Asbestos Analyst Registry or equivalent.

(iv) Each analyst shall select and count prepared slides from a "slide bank". These are quality assurance counts. The slide bank shall be prepared using uniformly distributed samples taken from the workload. Fiber densities should cover the entire range routinely analyzed by the laboratory. These slides are counted blind by all counters to establish an original standard deviation. This historical distribution is compared with the quality assurance counts. A counter must have 95% of all quality control samples counted within three standard deviations of the historical mean. This count is then integrated into a new historical mean and standard deviation for the slide. The analyses done by the counters to establish the slide bank may be used for an interim quality control program if the data are treated in a proper statistical fashion.

7. Calculations.

(a) Calculate the estimated airborne asbestos fiber concentration on the filter sample using the following formula:

$$AC = \frac{\left[\left(\frac{FB}{FL} \right) - \left(\frac{BFB}{BFL} \right) \right] \times ECA}{1000 \times FR \times T \times MFA}$$

Where:

AC	=	Airborne fiber concentration
FB	=	Total number of fibers greater than 5 μm counted
FL	=	Total number of fields counted on the filter
BFB	=	Total number of fibers greater than 5 μm counted in the blank
BFL	=	Total number of fields counted on the blank
ECA	=	Effective collecting area of filter (385 mm ² nominal for a 25-mm filter.)
FR	=	Pump flow rate (L/min)
MFA	=	Microscope count field area (mm ²). This is 0.00785 mm ² for a Walton-Beckett Graticule.
T	=	Sample collection time (min)
1,000	=	Conversion of L to cc

Note: The collection area of a filter is seldom equal to 385 mm². It is appropriate for laboratories to routinely monitor the exact diameter using an inside micrometer. The collection area is calculated according to the formula: Area = π(d/2)²

(b) Short-cut Calculation

Since a given analyst always has the same interpupillary distance, the number of fields per filter for a particular analyst will remain constant for a given size filter. The field size for that analyst is constant (i.e. the analyst is using an assigned microscope and is not changing the reticle). For example, if the exposed area of the filter is always 385 mm² and the size of the field is always 0.00785 mm², the number of fields per filter will always be 49,000. In addition it is necessary to convert liters of air to cc. These three constants can then be combined such that ECA/(1,000 X MFA)= 49. The previous equation simplifies to:

$$AC = \frac{\left(\frac{FB}{FL} \right) - \left(\frac{BFB}{BFL} \right) \times 49}{FR \times T}$$

(c) Recount Calculations. As mentioned in step 13 of 6 (f)(ii), a "blind recount" of 10% of the slides is performed. In all cases, differences will be observed between the first and second counts of the same filter wedge. Most of these differences will be due to chance alone, that is, due to the random variability (precision) of the count method. Statistical recount criteria enables one to decide whether observed differences can be explained due to chance alone or are probably due to systematic differences between analysts, microscopes, or other biasing factors. The following recount criterion is for a pair of counts that estimate AC in fibers/cc. The criterion is given at the type-I error level. That is, there is 5% maximum risk that we will reject a pair of counts for the reason that one

might be biased, when the large observed difference is really due to chance. Reject a pair of counts if:

$$\left| \sqrt{AC_2} - \sqrt{AC_1} \right| > 2.78 \times \left(\sqrt{AC_{avg}} \right) \times CV_{FB}$$

Where:

AC ₁	=	lower estimated airborne fiber concentration
AC ₂	=	higher estimated airborne fiber concentration
AC _{avg}	=	average of the two concentration estimates
CV _{FB}	=	CV for the average of the two concentration estimates

If a pair of counts are rejected by this criterion then, recount the rest of the filters in the submitted set. Apply the test and reject any other pairs failing the test. Rejection shall include a memo to the industrial hygienist stating that the sample failed a statistical test for homogeneity and the true air concentration may be significantly different than the reported value.

(d) Reporting Results. Report results to the industrial hygienist as fibers/cc. Use two significant figures. If multiple analyses are performed on a sample, an average of the results is to be reported unless any of the results can be rejected for cause.

8. References.

(a) Dreesen, W.C., et al, U.S. Public Health Service: A Study of Asbestosis in the Asbestos Textile Industry, (Public Health Bulletin No. 241), US Treasury Dept., Washington, DC, 1938.

(b) Asbestos Research Council: The Measurement of Airborne Asbestos Dust by the Membrane Filter Method (Technical Note), Asbestos Research Council, Rockdale, Lancashire, Great Britain, 1969.

(c) Bayer, S.G., Zumwalde, R.D., Brown, T.A., Equipment and Procedure for Mounting Millipore Filters and Counting Asbestos Fibers by Phase Contrast Microscopy, Bureau of Occupational Health, U.S. Dept. of Health, Education and Welfare, Cincinnati, OH, 1969.

(d) NIOSH Manual of Analytical Methods, 2nd ed., Vol. 1 (DHEW/NIOSH Pub. No. 77-157-A). National Institute for Occupational Safety and Health, Cincinnati, OH, 1977, pp.239-1-239-21.

(e) Asbestos, Code of Federal Regulations 29 CFR 1910.1001. 1971.

(f) Occupational Exposure to Asbestos, Tremolite, Anthophyllite, and Actinolite. Final Rule, Federal Register 51: 119 (20 June 1986). pp.22612-22790.

(g) Asbestos, Tremolite, Anthophyllite, and Actinolite, Code of Federal Regulations 1910.1001. 1988. pp 711-752.

(h) Criteria for a Recommended Standard—Occupational Exposure to Asbestos (DHEW/NIOSH Pub. No. HSM 72-10267), National Institute for Occupational Safety and Health NIOSH, Cincinnati, OH, 1972. pp. III-1-III-24.

(i) Leidel, N.A., Bayer, S.G., Zumwalde, R.D., Busch, K.A., USPHS/NIOSH Membrane Filter Method for Evaluating Airborne Asbestos Fibers (DHEW/NIOSH Pub. No. 79-127). National Institute for Occupational Safety and Health, Cincinnati, OH, 1979.

(j) Dixon, W.C., Applications of Optical Microscopy in Analysis of Asbestos and Quartz, Analytical Techniques in Occupational Health Chemistry, edited by D.D. Dollberg and A.W. Verstuyft. Wash. D.C.: American Chemical Society, (ACS Symposium Series 120) 1980. pp. 13-41.

9. Quality Control. The OSHA asbestos regulations require each laboratory to establish a quality control program. The following is presented as an example of how the OSHA-SLTC constructed its internal CV curve as part of meeting this requirement. Data for the CV curve shown below is from 395 samples collected during OSHA compliance inspections and analyzed from October 1980 through April 1986. Each sample was counted by 2 to 5 different counters independently of one another. The standard deviation and the CV statistic was calculated for each sample. This data was then plotted on a graph of CV vs. fibers/mm². A least squares regression was performed using the following equation:

$$CV = \text{antilog}_{10}[A(\log_{10}(x))^2 + B(\log_{10}(x)) + C]$$

Where:

x = the number of fibers/mm²

Application of least squares gave:

$$A = 0.182205$$

$$B = -0.973343$$

$$C = 0.327499$$

Using these values, the equation becomes:

$$CV = \text{antilog}_{10}[0.182205(\log_{10}(x))^2 - 0.973343(\log_{10}(x)) + 0.327499].$$

10. Sampling Pump Flow Rate Corrections. This correction is used if a difference greater than 5% in ambient temperature and/or pressure is noted between calibration and sampling sites and the pump does not compensate for the differences.

$$Q_{\text{act}} = Q_{\text{cal}} \times \sqrt{\frac{P_{\text{cal}}}{P_{\text{act}}}} \times \left(\frac{T_{\text{act}}}{T_{\text{cal}}}\right)$$

Where:

Q_{act} = actual flow rate

Q_{cal} = calibrated flow rate (if a rotameter was used, the rotameter value)

P_{cal} = uncorrected air pressure at calibration

P_{act} = uncorrected air pressure at sampling site

T_{act} = temperature at sampling site (K)

T_{cal} = temperature at calibration (K)

11. Walton-Beckett Graticule

When ordering the Graticule for asbestos counting, specify the exact disc diameter needed to fit the ocular of the microscope and the diameter (mm) of the circular counting area. Instructions for measuring the dimensions necessary are listed:

(a) Insert any available graticule into the focusing eyepiece and focus so that the graticule lines are sharp and clear.

(b) Align the microscope.

(c) Place a stage micrometer on the microscope object stage and focus the microscope on the graduated lines.

(d) Measure the magnified grid length, PL (μm), using the stage micrometer.

(e) Remove the graticule from the microscope and measure its actual grid length, AL (mm). This can be accomplished by using a mechanical stage fitted with verniers, or a jeweler's loupe with a direct reading scale.

(f) Let $D = 100 \mu\text{m}$. Calculate the circle diameter, d_c (mm), for the Walton-Beckett graticule and specify the diameter when making a purchase:

$$d_c = \frac{AL \times D}{PL}$$

Example: If $PL = 108 \mu\text{m}$, $AL = 2.93 \text{ mm}$ and $D = 100 \mu\text{m}$, then,

$$d_c = (2.93 \times 100)/108 = 2.71 \text{ mm}$$

(g) Each eyepiece-objective-reticle combination on the microscope must be calibrated. Should any of the three be changed (by zoom adjustment, disassembly, replacement, etc.), the combination must be recalibrated. Calibration may change if interpupillary distance is changed. Measure the field diameter, D (acceptable range: $100 \pm 2 \mu\text{m}$) with a stage micrometer upon receipt of the graticule from the manufacturer. Determine the field area (mm^2).

$$\text{Field Area} = \pi(D/2)^2$$

If $D = 100 \mu\text{m} = 0.1 \text{ mm}$, then

$$\text{Field Area} = \pi(0.1 \text{ mm}/2)^2 = 0.00785 \text{ mm}^2$$

The Graticule is available from: Graticules Ltd., Morley Road, Tonbridge TN9 1RN, Kent, England (Telephone 011-44-732-359061). Also available from PTR Optics Ltd., 145 Newton Street, Waltham, MA 02154 [telephone (617) 891-6000] or McCrone Accessories and Components, 2506 S. Michigan Ave., Chicago, IL 60616 [phone (312) 842-7100]. The graticule is custom made for each microscope.

BILLING CODE 4510-26-P

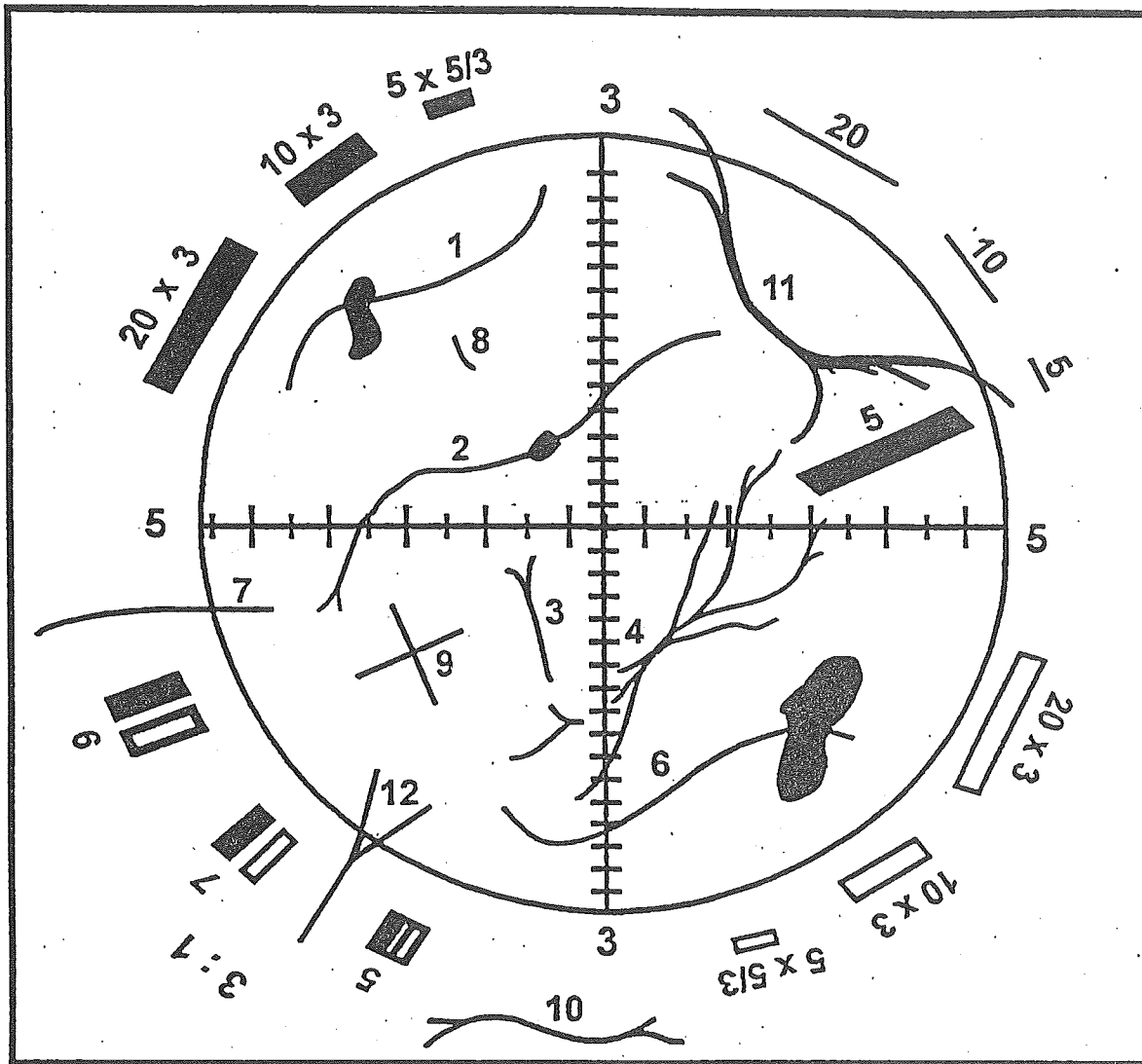


Figure 1: Walton-Beckett Graticule with some explanatory fibers.

Counts for the Fibers in the Figure

Structure No.	Count	Explanation
1 to 6	1	Single fibers all contained within the circle.
7	1/2	Fiber crosses circle once.
8	0	Fiber too short.
9	2	Two crossing fibers.
10	0	Fiber outside graticule.
11	0	Fiber crosses graticule twice.
12	1/2	Although split, fiber only crosses once.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060, 97-01-079, § 296-62-07737, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07737, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07737, filed 4/27/87.]

Reviser's note: The brackets and enclosed material in the text of the above section occurred in the copy filed by the agency.

WAC 296-62-07739 Appendix C—Qualitative and quantitative fit testing procedures—Mandatory. (1) Qualitative fit test protocols.

(a) Isoamyl acetate protocol.

(i) Odor threshold screening:

(A) Three one-liter glass jars with metal lids (e.g., Mason or Ball jars) are required.

(B) Odor free water (e.g., distilled or spring water) at approximately 25°C shall be used for the solutions.

(C) The isoamyl acetate (IAA) (also known as isopentyl acetate) stock solution is prepared by adding one cc of pure IAA to eight hundred cc of odor free water in a one-liter jar and shaking for thirty seconds. This solution shall be prepared new at least weekly.

(D) The screening test shall be conducted in a room separate from the room used for actual fit testing. The two rooms shall be well ventilated but shall not be connected to the same recirculating ventilation system.

(E) The odor test solution is prepared in a second jar by placing 0.4 cc of the stock solution into five hundred cc of odor free water using a clean dropper or pipette. Shake for thirty seconds and allow to stand for two to three minutes so that the IAA concentration above the liquid may reach equilibrium. This solution may be used for only one day.

(F) A test blank is prepared in a third jar by adding five hundred cc of odor free water.

(G) The odor test and test blank jars shall be labelled one and two for jar identification. If the labels are put on the lids they can be periodically peeled, dried off and switched to maintain the integrity of the test.

(H) The following instructions shall be typed on a card and placed on the table in front of the two test jars (i.e., one and two): "The purpose of this test is to determine if you can smell banana oil at a low concentration. The two bottles in front of you contain water. One of these bottles also contains a small amount of banana oil. Be sure the covers are on tight, then shake each bottle for two seconds. Unscrew the lid of each bottle, one at a time, and sniff at the mouth of the bottle. Indicate to the test conductor which bottle contains banana oil."

(I) The mixtures used in the IAA odor detection test shall be prepared in an area separate from where the test is performed, in order to prevent olfactory fatigue in the subject.

(J) If the test subject is unable to correctly identify the jar containing the odor test solution, the IAA qualitative fit test may not be used.

(K) If the test subject correctly identifies the jar containing the odor test solution, the test subject may proceed to respirator selection and fit testing.

(ii) Respirator selection.

(A) The test subject shall be allowed to pick the most comfortable respirator from a selection including respirators of various sizes from different manufacturers. The selection shall include at least five sizes of elastomeric half facepieces, from at least two manufacturers.

(B) The selection process shall be conducted in a room separate from the fit-test chamber to prevent odor fatigue. Prior to the selection process, the test subject shall be shown how to put on a respirator, how it should be positioned on the face, how to set strap tension and how to determine a "com-

fortable" respirator. A mirror shall be available to assist the subject in evaluating the fit and positioning of the respirator. This instruction may not constitute the subject's formal training on respirator use, as it is only a review.

(C) The test subject should understand that the employee is being asked to select the respirator which provides the most comfortable fit. Each respirator represents a different size and shape and, if fit properly and used properly will provide adequate protection.

(D) The test subject holds each facepiece up to the face and eliminates those which obviously do not give a comfortable fit. Normally, selection will begin with a half-mask and if a good fit cannot be found, the subject will be asked to test the full facepiece respirators. (A small percentage of users will not be able to wear any half-mask.)

(E) The more comfortable facepieces are noted; the most comfortable mask is donned and worn at least five minutes to assess comfort. All donning and adjustments of the facepiece shall be performed by the test subject without assistance from the test conductor or other person. Assistance in assessing comfort can be given by discussing the points in (a)(ii)(F) of this subsection. If the test subject is not familiar with using a particular respirator, the test subject shall be directed to don the mask several times and to adjust the straps each time to become adept at setting proper tension on the straps.

(F) Assessment of comfort shall include reviewing the following points with the test subject and allowing the test subject adequate time to determine the comfort of the respirator:

(I) Positioning of mask on nose.

(II) Room for eye protection.

(III) Room to talk.

(IV) Positioning mask on face and cheeks.

(G) The following criteria shall be used to help determine the adequacy of the respirator fit:

(I) Chin properly placed.

(II) Strap tension.

(III) Fit across nose bridge.

(IV) Distance from nose to chin.

(V) Tendency to slip.

(VI) Self-observation in mirror.

(H) The test subject shall conduct the conventional negative and positive-pressure fit checks before conducting the negative- or positive-pressure test the subject shall be told to "seat" the mask by rapidly moving the head from side-to-side and up and down, while taking a few deep breaths.

(I) The test subject is now ready for fit testing.

(J) After passing the fit test, the test subject shall be questioned again regarding the comfort of the respirator. If it has become uncomfortable, another model of respirator shall be tried.

(K) The employee shall be given the opportunity to select a different facepiece and be retested if the chosen facepiece becomes increasingly uncomfortable at any time.

(iii) Fit test.

(A) The fit test chamber shall be similar to a clear fifty-five gallon drum liner suspended inverted over a two-foot diameter frame, so that the top of the chamber is about six inches above the test subject's head. The inside top center of the chamber shall have a small hook attached.

(B) Each respirator used for the fitting and fit testing shall be equipped with organic vapor cartridges or offer protection against organic vapors. The cartridges or masks shall be changed at least weekly.

(C) After selecting, donning, and properly adjusting a respirator, the test subject shall wear it to the fit testing room. This room shall be separate from the room used for odor threshold screening and respirator selection, and shall be well ventilated, as by an exhaust fan or lab hood, to prevent general room contamination.

(D) A copy of the following test exercises and "rainbow passage" shall be taped to the inside of the test chamber:

Test exercises.

(I) Breathe normally.

(II) Breathe deeply. Be certain breaths are deep and regular.

(III) Turn head all the way from one side to the other. Inhale on each side. Be certain movement is complete. Do not bump the respirator against the shoulders.

(IV) Nod head up and down. Inhale when head is in the full up position (looking toward ceiling). Be certain motions are complete and made about every second. Do not bump the respirator on the chest.

(V) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the "rainbow passage." Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

(VI) Jogging in place.

(VII) Breathe normally.

"Rainbow Passage."

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(E) Each test subject shall wear the respirator for at least ten minutes before starting the fit test.

(F) Upon entering the test chamber, the test subject shall be given a six-inch by five-inch piece of paper towel or other porous absorbent single ply material, folded in half and wetted with three-quarters of one cc of pure IAA. The test subject shall hang the wet towel on the hook at the top of the chamber.

(G) Allow two minutes for the IAA test concentration to be reached before starting the fit-test exercises. This would be an appropriate time to talk with the test subject, to explain the fit test, the importance of cooperation, the purpose for the head exercises, or to demonstrate some of the exercises.

(H) Each exercise described in (D) of this subsection shall be performed for at least one minute.

(I) If at any time during the test, the subject detects the banana-like odor of IAA, the test has failed. The subject shall quickly exit from the test chamber and leave the test area to avoid olfactory fatigue.

(J) If the test is failed, the subject shall return to the selection room and remove the respirator, repeat the odor sensitivity test, select and put on another respirator, return to the test chamber, and again begin the procedure described in (b)(iii)(D) through (H) of this subsection. The process continues until a respirator that fits well has been found. Should the odor sensitivity test be failed, the subject shall wait about five minutes before retesting. Odor sensitivity will usually have returned by this time.

(K) If a person cannot pass the fit test described above wearing a half-mask respirator from the available selection, full facepiece models must be used.

(L) When a respirator is found that passes the test, the subject breaks the face seal and takes a breath before exiting the chamber. This is to assure that the reason the test subject is not smelling the IAA is the good fit of the respirator facepiece seal and not olfactory fatigue.

(M) When the test subject leaves the chamber, the subject shall remove the saturated towel and return it to the person conducting the test. To keep the area from becoming contaminated, the used towels shall be kept in a self-sealing bag so there is no significant IAA concentration buildup in the test chamber during subsequent tests.

(N) At least two facepieces shall be selected for the IAA test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

(O) Persons who have successfully passed this fit test with a half-mask respirator may be assigned the use of the test respirator in atmospheres with up to 2 f/cc of airborne asbestos.

(P) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(Q) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied-air respirator, or self-contained breathing apparatus.

(R) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(S) Qualitative fit testing shall be repeated at least every six months.

(T) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(I) Weight change of twenty pounds or more,

(II) Significant facial scarring in the area of the facepiece seal,

(III) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures,

(IV) Reconstructive or cosmetic surgery, or

(V) Any other condition that may interfere with facepiece sealing.

(iv) Recordkeeping.

A summary of all test results shall be maintained in each office for three years. The summary shall include:

- (A) Name of test subject.
- (B) Date of testing.
- (C) Name of the test conductor.
- (D) Respirators selected (indicate manufacturer, model, size and approval number).
- (E) Testing agent.
- (b) Saccharin solution aerosol protocol.
 - (i) Respirator selection. Respirators shall be selected as described in (a)(ii) of this subsection (respirator selection), except that each respirator shall be equipped with a particulate filter.
 - (ii) Taste threshold screening.
 - (A) An enclosure about head and shoulders shall be used for threshold screening (to determine if the individual can taste saccharin) and for fit testing. The enclosure shall be approximately twelve inches in diameter by fourteen inches tall with at least the front clear to allow free movement of the head when a respirator is worn.
 - (B) The test enclosure shall have a three-quarter inch hole in front of the test subject's nose and mouth area to accommodate the nebulizer nozzle.
 - (C) The entire screening and testing procedure shall be explained to the test subject prior to conducting the screening test.
 - (D) During the threshold screening test, the test subject shall don the test enclosure and breathe with open mouth with tongue extended.
 - (E) Using a DeVilbiss Model 40 Inhalation Medication Nebulizer or equivalent, the test conductor shall spray the threshold check solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the fit test solution nebulizer.
 - (F) The threshold check solution consists of 0.83 grams of sodium saccharin USP in 100 cc of warm water. It can be prepared by putting 1 cc of the test solution (see (b)(iii)(G) of this subsection) in one hundred cc of water.
 - (G) To produce the aerosol, the nebulizer bulb is firmly squeezed so that it collapses completely, then is released and allowed to fully expand.
 - (H) Ten squeezes of the nebulizer bulb are repeated rapidly and then the test subject is asked whether the saccharin can be tasted.
 - (I) If the first response is negative, ten more squeezes of the nebulizer bulb are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.
 - (J) If the second response is negative, ten more squeezes are repeated rapidly and the test subject is again asked whether the saccharin can be tasted.
 - (K) The test conductor will take note of the number of squeezes required to elicit a taste response.
 - (L) If the saccharin is not tasted after thirty squeezes ((b)(ii)(J) of this subsection), the saccharin fit test cannot be performed on the test subject.
 - (M) If a taste response is elicited, the test subject shall be asked to take note of the taste for reference in the fit test.
 - (N) Correct use of the nebulizer means that approximately 1 cc of liquid is used at a time in the nebulizer body.
 - (O) The nebulizer shall be thoroughly rinsed in water, shaken dry, and refilled at least every four hours.
- (iii) Fit test.

- (A) The test subject shall don and adjust the respirator without the assistance from any person.
 - (B) The fit test uses the same enclosure described in (b)(ii) of this subsection.
 - (C) Each test subject shall wear the respirator for at least ten minutes before starting the fit test.
 - (D) The test subject shall don the enclosure while wearing the respirator selected in (a)(ii) of this subsection. This respirator shall be properly adjusted and equipped with a particulate filter.
 - (E) The test subject may not eat, drink, (except plain water), or chew gum for fifteen minutes before the test.
 - (F) A second DeVilbiss Model 40 Inhalation Medication Nebulizer is used to spray the fit test solution into the enclosure. This nebulizer shall be clearly marked to distinguish it from the screening test solution nebulizer.
 - (G) The fit test solution is prepared by adding eighty-three grams of sodium saccharin to one hundred cc of warm water.
 - (H) As before, the test subject shall breathe with mouth open and tongue extended.
 - (I) The nebulizer is inserted into the hole in the front of the enclosure and the fit test solution is sprayed into the enclosure using the same technique as for the taste threshold screening and the same number of squeezes required to elicit a taste response in the screening. (See (b)(ii)(H) through (J) of this subsection.)
 - (J) After generation of the aerosol read the following instructions to the test subject. The test subject shall perform the exercises for one minute each.
 - (I) Breathe normally.
 - (II) Breathe deeply. Be certain breaths are deep and regular.
 - (III) Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.
 - (IV) Nod head up and down. Be certain motions are complete. Inhale when head is in the full up position (when looking toward the ceiling). Do not bump the respirator on the chest.
 - (V) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the "rainbow passage." Reading it will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.
 - (VI) Jogging in place.
 - (VII) Breathe normally.
- "Rainbow Passage."
- When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.
- (K) At the beginning of each exercise, the aerosol concentration shall be replenished using one-half the number of squeezes as initially described in (b)(iii)(I) of this subsection.

(L) The test subject shall indicate to the test conductor if at any time during the fit test the taste of saccharin is detected.

(M) If the saccharin is detected the fit is deemed unsatisfactory and a different respirator shall be tried.

(N) At least two facepieces shall be selected by the saccharin test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

(O) Successful completion of the test protocol shall allow the use of the half mask tested respirator in contaminated atmospheres up to 2 f/cc of asbestos. In other words this protocol may be used to assign protection factors no higher than ten.

(P) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(Q) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied-air respirator, or self-contained breathing apparatus.

(R) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(S) Qualitative fit testing shall be repeated at least every six months.

(T) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(I) Weight change of twenty pounds or more,

(II) Significant facial scarring in the area of the facepiece seal,

(III) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures,

(IV) Reconstructive or cosmetic surgery, or

(V) Any other condition that may interfere with facepiece sealing.

(iv) Recordkeeping.

A summary of all test results shall be maintained in each office for three years. The summary shall include:

(A) Name of test subject.

(B) Date of testing.

(C) Name of test conductor.

(D) Respirators selected (indicate manufacturer, model, size and approval number).

(E) Testing agent.

(c) Irritant fume protocol.

(i) Respirator selection.

Respirators shall be selected as described in (a)(ii) of this subsection, except that each respirator shall be equipped with a high-efficiency cartridge.

(ii) Fit test.

(A) The test subject shall be allowed to smell a weak concentration of the irritant smoke to familiarize the subject with the characteristic odor.

(B) The test subject shall properly don the respirator selected as above, and wear it for at least ten minutes before starting the fit test.

(C) The test conductor shall review this protocol with the test subject before testing.

(D) The test subject shall perform the conventional positive pressure and negative pressure fit checks (see ANSI Z88.2 1980). Failure of either check shall be cause to select an alternate respirator.

(E) Break both ends of a ventilation smoke tube containing stannic oxychloride, such as the MSA part #5645, or equivalent. Attach a short length of tubing to one end of the smoke tube. Attach the other end of the smoke tube to a low pressure air pump set to deliver two hundred milliliters per minute.

(F) Advise the test subject that the smoke can be irritating to the eyes and instruct the subject to keep the eyes closed while the test is performed.

(G) The test conductor shall direct the stream of irritant smoke from the tube towards the facepiece area of the test subject. The person conducting the test shall begin with the tube at least twelve inches from the facepiece and gradually move to within one inch, moving around the whole perimeter of the mask.

(H) The test subject shall be instructed to do the following exercises while the respirator is being challenged by the smoke. Each exercise shall be performed for one minute.

(I) Breathe normally.

(II) Breathe deeply. Be certain breaths are deep and regular.

(III) Turn head all the way from one side to the other. Be certain movement is complete. Inhale on each side. Do not bump the respirator against the shoulders.

(IV) Nod head up and down. Be certain motions are complete and made every second. Inhale when head is in the full up position (looking toward ceiling). Do not bump the respirator against the chest.

(V) Talking. Talk aloud and slowly for several minutes. The following paragraph is called the "rainbow passage." Repeating it after the test conductor (keeping eyes closed) will result in a wide range of facial movements, and thus be useful to satisfy this requirement. Alternative passages which serve the same purpose may also be used.

"Rainbow Passage."

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond his reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(VI) Jogging in place.

(VII) Breathe normally.

(I) The test subject shall indicate to the test conductor if the irritant smoke is detected. If smoke is detected, the test conductor shall stop the test. In this case, the tested respirator is rejected and another respirator shall be selected.

(J) Each test subject passing the smoke test (i.e., without detecting the smoke) shall be given a sensitivity check of smoke from the same tube to determine if the test subject reacts to the smoke. Failure to evoke a response shall void the fit test.

(K) This fit test protocol, (c)(ii)(D), (I), and (J) of this subsection, shall be performed in a location with exhaust ventilation sufficient to prevent general contamination of the testing area by the test agents.

(L) At least two facepieces shall be selected by the irritant fume test protocol. The test subject shall be given the opportunity to wear them for one week to choose the one which is more comfortable to wear.

(M) Respirators successfully tested by the protocol may be used in contaminated atmospheres up to 2 f/cc of asbestos.

(N) The test shall not be conducted if there is any hair growth between the skin and the facepiece sealing surface.

(O) If hair growth or apparel interfere with a satisfactory fit, then they shall be altered or removed so as to eliminate interference and allow a satisfactory fit. If a satisfactory fit is still not attained, the test subject must use a positive-pressure respirator such as powered air-purifying respirators, supplied-air respirator, or self-contained breathing apparatus.

(P) If a test subject exhibits difficulty in breathing during the tests, she or he shall be referred to a physician trained in respirator diseases or pulmonary medicine to determine whether the test subject can wear a respirator while performing her or his duties.

(Q) Qualitative fit testing shall be repeated at least every six months.

(R) In addition, because the sealing of the respirator may be affected, qualitative fit testing shall be repeated immediately when the test subject has a:

(I) Weight change of twenty pounds or more,

(II) Significant facial scarring in the area of the facepiece seal,

(III) Significant dental changes; i.e., multiple extractions without prosthesis, or acquiring dentures,

(IV) Reconstructive or cosmetic surgery, or

(V) Any other condition that may interfere with facepiece sealing.

(iii) Recordkeeping.

A summary of all test results shall be maintained in each office for three years. The summary shall include:

(A) Name of test subject.

(B) Date of testing.

(C) Name of test conductor.

(D) Respirators selected (indicate manufacturer, model, size and approval number).

(E) Testing agent.

(2) Quantitative fit test procedures.

(a) General.

(i) The method applies to the negative-pressure nonpowered air-purifying respirators only.

(ii) The employer shall assign one individual who shall assume the full responsibility for implementing the respirator quantitative fit test program.

(b) Definition.

(i) "Quantitative fit test" means the measurement of the effectiveness of a respirator seal in excluding the ambient

atmosphere. The test is performed by dividing the measured concentration of challenge agent in a test chamber by the measured concentration of the challenge agent inside the respirator facepiece when the normal air-purifying element has been replaced by an essentially perfect purifying element.

(ii) "Challenge agent" means the air contaminant introduced into a test chamber so that its concentration inside and outside the respirator may be compared.

(iii) "Test subject" means the person wearing the respirator for quantitative fit testing.

(iv) "Normal standing position" means standing erect and straight with arms down along the sides and looking straight ahead.

(v) "Fit factor" means the ratio of challenge agent concentration outside with respect to the inside of a respirator inlet covering (facepiece or enclosure).

(c) Apparatus.

(i) Instrumentation. Corn oil, sodium chloride or other appropriate aerosol generation, dilution, and measurement systems shall be used for quantitative fit test.

(ii) Test chamber. The test chamber shall be large enough to permit all test subjects to freely perform all required exercises without distributing the challenge agent concentration or the measurement apparatus. The test chamber shall be equipped and constructed so that the challenge agent is effectively isolated from the ambient air yet uniform in concentration throughout the chamber.

(iii) When testing air-purifying respirators, the respirator shall be equipped with a cartridge or canister approved for removal of the test agent, or with a high efficiency particulate filter. Only approved assemblies shall be tested.

(iv) The sampling instrument shall be selected so that a strip chart record may be made of the test showing the rise and fall of challenge agent concentration with each inspiration and expiration at fit factors of at least two thousand.

(v) The combination of substitute air-purifying elements (if any), challenge agent, and challenge agent concentration in the test chamber shall be such that the test subject is not exposed in excess of PEL to the challenge agent at any time during the testing process.

(vi) The sampling port on the test specimen respirator shall be placed and constructed so that there is no detectable leak around the port, a free air flow is allowed into the sampling line at all times and so there is no interference with the fit or performance of the respirator.

(vii) The test chamber and test set-up shall permit the person administering the test to observe one test subject inside the chamber during the test.

(viii) The equipment generating the challenge atmosphere shall maintain the concentration of challenge agent constant within a ten percent variation for the duration of the test.

(ix) The time lag (interval between an event and its being recorded on the strip chart) of the instrumentation may not exceed two seconds.

(x) The tubing for the test chamber atmosphere and for the respirator sampling port shall be the same diameter, length and material. It shall be kept as short as possible. The smallest diameter tubing recommended by the manufacturer shall be used.

(xi) The exhaust flow from the test chamber shall pass through a high-efficiency filter before release to the room.

(xii) When sodium chloride aerosol is used, the relative humidity inside the test chamber shall not exceed fifty percent.

(d) Procedural requirements.

(i) The fitting of half-mask respirators should be started with those having multiple sizes and a variety of interchangeable cartridges and canisters such as the MSA Comfo II-M, North M, Survivair M, A-O M, or Scott-M. Use either of the tests outlined below to assure that the facepiece is properly adjusted.

(A) Positive pressure test. With the exhaust port(s) blocked, the negative pressure of slight inhalation should remain constant for several seconds.

(B) Negative pressure test. With the intake port(s) blocked, the negative pressure slight inhalation should remain constant for several seconds.

(ii) After a facepiece is adjusted, the test subject shall wear the facepiece for at least five minutes before conducting a qualitative test by using either of the methods described below and using the exercise regime described in (e)(i) through (v) of this subsection.

(A) Isoamyl acetate test. When using organic vapor cartridges, the test subject who can smell the odor should be unable to detect the odor of isoamyl acetate squirted into the air near the most vulnerable portions of the facepiece seal. In a location which is separated from the test area, the test subject shall be instructed to close her/his eyes during the test period. A combination cartridge or canister with organic vapor and high-efficiency filters shall be used when available for the particular mask being tested. The test subject shall be given an opportunity to smell the odor of isoamyl acetate before the test is conducted.

(B) Irritant fume test. When using high-efficiency filters, the test subject should be unable to detect the odor of irritant fume (stannic chloride or titanium tetrachloride ventilation smoke tubes) squirted into the air near the most vulnerable portions of the facepiece seal. The test subject shall be instructed to close her/his eyes during the test period.

(iii) The test subject may enter the quantitative testing chamber only if she or he has obtained a satisfactory fit as stated in (d)(ii) of this subsection.

(iv) Before the subject enters the test chamber, a reasonably stable challenge agent concentration shall be measured in the test chamber.

(v) Immediately after the subject enters the test chamber, the challenge agent concentration inside the respirator shall be measured to ensure that the peak penetration does not exceed five percent for a half-mask and one percent for a full facepiece.

(vi) A stable challenge agent concentration shall be obtained prior to the actual start of testing.

(A) Respirator restraining straps may not be overtightened for testing. The straps shall be adjusted by the wearer to give a reasonably comfortable fit typical of normal use.

(e) Exercise regime. Prior to entering the test chamber, the test subject shall be given complete instructions as to her/his part in the test procedures. The test subject shall per-

form the following exercises, in the order given, for each independent test.

(i) Normal breathing (NB). In the normal standing position, without talking, the subject shall breathe normally for at least one minute.

(ii) Deep breathing (DB). In the normal standing position the subject shall do deep breathing for at least one minute pausing so as not to hyperventilate.

(iii) Turning head side to side (SS). Standing in place the subject shall slowly turn his/her head from side between the extreme positions to each side. The head shall be held at each extreme position for at least five seconds. Perform for at least three complete cycles.

(iv) Moving head up and down (UD). Standing in place, the subject shall slowly move his/her head up and down between the extreme position straight up and the extreme position straight down. The head shall be held at each extreme position for at least five seconds. Perform for at least three complete cycles.

(v) Reading (R). The test subject (keeping eyes closed) shall repeat after the test conductor the "rainbow passage" at the end of this section. The subject shall talk slowly and aloud so as to be heard clearly by the test conductor or monitor. The test subject shall read the "rainbow passage" at the end of this section.

(vi) Grimace (G). The test subject shall grimace, smile, frown, and generally contort the face using the facial muscles. Continue for at least fifteen seconds.

(vii) Bend over and touch toes (B). The test subject shall bend at the waist and touch toes and return to upright position. Repeat for at least thirty seconds.

(viii) Jogging in place (J). The test subject shall perform jog in place for at least thirty seconds.

(ix) Normal breathing (NB). Same as exercise (e)(i) of this subsection.

"Rainbow Passage."

When the sunlight strikes raindrops in the air, they act like a prism and form a rainbow. The rainbow is a division of white light into many beautiful colors. These take the shape of a long round arch, with its path high above, and its two ends apparently beyond the horizon. There is, according to legend, a boiling pot of gold at one end. People look, but no one ever finds it. When a man looks for something beyond reach, his friends say he is looking for the pot of gold at the end of the rainbow.

(f) The test shall be terminated whenever any single peak penetration exceeds five percent for half-masks and one percent for full facepieces. The test subject may be refitted and retested. If two of the three required tests are terminated, the fit shall be deemed inadequate.

(g) Calculation of fit factors.

(i) The fit factor is determined by dividing the average challenge agent concentration in the test chamber by the average challenge agent concentration inside the respirator facepiece for the test exercise.

(ii) The average test chamber concentration is the arithmetic average of the test chamber concentration at the beginning and at the end of the test.

(iii) The average peak concentration of the challenge agent inside the respirator shall be the arithmetic average

- Was exposure: 1. Mild... 2. Moderate... 3. Severe...
- D. What has been your usual occupation or job—the one you have worked at the longest?
1. Job occupation
 2. Number of years employed in this occupation
 3. Position/job title
 4. Business, field or industry

(Record on lines the years in which you have worked in any of these industries, e.g., 1960-1969.)

Have you ever worked:

- | | | |
|------------------------------------|--------------------------|--------------------------|
| | YES | NO |
| E. In a mine? | <input type="checkbox"/> | <input type="checkbox"/> |
| F. In a quarry? | <input type="checkbox"/> | <input type="checkbox"/> |
| G. In a foundry? | <input type="checkbox"/> | <input type="checkbox"/> |
| H. In a pottery? | <input type="checkbox"/> | <input type="checkbox"/> |
| I. In a cotton, flax or hemp mill? | <input type="checkbox"/> | <input type="checkbox"/> |
| J. With asbestos? | <input type="checkbox"/> | <input type="checkbox"/> |

18. PAST MEDICAL HISTORY

- | | | |
|---|--------------------------|--------------------------|
| | YES | NO |
| A. Do you consider yourself to be in good health? | <input type="checkbox"/> | <input type="checkbox"/> |
| If "NO" state reason | | |
| B. Have you any defect in vision? | <input type="checkbox"/> | <input type="checkbox"/> |
| If "YES" state nature of defect | | |
| C. Have you any hearing defect? | <input type="checkbox"/> | <input type="checkbox"/> |
| If "YES" state nature of defect | | |
| D. Are you suffering from or have you ever suffered from: | | |
| a. Epilepsy (or fits, seizures, convulsions)? | <input type="checkbox"/> | <input type="checkbox"/> |
| b. Rheumatic fever? | <input type="checkbox"/> | <input type="checkbox"/> |
| c. Kidney disease? | <input type="checkbox"/> | <input type="checkbox"/> |
| d. Bladder disease? | <input type="checkbox"/> | <input type="checkbox"/> |
| e. Diabetes? | <input type="checkbox"/> | <input type="checkbox"/> |
| f. Jaundice | <input type="checkbox"/> | <input type="checkbox"/> |

19. CHEST COLDS AND CHEST ILLNESSES

- 19A. If you get a cold, does it usually go to your chest? (Usually means more than 1/2 the time.) 1. Yes... 2. No... 3. Don't get colds...
- 20A. During the past 3 years, have you had any chest illnesses that have kept you off work, indoors at home, or in bed? 1. Yes... 2. No...
- IF YES TO 20A:
- B. Did you produce phlegm with any of these chest illnesses? 1. Yes... 2. No... 3. Does not apply...
- C. In the last 3 years, how many such illnesses with (increased) phlegm did you have which lasted a week or more? Number of illnesses... No such illnesses...
21. Did you have any lung trouble before the age of 16? 1. Yes... 2. No...
22. Have you ever had any of the following?
- 1A. Attacks of bronchitis? 1. Yes... 2. No...
- IF YES TO 1A:
- B. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- C. At what age was your first attack? Age in years... Does not apply...
- 2A. Pneumonia? (include broncho-pneumonia) 1. Yes... 2. No...
- IF YES TO 2A:
- B. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- C. At what age did you first have it? Age in years... Does not apply...
- 3A. Hay fever? 1. Yes... 2. No...
- IF YES TO 3A:
- B. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- C. At what age did it start? Age in years... Does not apply...
- 23A. Have you ever had chronic bronchitis? 1. Yes... 2. No...
- IF YES TO 23A:
- B. Do you still have it? 1. Yes... 2. No... 3. Does not apply...

- C. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- D. At what age did it start? Age in years... Does not apply...
- 24A. Have you ever had emphysema? 1. Yes... 2. No...
- IF YES TO 24A:
- B. Do you still have it? 1. Yes... 2. No... 3. Does not apply...
- C. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- D. At what age did it start? Age in years... Does not apply...
- 25A. Have you ever had asthma? 1. Yes... 2. No...
- IF YES TO 25A:
- B. Do you still have it? 1. Yes... 2. No... 3. Does not apply...
- C. Was it confirmed by a doctor? 1. Yes... 2. No... 3. Does not apply...
- D. At what age did it start? Age in years... Does not apply...
- E. If you no longer have it, at what age did it stop? Age stopped... Does not apply...
26. Have you ever had:
- A. Any other chest illness? 1. Yes... 2. No... If yes, please specify
- B. Any chest operations? 1. Yes... 2. No... If yes, please specify
- C. Any chest injuries? 1. Yes... 2. No... If yes, please specify
- 27A. Has a doctor ever told you that you had heart trouble? 1. Yes... 2. No...
- IF YES TO 27A:
- B. Have you ever had treatment for heart trouble in the past 10 years? 1. Yes... 2. No... 3. Does not apply...
- 28A. Has a doctor ever told you that you had high blood pressure? 1. Yes... 2. No...
- IF YES TO 28A:
- B. Have you had any treatment for high blood pressure (hypertension) in the past 10 years? 1. Yes... 2. No... 3. Does not apply...
29. When did you last have your chest x-rayed? (Year) ... 25 26 27 28
30. Where did you last have your chest x-rayed (if known)? What was the outcome? ...

FAMILY HISTORY

31. Were either of your natural parents ever told by a doctor that they had a chronic lung condition such as:
- | | | | | | | |
|-------------------------------|--------|---------------|---------------|--------|---------------|---------------|
| | FATHER | | | MOTHER | | |
| | 1. Yes | 2. No | 3. Don't Know | 1. Yes | 2. No | 3. Don't Know |
| A. Chronic Bronchitis? | ... | ... | ... | ... | ... | ... |
| B. Emphysema? | ... | ... | ... | ... | ... | ... |
| C. Asthma? | ... | ... | ... | ... | ... | ... |
| D. Lung cancer? | ... | ... | ... | ... | ... | ... |
| E. Other chest conditions? | ... | ... | ... | ... | ... | ... |
| F. Is parent currently alive? | ... | ... | ... | ... | ... | ... |
| G. Please specify | ... | Age if living | ... | ... | Age if living | ... |
| | ... | Age at death | ... | ... | Age at death | ... |
| | ... | Don't Know | ... | ... | Don't Know | ... |
- H. Please specify cause of death ...

COUGH

- 32A. Do you usually have a cough? 1. Yes... 2. No... (Count a cough with first smoke or on first going out of doors. Exclude clearing of throat.) (If no, skip to question 32C.)

- B. Do you usually cough as much as 4 to 6 times a day 4 or more days out of the week? 1. Yes ... 2. No ...
- C. Do you usually cough at all on getting up or first thing in the morning? 1. Yes ... 2. No ...
- D. Do you usually cough at all during the rest of the day or at night? 1. Yes ... 2. No ...

IF YES TO ANY OF ABOVE (32A, B, C, OR D), ANSWER THE FOLLOWING. IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO NEXT PAGE

- E. Do you usually cough like this on most days for 3 consecutive months or more during the year? 1. Yes ... 2. No ... 3. Does not apply ...
- F. For how many years have you had the cough? Number of years ... Does not apply ...

- 33A. Do you usually bring up phlegm from your chest? (Count phlegm with the first smoke or on first going out of doors. Exclude phlegm from the nose. Count swallowed phlegm.) (If no, skip to 33C.) 1. Yes ... 2. No ...
- B. Do you usually bring up phlegm like this as much as twice a day 4 or more days out of the week? 1. Yes ... 2. No ...
- C. Do you usually bring up phlegm at all on getting up or first thing in the morning? 1. Yes ... 2. No ...
- D. Do you usually bring up phlegm at all during the rest of the day or at night? 1. Yes ... 2. No ...

IF YES TO ANY OF THE ABOVE (33A, B, C, OR D), ANSWER THE FOLLOWING: IF NO TO ALL, CHECK DOES NOT APPLY AND SKIP TO 34A.

- E. Do you bring up phlegm like this on most days for 3 consecutive months or more during the year? 1. Yes ... 2. No ... 3. Does not apply ...
- F. For how many years have you had trouble with phlegm? Number of years ... Does not apply ...

EPISODES OF COUGH AND PHLEGM

- 34A. Have you had periods or episodes of (increased*) cough and phlegm lasting for 3 weeks or more each year?*(For persons who usually have cough and/or phlegm.) 1. Yes ... 2. No ...
- IF YES TO 34A:
- B. For how long have you had at least 1 such episode per year? Number of years ... Does not apply ...

WHEEZING

- 35A. Does your chest ever sound wheezy or whistling:
 - 1. When you have a cold? 1. Yes ... 2. No ...
 - 2. Occasionally apart from colds? 1. Yes ... 2. No ...
 - 3. Most days or nights? 1. Yes ... 2. No ...
- IF YES TO 1, 2, OR 3 IN 35A:
- B. For how many years has this been present? Number of years ... Does not apply ...
- 36A. Have you ever had an attack of wheezing that has made you feel short of breath? 1. Yes ... 2. No ...
- IF YES TO 36A:
- B. How old were you when you had your first such attack? Age in years ... Does not apply ...
- C. Have you had 2 or more such episodes? 1. Yes ... 2. No ... 3. Does not apply ...
- D. Have you ever required medicine or treatment for the(se) attack(s)? 1. Yes ... 2. No ... 3. Does not apply ...

BREATHLESSNESS

- 37. If disabled from walking by any condition other than heart or lung disease, please describe and proceed to question 39A. Nature of condition(s)

- 38A. Are you troubled by shortness of breath when hurrying on the level or walking up a slight hill? 1. Yes ... 2. No ...
- IF YES TO 38A:
- B. Do you have to walk slower than people of your age on the level because of breathlessness? 1. Yes ... 2. No ... 3. Does not apply ...
- C. Do you ever have to stop for breath when walking at your own pace on the level? 1. Yes ... 2. No ... 3. Does not apply ...
- D. Do you ever have to stop for breath after walking about 100 yards (or after a few minutes) on the level? 1. Yes ... 2. No ... 3. Does not apply ...
- E. Are you too breathless to leave the house or breathless on dressing or climbing one flight of stairs? 1. Yes ... 2. No ... 3. Does not apply ...

TOBACCO SMOKING

- 39A. Have you ever smoked cigarettes? (No means less than 20 packs of cigarettes or 12 oz. of tobacco in a lifetime or less than 1 cigarette a day for 1 year.) 1. Yes ... 2. No ...
- IF YES TO 39A:
- B. Do you now smoke cigarettes (as of one month ago)? 1. Yes ... 2. No ... 3. Does not apply ...
- C. How old were you when you first started regular cigarette smoking? Age in years ... Does not apply ...
- D. If you have stopped smoking cigarettes completely, how old were you when you stopped? Aged stopped ... Check if still smoking ... Does not apply ...
- E. How many cigarettes do you smoke per day now? Cigarettes per day ... Does not apply ...
- F. On the average of the entire time you smoked, how many cigarettes did you smoke per day? Cigarettes per day ... Does not apply ...
- G. Do you or did you inhale the cigarette smoke? 1. Does not apply ... 2. Not at all ... 3. Slightly ... 4. Moderately ... 5. Deeply ...
- 40A. Have you ever smoked a pipe regularly? (Yes means more than 12 ounces of tobacco in a lifetime.) 1. Yes ... 2. No ...

FOR PERSONS WHO HAVE EVER SMOKED A PIPE

- B. 1. How old were you when you started to smoke a pipe regularly? Age ...
- 2. If you have stopped smoking a pipe completely, how old were you when you stopped? Age stopped ... Check if still smoking pipe ... Does not apply ...
- C. On the average over the entire time you smoked a pipe, how much pipe tobacco did you smoke per week? ... oz. per week (a standard pouch of tobacco contains 1-1/2 ounces) ... Does not apply ...
- D. How much pipe tobacco are you smoking now? oz. per week ... Not currently smoking a pipe ...
- E. Do you or did you inhale the pipe smoke? 1. Never smoked ... 2. Not at all ... 3. Slightly ... 4. Moderately ... 5. Deeply ...
- 41A. Have you ever smoked cigars regularly? (Yes means more than 1 cigar a week for a year.) 1. Yes ... 2. No ...

FOR PERSONS WHO HAVE EVER SMOKED CIGARS

- B. 1. How old were you when you started smoking cigars regularly? Age ...

- 2. If you have stopped smoking cigars completely, how old were you when you stopped?
C. On the average over the entire time you smoked cigars, how many cigars did you smoke per week?
D. How many cigars are you smoking per week now?
E. Do you or did you inhale the cigar smoke?
Signature Date

- IF YES TO 15A:
15B. Did you produce phlegm with any of these chest illnesses?
15C. In the past year, how many such illnesses with (increased) phlegm did you have which lasted a week or more?
16. RESPIRATORY SYSTEM
In the past year have you had:
Asthma
Bronchitis
Hay fever
Other allergies

Part 2
PERIODIC MEDICAL QUESTIONNAIRE

- 1. NAME
2. SOCIAL SECURITY #
3. CLOCK NUMBER
4. PRESENT OCCUPATION
5. PLANT
6. ADDRESS
7. (Zip Code)
8. TELEPHONE NUMBER
9. INTERVIEWER
10. DATE
11. What is your marital status? 1. Single . . . 4. Separated/
2. Married . . . Divorced . . .
3. Widowed . . .

- Yes or No Further Comment on Positive Answers
Pneumonia
Tuberculosis
Chest Surgery
Other Lung Problems
Heart disease
Do you have:
Frequent colds
Chronic cough
Shortness of breath when walking or climbing one flight of stairs
Do you:
Wheeze
Cough up phlegm
Smoke cigarettes
Packs per day . . .
How many years . . .
Date Signature

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07741, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07741, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07741, filed 4/27/87.]

WAC 296-62-07743 Appendix E—Interpretation and classification of chest roentgenograms—Mandatory. (1) Chest roentgenograms shall be interpreted and classified in accordance with a professionally accepted classification system and recorded on an interpretation form following the format of the CDC/NIOSH (M) 2.8 form. As a minimum, the content within the bold lines of this form (items one through four) shall be included. This form is not to be submitted to NIOSH.

(2) Roentgenograms shall be interpreted and classified only by a B-reader, a board eligible/certified radiologist, or an experienced physician with known expertise in pneumoconioses.

(3) All interpreters, whenever interpreting chest roentgenograms made under this section, shall have immediately available for reference a complete set of the ILO-U/C International Classification of Radiographs for Pneumoconioses, 1980.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-07743, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07743, filed 4/27/87.]

WAC 296-62-07745 Appendix F—Work practices and engineering controls for automotive brake and clutch

inspection, disassembly, repair and assembly—Mandatory. This mandatory appendix specifies engineering controls and work practices that must be implemented by the employer during automotive brake and clutch inspection, disassembly, repair, and assembly operations. Proper use of these engineering controls and work practices will reduce employees' asbestos exposure below the permissible exposure level during clutch and brake inspection, disassembly, repair, and assembly operations. The employer shall institute engineering controls and work practices using either the method set forth in (1) or (2) of this appendix, or any other method which the employer can demonstrate to be equivalent in terms of reducing employee exposure to asbestos as defined and which meets the requirements described in (3) of this appendix, for those facilities in which no more than 5 pairs of brakes or 5 clutches are inspected, disassembled, reassembled and/or repaired per week, the method set forth in (4) of this appendix may be used:

(1) Negative pressure enclosure/HEPA vacuum system method.

(a) The brake and clutch inspection, disassembly, repair, and assembly operations shall be enclosed to cover and contain the clutch or brake assembly and to prevent the release of asbestos fibers into the worker's breathing zone.

(b) The enclosure shall be sealed tightly and thoroughly inspected for leaks before work begins on brake and clutch inspection, disassembly, repair and assembly.

(c) The enclosure shall be such that the worker can clearly see the operation and shall provide impermeable sleeves through which the worker can handle the brake and clutch inspection, disassembly, repair and assembly. The integrity of the sleeves and ports shall be examined before work begins.

(d) A HEPA-filtered vacuum shall be employed to maintain the enclosure under negative pressure throughout the operation. Compressed-air may be used to remove asbestos fibers or particles from the enclosure.

(e) The HEPA vacuum shall be used first to loosen the asbestos containing residue from the brake and clutch parts and then to evacuate the loosened asbestos containing material from the enclosure and capture the material in the vacuum filter.

(f) The vacuum's filter, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to WAC 296-62-07721 (6)(b) and disposed of according to WAC 296-62-07713 (1)(a) and (2)(f).

(g) Any spills or releases of asbestos containing waste material from inside of the enclosure or vacuum hose or vacuum filter shall be immediately cleaned up and disposed of according to WAC 296-62-07713 (1)(a) and (2)(f).

(2) Low pressure/wet cleaning method.

(a) A catch basin shall be placed under the brake assembly, positioned to avoid splashes and spills.

(b) The reservoir shall contain water containing an organic solvent or wetting agent. The flow of liquid shall be controlled such that the brake assembly is gently flooded to prevent the asbestos-containing brake dust from becoming airborne.

(c) The aqueous solution shall be allowed to flow between the brake drum and brake support before the drum is removed.

(d) After removing the brake drum, the wheel hub and back of the brake assembly shall be thoroughly wetted to suppress dust.

(e) The brake support plate, brake shoes and brake components used to attach the brake shoes shall be thoroughly washed before removing the old shoes.

(f) In systems using filters, the filters, when full, shall be first wetted with a fine mist of water, then removed and placed immediately in an impermeable container, labeled according to WAC 296-62-07721 (6)(b) and disposed of according to WAC 296-62-07713 (1)(a) and (2)(f).

(g) Any spills of asbestos-containing aqueous solution or any asbestos-containing waste material shall be cleaned up immediately and disposed of according to WAC 296-62-07713 (1)(a) and (2)(f).

(h) The use of dry brushing during low pressure/wet cleaning operations is prohibited.

(3) Equivalent methods. An equivalent method is one which has sufficient written detail so that it can be reproduced and has been demonstrated that the exposures resulting from the equivalent method are equal to or less than the exposure which would result from the use of the method described in subsection (1) of this appendix. For purposes of making this comparison, the employer shall assume that exposures resulting from the use of the method described in subsection (1) of this appendix shall not exceed 0.016 f/cc, as measured by the WISHA reference method and as averaged over at least 18 personal samples.

(4) Wet method.

(a) A spray bottle, hose nozzle, or other implement capable of delivering a fine mist of water or amended water or other delivery system capable of delivering water at low pressure, shall be used to first thoroughly wet the brake and clutch parts. Brake and clutch components shall then be wiped clean with a cloth.

(b) The cloth shall be placed in an impermeable container, labeled according to WAC 296-62-07721 (6)(b) and then disposed of according to WAC 296-62-07713 (1)(a) and (2)(f), or the cloth shall be laundered in a way to prevent the release of asbestos fibers in excess of 0.1 fiber per cubic centimeter of air.

(c) Any spills of solvent or any asbestos containing waste material shall be cleaned up immediately according to WAC 296-62-07713 (1)(a) and (2)(f).

(d) The use of dry brushing during the wet method operations is prohibited.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060, 97-01-079, § 296-62-07745, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-07745, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07745, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07745, filed 4/27/87.]

WAC 296-62-07747 Appendix G—Substance technical information for asbestos—Nonmandatory. (1) Substance identification.

(a) Substance: "Asbestos" is the name of a class of magnesium-silicate minerals that occur in fibrous form. Minerals

that are included in this group are chrysotile, crocidolite, amosite, tremolite asbestos, anthophyllite asbestos, and actinolite asbestos.

(b) Asbestos is used in the manufacture of heat-resistant clothing, automotive brake and clutch linings, and a variety of building materials including floor tiles, roofing felts, ceiling tiles, asbestos-cement pipe and sheet, and fire-resistant drywall. Asbestos is also present in pipe and boiler insulation materials, and in sprayed-on materials located on beams, in crawlspaces, and between walls.

(c) The potential for a product containing asbestos, tremolite, anthophyllite, and actinolite to release breathable fibers depends on its degree of friability. Friable means that the material can be crumbled with hand pressure and is therefore likely to emit fibers. The fibrous or fluffy sprayed-on materials used for fireproofing, insulation, or sound proofing are considered to be friable, and they readily release airborne fibers if disturbed. Materials such as vinyl-asbestos floor tile or roofing felts are considered nonfriable and generally do not emit airborne fibers unless subjected to sanding or sawing operations. Asbestos-cement pipe or sheet can emit airborne fibers if the materials are cut or sawed, or if they are broken during demolition operations.

(d) Permissible exposure: Exposure to airborne asbestos fibers may not exceed 0.1 fiber per cubic centimeter of air (0.1 f/cc) averaged over the eight-hour workday (time weighted average), or 1 fiber per cubic centimeter of air (1 f/cc) during any thirty minute period, (excursion limit).

(2) Health hazard data.

(a) Asbestos can cause disabling respiratory disease and various types of cancers if the fibers are inhaled. Inhaling or ingesting fibers from contaminated clothing or skin can also result in these diseases. The symptoms of these diseases generally do not appear for twenty or more years after initial exposure.

(b) Exposure to asbestos has been shown to cause lung cancer, mesothelioma, and cancer of the stomach and colon. Mesothelioma is a rear cancer of the thin membrane lining of the chest and abdomen. Symptoms of mesothelioma include shortness of breath, pain in the walls of the chest, and/or abdominal pain.

(3) Respirators and protective clothing.

(a) Respirators: You are required to wear a respirator when performing tasks that result in asbestos exposure that exceeds 0.1 fiber per cubic centimeter of air (0.1 f/cc) as an eight-hour time weighted average and/or 1.0 fiber per cubic centimeter (1 f/cc) during any thirty minute period (excursion limit). These conditions can occur while your employer is in the process of installing engineering controls to reduce asbestos exposure, or where engineering controls are not feasible to reduce asbestos exposure. Air-purifying respirators equipped with a high-efficiency particulate air (HEPA) filter can be used where airborne asbestos fiber concentrations do not exceed 1 f/cc; otherwise, air-supplied, positive-pressure, full facepiece respirators must be used. Disposable respirators or dust masks are not permitted to be used for asbestos work. For effective protection, respirators must fit your face and head snugly. Your employer is required to conduct fit tests when you are first assigned a respirator and every six

months thereafter. Respirators should not be loosened or removed in work situations where their use is required.

(b) Protective clothing: You are required to wear protective clothing in work areas where asbestos fiber concentrations exceed the permissible exposure limits to prevent contamination of the skin. Where protective clothing is required, your employer must provide you with clean garments. Unless you are working on a large asbestos removal or demolition project, your employer must also provide a change room and separate lockers for your street clothes and contaminated work clothes. If you are working on a large asbestos removal or demolition project, and where it is feasible to do so, your employer must provide a clean room, shower, and decontamination room contiguous to the work area. When leaving the work area, you must remove contaminated clothing before proceeding to the shower. If the shower is not adjacent to the work area, you must vacuum your clothing before proceeding to the change room and shower. To prevent inhaling fibers in contaminated change rooms and showers, leave your respirator on until you leave the shower and enter the clean change room.

(4) Disposal procedures and cleanup.

(a) Wastes that are generated by processes where asbestos is present include:

(i) Empty asbestos shipping containers.

(ii) Process wastes such as cuttings, trimmings, or reject material.

(iii) Housekeeping waste from sweeping or HEPA vacuuming.

(iv) Asbestos fireproofing or insulating material that is removed from buildings.

(v) Building products that contain asbestos removed during building renovation or demolition.

(vi) Contaminated disposable protective clothing.

(b) Empty shipping bags can be flattened under exhaust hoods and packed into airtight containers for disposal. Empty shipping drums are difficult to clean and should be sealed.

(c) Vacuum bags or disposable paper filters should not be cleaned, but should be sprayed with a fine water mist and placed into a labeled waste container.

(d) Process waste and housekeeping waste should be wetted with water or a mixture of water and surfactant prior to packaging in disposable containers.

(e) Material containing asbestos that is removed from buildings must be disposed of in leaktight 6-mil thick plastic bags, plastic-lined cardboard containers, or plastic-lined metal containers. These wastes, which are removed while wet, should be sealed in containers before they dry out to minimize the release of asbestos fibers during handling.

(5) Access to information.

(a) Each year, your employer is required to inform you of the information contained in this standard and appendices for asbestos. In addition, your employer must instruct you in the proper work practices for handling materials containing asbestos and the correct use of protective equipment.

(b) Your employer is required to determine whether you are being exposed to asbestos. You or your representative has the right to observe employee measurements and to record the results obtained. Your employer is required to inform you of your exposure, and, if you are exposed above the permissi-

ble limits, he or she is required to inform you of the actions that are being taken to reduce your exposure to within the permissible limits.

(c) Your employer is required to keep records of your exposures and medical examinations. These exposure records must be kept for at least thirty years. Medical records must be kept for the period of your employment plus thirty years.

(d) Your employer is required to release your exposure and medical records to your physician or designated representative upon your written request.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060, 97-01-079, § 296-62-07747, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 89-11-035 (Order 89-03), § 296-62-07747, filed 5/15/89, effective 6/30/89; 87-24-051 (Order 87-24), § 296-62-07747, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040, 87-10-008 (Order 87-06), § 296-62-07747, filed 4/27/87.]

WAC 296-62-07749 Appendix H—Medical surveillance guidelines for asbestos—Nonmandatory. (1) Route of entry inhalation, ingestion.

(2) Toxicology.

Clinical evidence of the adverse effects associated with exposure to asbestos is present in the form of several well-conducted epidemiological studies of occupationally exposed workers, family contacts of workers, and persons living near asbestos mines. These studies have shown a definite association between exposure to asbestos and an increased incidence of lung cancer, pleural and peritoneal mesothelioma, gastrointestinal cancer, and asbestosis. The latter is a disabling fibrotic lung disease that is caused only by exposure to asbestos. Exposure to asbestos has also been associated with an increased incidence of esophageal, kidney, laryngeal, pharyngeal, and buccal cavity cancers. As with other known chronic occupational diseases, disease associated with asbestos generally appears about twenty years following the first occurrence of exposure: There are no known acute effects associated with exposure to asbestos.

Epidemiological studies indicate that the risk of lung cancer among exposed workers who smoke cigarettes is greatly increased over the risk of lung cancer among nonexposed smokers or exposed nonsmokers. These studies suggest that cessation of smoking will reduce the risk of lung cancer for a person exposed to asbestos but will not reduce it to the same level of risk as that existing for an exposed worker who has never smoked.

(3) Signs and symptoms of exposure-related disease.

The signs and symptoms of lung cancer or gastrointestinal cancer induced by exposure to asbestos are not unique, except that a chest x-ray of an exposed patient with lung cancer may show pleural plaques, pleural calcification, or pleural fibrosis. Symptoms characteristic of mesothelioma include shortness of breath, pain in the walls of the chest, or abdominal pain. Mesothelioma has a much longer latency period compared with lung cancer (forty years versus fifteen to twenty years), and mesothelioma is therefore more likely to be found among workers who were first exposed to asbestos at an early age. Mesothelioma is always fatal.

Asbestosis is pulmonary fibrosis caused by the accumulation of asbestos fibers in the lungs. Symptoms include shortness of breath, coughing, fatigue, and vague feelings of sickness. When the fibrosis worsens, shortness of breath

occurs even at rest. The diagnosis of asbestosis is based on a history of exposure to asbestos, the presence of characteristic radiologic changes, endinspiratory crackles (rales), and other clinical features of fibrosing lung disease. Pleural plaques and thickening are observed on x-rays taken during the early stages of the disease. Asbestosis is often a progressive disease even in the absence of continued exposure, although this appears to be a highly individualized characteristic. In severe cases, death may be caused by respiratory or cardiac failure.

(4) Surveillance and preventive considerations.

As noted above, exposure to asbestos has been linked to an increased risk of lung cancer, mesothelioma, gastrointestinal cancer, and asbestosis among occupationally exposed workers. Adequate screening tests to determine an employee's potential for developing serious chronic diseases, such as cancer, from exposure to asbestos do not presently exist. However, some tests, particularly chest x-rays and pulmonary function tests, may indicate that an employee has been overexposed to asbestos increasing his or her risk of developing exposure-related chronic diseases. It is important for the physician to become familiar with the operating conditions in which occupational exposure to asbestos is likely to occur. This is particularly important in evaluating medical and work histories and in conducting physical examinations. When an active employee has been identified as having been overexposed to asbestos measures taken by the employer to eliminate or mitigate further exposure should also lower the risk of serious long-term consequences.

The employer is required to institute a medical surveillance program for all employees who are or will be exposed to asbestos at or above the permissible exposure limits (0.1 fiber per cubic centimeter of air) for 30 or more days per year and for all employees who are assigned to wear a negative pressure respirator. All examinations and procedures must be performed by or under the supervision of a licensed physician, at a reasonable time and place, and at no cost to the employee.

Although broad latitude is given to the physician in prescribing specific tests to be included in the medical surveillance program, WISHA requires inclusion of the following elements in the routine examination:

(a) Medical and work histories with special emphasis directed to symptoms of the respiratory system, cardiovascular system, and digestive tract.

(b) Completion of the respiratory disease questionnaire contained in WAC 296-62-07741, Appendix D.

(c) A physical examination including a chest roentgenogram and pulmonary function test that includes measurement of the employee's forced vital capacity (FVC) and forced expiratory volume at one second (FEV₁).

(d) Any laboratory or other test that the examining physician deems by sound medical practice to be necessary.

The employer is required to make the prescribed tests available at least annually to those employees covered; more often than specified if recommended by the examining physician; and upon termination of employment.

The employer is required to provide the physician with the following information: A copy of this standard and appendices; a description of the employee's duties as they relate to asbestos exposure; the employee's representative

level of exposure to asbestos; a description of any personal protective and respiratory equipment used; and information from previous medical examinations of the affected employee that is not otherwise available to the physician. Making this information available to the physician will aid in the evaluation of the employee's health in relation to assigned duties and fitness to wear personal protective equipment, if required.

The employer is required to obtain a written opinion from the examining physician containing the results of the medical examination; the physician's opinion as to whether the employee has any detected medical conditions that would place the employee at an increased risk of exposure-related disease; any recommended limitations on the employee or on the use of personal protective equipment; and a statement that the employee has been informed by the physician of the results of the medical examination and of any medical conditions related to asbestos exposure that require further explanation or treatment. This written opinion must not reveal specific findings or diagnoses unrelated to exposure to asbestos and a copy of the opinion must be provided to the affected employee.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07749, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07749, filed 7/20/94, effective 9/20/94; 87-24-051 (Order 87-24), § 296-62-07749, filed 11/30/87. Statutory Authority: RCW 49.17.050(2) and 49.17.040. 87-10-008 (Order 87-06), § 296-62-07749, filed 4/27/87.]

WAC 296-62-07751 Appendix I—Work practices and engineering controls for Class I asbestos operations—Nonmandatory. This is a nonmandatory appendix to the asbestos standards for construction and for shipyards. It describes criteria and procedures for erecting and using negative pressure enclosures for Class I Asbestos Work, when NPEs are used as an allowable control method to comply with WAC 296-62-07712 (7)(a). Many small and variable details are involved in the erection of a negative pressure enclosure. OSHA and most participants in the rulemaking agreed that only the major, more performance oriented criteria should be made mandatory. These criteria are set out in WAC 296-62-07712. In addition, this appendix includes these mandatory specifications and procedures in its guidelines in order to make this appendix coherent and helpful. The mandatory nature of the criteria which appear in the regulatory text is not changed because they are included in this "nonmandatory" appendix. Similarly, the additional criteria and procedures included as guidelines in the appendix, do not become mandatory because mandatory criteria are also included in these comprehensive guidelines.

In addition, none of the criteria, both mandatory and recommended, are meant to specify or imply the need for use of patented or licensed methods or equipment. Recommended specifications included in this attachment should not discourage the use of creative alternatives which can be shown to reliably achieve the objectives of negative-pressure enclosures.

Requirements included in this appendix, cover general provisions to be followed in all asbestos jobs, provisions which must be followed for all Class I asbestos jobs, and provisions governing the construction and testing of negative

pressure enclosures. The first category includes the requirement for use of wet methods, HEPA vacuums, and immediate bagging of waste; Class I work must conform to the following provisions:

- oversight by competent person
- use of critical barriers over all openings to work area
- isolation of HVAC systems
- use of impermeable dropcloths and coverage of all objects within regulated areas

In addition, more specific requirements for NPEs include:

- maintenance of -0.02 inches water gauge within enclosure
- manometric measurements
- air movement away from employees performing removal work
- smoke testing or equivalent for detection of leaks and air direction
- deactivation of electrical circuits, if not provided with ground-fault circuit interrupters.

Planning the Project

The standard requires that an exposure assessment be conducted before the asbestos job is begun WAC 296-62-07709(3). Information needed for that assessment, includes data relating to prior similar jobs, as applied to the specific variables of the current job. The information needed to conduct the assessment will be useful in planning the project, and in complying with any reporting requirements under this standard, when significant changes are being made to a control system listed in the standard, (see WAC 296-62-07719), as well as those of USEPA (40 CFR Part 61, subpart M). Thus, although the standard does not explicitly require the preparation of a written asbestos removal plan, the usual constituents of such a plan, i.e., a description of the enclosure, the equipment, and the procedures to be used throughout the project, must be determined before the enclosure can be erected. The following information should be included in the planning of the system:

- A physical description of the work area;
 - A description of the approximate amount of material to be removed;
 - A schedule for turning off and sealing existing ventilation systems;
 - Personnel hygiene procedures;
 - A description of personal protective equipment and clothing to be worn by employees;
 - A description of the local exhaust ventilation systems to be used and how they are to be tested;
 - A description of work practices to be observed by employees;
 - An air monitoring plan;
 - A description of the method to be used to transport waste material; and
 - The location of the dump site.
- Materials and Equipment Necessary for Asbestos Removal

Although individual asbestos removal projects vary in terms of the equipment required to accomplish the removal of

the materials, some equipment and materials are common to most asbestos removal operations.

Plastic sheeting used to protect horizontal surfaces, seal HVAC openings or to seal vertical openings and ceilings should have a minimum thickness of 6 mils. Tape or other adhesive used to attach plastic sheeting should be of sufficient adhesive strength to support the weight of the material plus all stresses encountered during the entire duration of the project without becoming detached from the surface.

Other equipment and materials which should be available at the beginning of each project are:

- HEPA Filtered Vacuum is essential for cleaning the work area after the asbestos has been removed. It should have a long hose capable of reaching out-of-the-way places, such as areas above ceiling tiles, behind pipes, etc.
- Portable air ventilation systems installed to provide the negative air pressure and air removal from the enclosure must be equipped with a HEPA filter. The number and capacity of units required to ventilate an enclosure depend on the size of the area to be ventilated. The filters for these systems should be designed in such a manner that they can be replaced when the air flow volume is reduced by the build-up of dust in the filtration material. Pressure monitoring devices with alarms and strip chart recorders attached to each system to indicate the pressure differential and the loss due to dust buildup on the filter are recommended.
- Water sprayers should be used to keep the asbestos material as saturated as possible during removal; the sprayers will provide a fine mist that minimizes the impact of the spray on the material.
- Water used to saturate the asbestos containing material can be amended by adding at least 15 milliliters (½ ounce) of wetting agent in 1 liter (1 pint) of water. An example of a wetting agent is a 50/50 mixture of polyoxyethylene ether and polyoxyethylene polyglycol ester.
- Backup power supplies are recommended, especially for ventilation systems.
- Shower and bath water should be with mixed hot and cold water faucets. Water that has been used to clean personnel or equipment should either be filtered or be collected and discarded as asbestos waste. Soap and shampoo should be provided to aid in removing dust from the workers' skin and hair.
- See WAC 296-62-07715 and 296-62-07717 for appropriate respiratory protection and protective clothing.
- See WAC 296-62-07721 for required signs and labels.

Preparing the Work Area

Disabling HVAC Systems: The power to the heating, ventilation, and air conditioning systems that service the restricted area must be deactivated and locked off. All ducts, grills, access ports, windows and vents must be sealed off with two layers of plastic to prevent entrainment of contaminated air.

Operating HVAC Systems in the Restricted Area: If components of a HVAC system located in the restricted area are connected to a system that will service another zone during the project, the portion of the duct in the restricted area must be sealed and pressurized. Necessary precautions include caulking the duct joints, covering all cracks and openings with two layers of sheeting, and pressurizing the duct throughout the duration of the project by restricting the return air flow. The power to the fan supplying the positive pressure should be locked "on" to prevent pressure loss.

Sealing Elevators: If an elevator shaft is located in the restricted area, it should be either shut down or isolated by sealing with two layers of plastic sheeting. The sheeting should provide enough slack to accommodate the pressure changes in the shaft without breaking the air-tight seal.

Removing Mobile Objects: All movable objects should be cleaned and removed from the work area before an enclosure is constructed unless moving the objects creates a hazard. Mobile objects will be assumed to be contaminated and should be either cleaned with amended water and a HEPA vacuum and then removed from the area or wrapped and then disposed of as hazardous waste.

Cleaning and Sealing Surfaces: After cleaning with water and a HEPA vacuum, surfaces of stationary objects should be covered with two layers of plastic sheeting. The sheeting should be secured with duct tape or an equivalent method to provide a tight seal around the object.

Bagging Waste: In addition to the requirement for immediate bagging of waste for disposal, it is further recommended that the waste material be double-bagged and sealed in plastic bags designed for asbestos disposal. The bags should be stored in a waste storage area that can be controlled by the workers conducting the removal. Filters removed from air handling units and rubbish removed from the area are to be bagged and handled as hazardous waste.

Constructing the Enclosure

The enclosure should be constructed to provide an airtight seal around ducts and openings into existing ventilation systems and around penetrations for electrical conduits, telephone wires, water lines, drain pipes, etc. Enclosures should be both airtight and watertight except for those openings designed to provide entry and/or air flow control.

Size: An enclosure should be the minimum volume to encompass all of the working surfaces yet allow unencumbered movement by the worker(s), provide unrestricted air flow past the worker(s), and ensure walking surfaces can be kept free of tripping hazards.

Shape: The enclosure may be any shape that optimizes the flow of ventilation air past the worker(s).

Structural Integrity: The walls, ceilings and floors must be supported in such a manner that portions of the enclosure will not fall down during normal use.

Openings: It is not necessary that the structure be airtight; openings may be designed to direct air flow. Such openings should be located at a distance from active removal operations. They should be designed to draw air into the enclosure under all anticipated circumstances. In the event that negative pressure is lost, they should be fitted with either HEPA filters to trap dust or automatic trap doors that prevent

dust from escaping the enclosure. Openings for exits should be controlled by an airlock or a vestibule.

Barrier Supports: Frames should be constructed to support all unsupported spans of sheeting.

Sheeting: Walls, barriers, ceilings, and floors should be lined with two layers of plastic sheeting having a thickness of at least 6 mil.

Seams: Seams in the sheeting material should be minimized to reduce the possibilities of accidental rips and tears in the adhesive or connections. All seams in the sheeting should overlap, be staggered and not be located at corners or wall-to-floor joints.

Areas Within an Enclosure: Each enclosure consists of a work area, a decontamination area, and waste storage area. The work area where the asbestos removal operations occur should be separated from both the waste storage area and the contamination control area by physical curtains, doors, and/or airflow patterns that force any airborne contamination back into the work area.

See WAC 296-62-07719 for requirements for hygiene facilities.

During egress from the work area, each worker should step into the equipment room, clean tools and equipment, and remove gross contamination from clothing by wet cleaning and HEPA vacuuming. Before entering the shower area, foot coverings, head coverings, hand coverings, and coveralls are removed and placed in impervious bags for disposal or cleaning. Airline connections from airline respirators with HEPA disconnects and power cables from powered air-purifying respirators (PAPRs) will be disconnected just prior to entering the shower room.

Establishing Negative Pressure Within the Enclosure

Negative Pressure: Air is to be drawn into the enclosure under all anticipated conditions and exhausted through a HEPA filter for 24 hours a day during the entire duration of the project.

Air Flow Tests: Air flow patterns will be checked before removal operations begin, at least once per operating shift and any time there is a question regarding the integrity of the enclosure. The primary test for air flow is to trace air currents with smoke tubes or other visual methods. Flow checks are made at each opening and at each doorway to demonstrate that air is being drawn into the enclosure and at each worker's position to show that air is being drawn away from the breathing zone.

Monitoring Pressure Within the Enclosure: After the initial air flow patterns have been checked, the static pressure must be monitored within the enclosure. Monitoring may be made using manometers, pressure gauges, or combinations of these devices. It is recommended that they be attached to alarms and strip chart recorders at points identified by the design engineer.

Corrective Actions: If the manometers or pressure gauges demonstrate a reduction in pressure differential below the required level, work should cease and the reason for the change investigated and appropriate changes made. The air flow patterns should be retested before work begins again.

Pressure Differential: The design parameters for static pressure differentials between the inside and outside of enclosures typically range from 0.02 to 0.10 inches of water

gauge, depending on conditions. All zones inside the enclosure must have less pressure than the ambient pressure outside of the enclosure (-0.02 inches water gauge differential). Design specifications for the differential vary according to the size, configuration, and shape of the enclosure as well as ambient and mechanical air pressure conditions around the enclosure.

Air Flow Patterns: The flow of air past each worker shall be enhanced by positioning the intakes and exhaust ports to remove contaminated air from the worker's breathing zone, by positioning HEPA vacuum cleaners to draw air from the worker's breathing zone, by forcing relatively uncontaminated air past the worker toward an exhaust port, or by using a combination of methods to reduce the worker's exposure.

Air Handling Unit Exhaust: The exhaust plume from air handling units should be located away from adjacent personnel and intakes for HVAC systems.

Air Flow Volume: The air flow volume (cubic meters per minute) exhausted (removed) from the workplace must exceed the amount of makeup air supplied to the enclosure. The rate of air exhausted from the enclosure should be designed to maintain a negative pressure in the enclosure and air movement past each worker. The volume of air flow removed from the enclosure should replace the volume of the container at every 5 to 15 minutes. Air flow volume will need to be relatively high for large enclosures, enclosures with awkward shapes, enclosures with multiple openings, and operations employing several workers in the enclosure.

Air Flow Velocity: At each opening, the air flow velocity must visibly "drag" air into the enclosure. The velocity of air flow within the enclosure must be adequate to remove airborne contamination from each worker's breathing zone without disturbing the asbestos-containing material on surfaces.

Airlocks: Airlocks are mechanisms on doors and curtains that control the air flow patterns in the doorways. If air flow occurs, the patterns through doorways must be such that the air flows toward the inside of the enclosure. Sometimes vestibules, double doors, or double curtains are used to prevent air movement through the doorways. To use a vestibule, a worker enters a chamber by opening the door or curtain and then closing the entry before opening the exit door or curtain.

Airlocks should be located between the equipment room and shower room, between the shower room and the clean room, and between the waste storage area and the outside of the enclosure. The air flow between adjacent rooms must be checked using smoke tubes or other visual tests to ensure the flow patterns draw air toward the work area without producing eddies.

Monitoring for Airborne Concentrations

In addition to the breathing zone samples taken as outlined in WAC 296-62-07709, samples of air should be taken to demonstrate the integrity of the enclosure, the cleanliness of the clean room and shower area, and the effectiveness of the HEPA filter. If the clean room is shown to be contaminated, the room must be relocated to an uncontaminated area.

Samples taken near the exhaust of portable ventilation systems must be done with care.

General Work Practices

Preventing dust dispersion is the primary means of controlling the spread of asbestos within the enclosure. Whenever practical, the point of removal should be isolated, enclosed, covered, or shielded from the workers in the area. Waste asbestos containing materials must be bagged during or immediately after removal; the material must remain saturated until the waste container is sealed.

Waste material with sharp points or corners must be placed in hard air-tight containers rather than bags.

Whenever possible, large components should be sealed in plastic sheeting and removed intact.

Bags or containers of waste will be moved to the waste holding area, washed, and wrapped in a bag with the appropriate labels.

Cleaning the Work Area

Surfaces within the work area should be kept free of visible dust and debris to the extent feasible. Whenever visible dust appears on surfaces, the surfaces within the enclosure must be cleaned by wiping with a wet sponge, brush, or cloth and then vacuumed with a HEPA vacuum.

All surfaces within the enclosure should be cleaned before the exhaust ventilation system is deactivated and the enclosure is disassembled. An approved encapsulant may be sprayed onto areas after the visible dust has been removed.

[Statutory Authority: RCW 49.17.040, [49.17.]050 and [49.17.]060. 97-01-079, § 296-62-07751, filed 12/17/96, effective 3/1/97. Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07751, filed 7/20/94, effective 9/20/94; 87-24-051 (Order 87-24), § 296-62-07751, filed 11/30/87.]

WAC 296-62-07753 Appendix J—Polarized light microscopy of asbestos—Nonmandatory. Method number: ID-191

Matrix: Bulk

Collection Procedure

Collect approximately 1 to 2 grams of each type of material and place into separate 20 mL scintillation vials.

Analytical Procedure

A portion of each separate phase is analyzed by gross examination, phase-polar examination, and central stop dispersion microscopy.

Commercial manufacturers and products mentioned in this method are for descriptive use only and do not constitute endorsements by USDOL-WISHA. Similar products from other sources may be substituted.

(1) Introduction

This method describes the collection and analysis of asbestos bulk materials by light microscopy techniques including phase-polar illumination and central-stop dispersion microscopy. Some terms unique to asbestos analysis are defined below:

Amphibole: A family of minerals whose crystals are formed by long, thin units which have two thin ribbons of double chain silicate with a brucite ribbon in between. The shape of each unit is similar to an "I beam." Minerals important in asbestos analysis include cummingtonite-grunerite, crocidolite, tremolite-actinolite and anthophyllite.

Asbestos: A term for naturally occurring fibrous minerals. Asbestos includes chrysotile, cummingtonite-grunerite asbestos (amosite), anthophyllite asbestos, tremolite asbestos, crocidolite, actinolite asbestos and any of these minerals

which have been chemically treated or altered. The precise chemical formulation of each species varies with the location from which it was mined. Nominal compositions are listed:

Chrysotile $Mg_3Si_2O_5(OH)_4$

Crocidolite (Riebeckite

asbestos) $Na_2Fe_32+Fe_23+Si_8O_{22}(OH)_2$

Cummingtonite-Grunerite

asbestos (Amosite) $(Mg,Fe)_7Si_8O_{22}(OH)_2$

Tremolite-Actinolite asbestos $Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$

Anthophyllite asbestos $(Mg,Fe)_7Si_8O_{22}(HO)_2$

Asbestos Fiber: A fiber of asbestos meeting the criteria for a fiber. (See section (3)(e))

Aspect Ratio: The ratio of the length of a fiber to its diameter usually defined as "length: width," e.g. 3:1.

Brucite: A sheet mineral with the composition $mg(OH)_2$.

Central Stop Dispersion Staining (microscope): This is a dark field microscope technique that images particles using only light refracted by the particle, excluding light that travels through the particle unrefracted. This is usually accomplished with a McCrone objective or other arrangement which places a circular stop with apparent aperture equal to the objective aperture in the back focal plane of the microscope.

Cleavage Fragments: Mineral particles formed by the comminution of minerals, especially those characterized by relatively parallel sides and moderate aspect ratio.

Differential Counting: The term applied to the practice of excluding certain kinds of fibers from a phase contrast asbestos count because they are not asbestos.

Fiber: A particle longer than or equal to 5 microns with a length to width ratio greater than or equal to 3:1. This may include cleavage fragments. (See section (3)(e) of this appendix).

Phase Contrast: Contrast obtained in the microscope by causing light scattered by small particles to destructively interfere with unscattered light, thereby enhancing the visibility of very small particles and particles with very low intrinsic contrast.

Phase Contrast Microscope: A microscope configured with a phase mask pair to create phase contrast. The technique which uses this is called Phase Contrast Microscopy (PCM).

Phase-Polar Analysis: This is the use of polarized light in a phase contrast microscope. It is used to see the same size fibers that are visible in air filter analysis. Although fibers finer than 1 micron are visible, analysis of these is inferred from analysis of larger bundles that are usually present.

Phase-Polar Microscope: The phase-polar microscope is a phase contrast microscope which has an analyzer, a polarizer, a first order red plate and a rotating phase condenser all in place so that the polarized light image is enhanced by phase contrast.

Sealing Encapsulant: This is a product which can be applied, preferably by spraying, onto an asbestos surface which will seal the surface so that fibers cannot be released.

Serpentine: A mineral family consisting of minerals with the general composition $Mg_3(Si_2O_5(OH)_4$ having the magne-

sium in brucite layer over a silicate layer. Minerals important in asbestos analysis included in this family are chrysotile, lizardite, antigorite.

(a) History

Light microscopy has been used for well over 100 years for the determination of mineral species. This analysis is carried out using specialized polarizing microscopes as well as bright field microscopes. The identification of minerals is an on-going process with many new minerals described each year. The first recorded use of asbestos was in Finland about 2500 B.C. where the material was used in the mud wattle for the wooden huts the people lived in as well as strengthening for pottery. Adverse health aspects of the mineral were noted nearly 2000 years ago when Pliny the Younger wrote about the poor health of slaves in the asbestos mines. Although known to be injurious for centuries, the first modern references to its toxicity were by the British Labor Inspectorate when it banned asbestos dust from the workplace in 1898. Asbestosis cases were described in the literature after the turn of the century. Cancer was first suspected in the mid 1930's and a causal link to mesothelioma was made in 1965. Because of the public concern for worker and public safety with the use of this material, several different types of analysis were applied to the determination of asbestos content. Light microscopy requires a great deal of experience and craft. Attempts were made to apply less subjective methods to the analysis. X-ray diffraction was partially successful in determining the mineral types but was unable to separate out the fibrous portions from the nonfibrous portions. Also, the minimum detection limit for asbestos analysis by X-ray diffraction (XRD) is about 1%. Differential Thermal Analysis (DTA) was no more successful. These provide useful corroborating information when the presence of asbestos has been shown by microscopy; however, neither can determine the difference between fibrous and nonfibrous minerals when both habits are present. The same is true of Infrared Absorption (IR).

When electron microscopy was applied to asbestos analysis, hundreds of fibers were discovered present too small to be visible in any light microscope. There are two different types of electron microscopes used for asbestos analysis: Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM). Scanning Electron Microscopy is useful in identifying minerals. The SEM can provide two of the three pieces of information required to identify fibers by electron microscopy: Morphology and chemistry. The third is structure as determined by Selected Area Electron Diffraction-SAED which is performed in the TEM. Although the resolution of the SEM is sufficient for very fine fibers to be seen, accuracy of chemical analysis that can be performed on the fibers varies with fiber diameter in fibers of less than 0.2 micron diameter. The TEM is a powerful tool to identify fibers too small to be resolved by light microscopy and should be used in conjunction with this method when necessary. The TEM can provide all three pieces of information required for fiber identification. Most fibers thicker than 1 micron can adequately be defined in the light microscope. The light microscope remains as the best instrument for the determination of mineral type. This is because the minerals under investigation were first described analytically with the

light microscope. It is inexpensive and gives positive identification for most samples analyzed. Further, when optical techniques are inadequate, there is ample indication that alternative techniques should be used for complete identification of the sample.

(b) Principle

Minerals consist of atoms that may be arranged in random order or in a regular arrangement. Amorphous materials have atoms in random order while crystalline materials have long range order. Many materials are transparent to light, at least for small particles or for thin sections. The properties of these materials can be investigated by the effect that the material has on light passing through it. The six asbestos minerals are all crystalline with particular properties that have been identified and cataloged. These six minerals are anisotropic. They have a regular array of atoms, but the arrangement is not the same in all directions. Each major direction of the crystal presents a different regularity. Light photons travelling in each of these main directions will encounter different electrical neighborhoods, affecting the path and time of travel. The techniques outlined in this method use the fact that light traveling through fibers or crystals in different directions will behave differently, but predictably. The behavior of the light as it travels through a crystal can be measured and compared with known or determined values to identify the mineral species. Usually, Polarized Light Microscopy (PLM) is performed with strain-free objectives on a bright-field microscope platform. This would limit the resolution of the microscope to about 0.4 micron. Because WISHA requires the counting and identification of fibers visible in phase contrast, the phase contrast platform is used to visualize the fibers with the polarizing elements added into the light path. Polarized light methods cannot identify fibers finer than about 1 micron in diameter even though they are visible. The finest fibers are usually identified by inference from the presence of larger, identifiable fiber bundles. When fibers are present, but not identifiable by light microscopy, use either SEM or TEM to determine the fiber identity.

(c) Advantages and Disadvantages

The advantages of light microscopy are:

(i) Basic identification of the materials was first performed by light microscopy and gross analysis. This provides a large base of published information against which to check analysis and analytical technique.

(ii) The analysis is specific to fibers. The minerals present can exist in asbestiform, fibrous, prismatic, or massive varieties all at the same time. Therefore, bulk methods of analysis such as X-ray diffraction, IR analysis, DTA, etc. are inappropriate where the material is not known to be fibrous.

(iii) The analysis is quick, requires little preparation time, and can be performed on-site if a suitably equipped microscope is available.

The disadvantages are:

(iv) Even using phase-polar illumination, not all the fibers present may be seen. This is a problem for very low asbestos concentrations where agglomerations or large bundles of fibers may not be present to allow identification by inference.

(v) The method requires a great degree of sophistication on the part of the microscopist. An analyst is only as useful as

his mental catalog of images. Therefore, a microscopist's accuracy is enhanced by experience. The mineralogical training of the analyst is very important. It is the basis on which subjective decisions are made.

(vi) The method uses only a tiny amount of material for analysis. This may lead to sampling bias and false results (high or low). This is especially true if the sample is severely inhomogeneous.

(vii) Fibers may be bound in a matrix and not distinguishable as fibers so identification cannot be made.

(d) Method Performance

(i) This method can be used for determination of asbestos content from 0 to 100% asbestos. The detection limit has not been adequately determined, although for selected samples, the limit is very low, depending on the number of particles examined. For mostly homogeneous, finely divided samples, with no difficult fibrous interferences, the detection limit is below 1%. For inhomogeneous samples (most samples), the detection limit remains undefined. NIST has conducted proficiency testing of laboratories on a national scale. Although each round is reported statistically with an average, control limits, etc., the results indicate a difficulty in establishing precision especially in the low concentration range. It is suspected that there is significant bias in the low range especially near 1%. EPA tried to remedy this by requiring a mandatory point counting scheme for samples less than 10%. The point counting procedure is tedious, and may introduce significant biases of its own. It has not been incorporated into this method.

(ii) The precision and accuracy of the quantitation tests performed in this method are unknown. Concentrations are easier to determine in commercial products where asbestos was deliberately added because the amount is usually more than a few percent. An analyst's results can be "calibrated" against the known amounts added by the manufacturer. For geological samples, the degree of homogeneity affects the precision.

(iii) The performance of the method is analyst dependent. The analyst must choose carefully and not necessarily randomly the portions for analysis to assure that detection of asbestos occurs when it is present. For this reason, the analyst must have adequate training in sample preparation, and experience in the location and identification of asbestos in samples. This is usually accomplished through substantial on-the-job training as well as formal education in mineralogy and microscopy.

(e) Interferences

Any material which is long, thin, and small enough to be viewed under the microscope can be considered an interference for asbestos. There are literally hundreds of interferences in workplaces. The techniques described in this method are normally sufficient to eliminate the interferences. An analyst's success in eliminating the interferences depends on proper training.

Asbestos minerals belong to two mineral families: The serpentines and the amphiboles. In the serpentine family, the only common fibrous mineral is chrysotile. Occasionally, the mineral antigorite occurs in a fibril habit with morphology similar to the amphiboles. The amphibole minerals consist of a score of different minerals of which only five are regulated

by federal standard: Amosite, crocidolite, anthophyllite asbestos, tremolite asbestos and actinolite asbestos. These are the only amphibole minerals that have been commercially exploited for their fibrous properties; however, the rest can and do occur occasionally in asbestiform habit.

In addition to the related mineral interferences, other minerals common in building material may present a problem for some microscopists: Gypsum, anhydrite, brucite, quartz fibers, talc fibers or ribbons, wollastonite, perlite, attapulgite, etc. Other fibrous materials commonly present in workplaces are: Fiberglass, mineral wool, ceramic wool, refractory ceramic fibers, kevlar, nomex, synthetic fibers, graphite or carbon fibers, cellulose (paper or wood) fibers, metal fibers, etc.

Matrix embedding material can sometimes be a negative interference. The analyst may not be able to easily extract the fibers from the matrix in order to use the method. Where possible, remove the matrix before the analysis, taking careful note of the loss of weight. Some common matrix materials are: Vinyl, rubber, tar, paint, plant fiber, cement, and epoxy. A further negative interference is that the asbestos fibers themselves may be either too small to be seen in Phase Contrast Microscopy (PCM) or of a very low fibrous quality, having the appearance of plant fibers. The analyst's ability to deal with these materials increases with experience.

(f) Uses and Occupational Exposure

Asbestos is ubiquitous in the environment. More than 40% of the land area of the United States is composed of minerals which may contain asbestos. Fortunately, the actual formation of great amounts of asbestos is relatively rare. Nonetheless, there are locations in which environmental exposure can be severe such as in the Serpentine Hills of California.

There are thousands of uses for asbestos in industry and the home. Asbestos abatement workers are the most current segment of the population to have occupational exposure to great amounts of asbestos. If the material is undisturbed, there is no exposure. Exposure occurs when the asbestos-containing material is abraded or otherwise disturbed during maintenance operations or some other activity. Approximately 95% of the asbestos in place in the United States is chrysotile.

Amosite and crocidolite make up nearly all the difference. Tremolite and anthophyllite make up a very small percentage. Tremolite is found in extremely small amounts in certain chrysotile deposits. Actinolite exposure is probably greatest from environmental sources, but has been identified in vermiculite containing, sprayed-on insulating materials which may have been certified as asbestos-free.

(g) Physical and Chemical Properties

The nominal chemical compositions for the asbestos minerals were given in subsection (1). Compared to cleavage fragments of the same minerals, asbestiform fibers possess a high tensile strength along the fiber axis. They are chemically inert, noncombustible, and heat resistant. Except for chrysotile, they are insoluble in Hydrochloric acid (HCl). Chrysotile is slightly soluble in HCl. Asbestos has high electrical resistance and good sound absorbing characteristics. It can be woven into cables, fabrics or other textiles, or matted into papers, felts, and mats.

(h) Toxicology (This Section is for Information Only and Should Not Be Taken as WISHA Policy)

Possible physiologic results of respiratory exposure to asbestos are mesothelioma of the pleura or peritoneum, interstitial fibrosis, asbestosis, pneumoconiosis, or respiratory cancer. The possible consequences of asbestos exposure are detailed in the NIOSH Criteria Document or in the WISHA Asbestos Standards, WAC 296-62-077.

(2) Sampling Procedure

(a) Equipment for Sampling

- (i) Tube or cork borer sampling device
 - (ii) Knife
 - (iii) 20 mL scintillation vial or similar vial
 - (iv) Sealing encapsulant
- (b) Safety Precautions

Asbestos is a known carcinogen. Take care when sampling. While in an asbestos-containing atmosphere, a properly selected and fit-tested respirator should be worn. Take samples in a manner to cause the least amount of dust. Follow these general guidelines:

- (i) Do not make unnecessary dust.
- (ii) Take only a small amount (1 to 2 g).
- (iii) Tightly close the sample container.
- (iv) Use encapsulant to seal the spot where the sample was taken, if necessary.

(c) Sampling procedure

Samples of any suspect material should be taken from an inconspicuous place. Where the material is to remain, seal the sampling wound with an encapsulant to eliminate the potential for exposure from the sample site. Microscopy requires only a few milligrams of material. The amount that will fill a 20 mL scintillation vial is more than adequate. Be sure to collect samples from all layers and phases of material. If possible, make separate samples of each different phase of the material. This will aid in determining the actual hazard. DO NOT USE ENVELOPES, PLASTIC OR PAPER BAGS OF ANY KIND TO COLLECT SAMPLES. The use of plastic bags presents a contamination hazard to laboratory personnel and to other samples. When these containers are opened, a bellows effect blows fibers out of the container onto everything, including the person opening the container.

If a cork-borer type sampler is available, push the tube through the material all the way, so that all layers of material are sampled. Some samplers are intended to be disposable. These should be capped and sent to the laboratory. If a non-disposable cork borer is used, empty the contents into a scintillation vial and send to the laboratory. Vigorously and completely clean the cork borer between samples.

(d) Shipment

Samples packed in glass vials must not touch or they might break in shipment.

- (i) Seal the samples with a sample seal over the end to guard against tampering and to identify the sample.
- (ii) Package the bulk samples in separate packages from the air samples. They may cross-contaminate each other and will invalidate the results of the air samples.
- (iii) Include identifying paperwork with the samples, but not in contact with the suspected asbestos.

(iv) To maintain sample accountability, ship the samples by certified mail, overnight express, or hand carry them to the laboratory.

(3) Analysis

The analysis of asbestos samples can be divided into two major parts: Sample preparation and microscopy. Because of the different asbestos uses that may be encountered by the analyst, each sample may need different preparation steps. The choices are outlined below. There are several different tests that are performed to identify the asbestos species and determine the percentage. They will be explained below.

(a) Safety

(i) Do not create unnecessary dust. Handle the samples in HEPA-filter equipped hoods. If samples are received in bags, envelopes or other inappropriate container, open them only in a hood having a face velocity at or greater than 100 fpm. Transfer a small amount to a scintillation vial and only handle the smaller amount.

(ii) Open samples in a hood, never in the open lab area.

(iii) Index of refraction oils can be toxic. Take care not to get this material on the skin. Wash immediately with soap and water if this happens.

(iv) Samples that have been heated in the muffle furnace or the drying oven may be hot. Handle them with tongs until they are cool enough to handle.

(v) Some of the solvents used, such as THF (tetrahydrofuran), are toxic and should only be handled in an appropriate fume hood and according to instructions given in the Material Safety Data Sheet (MSDS).

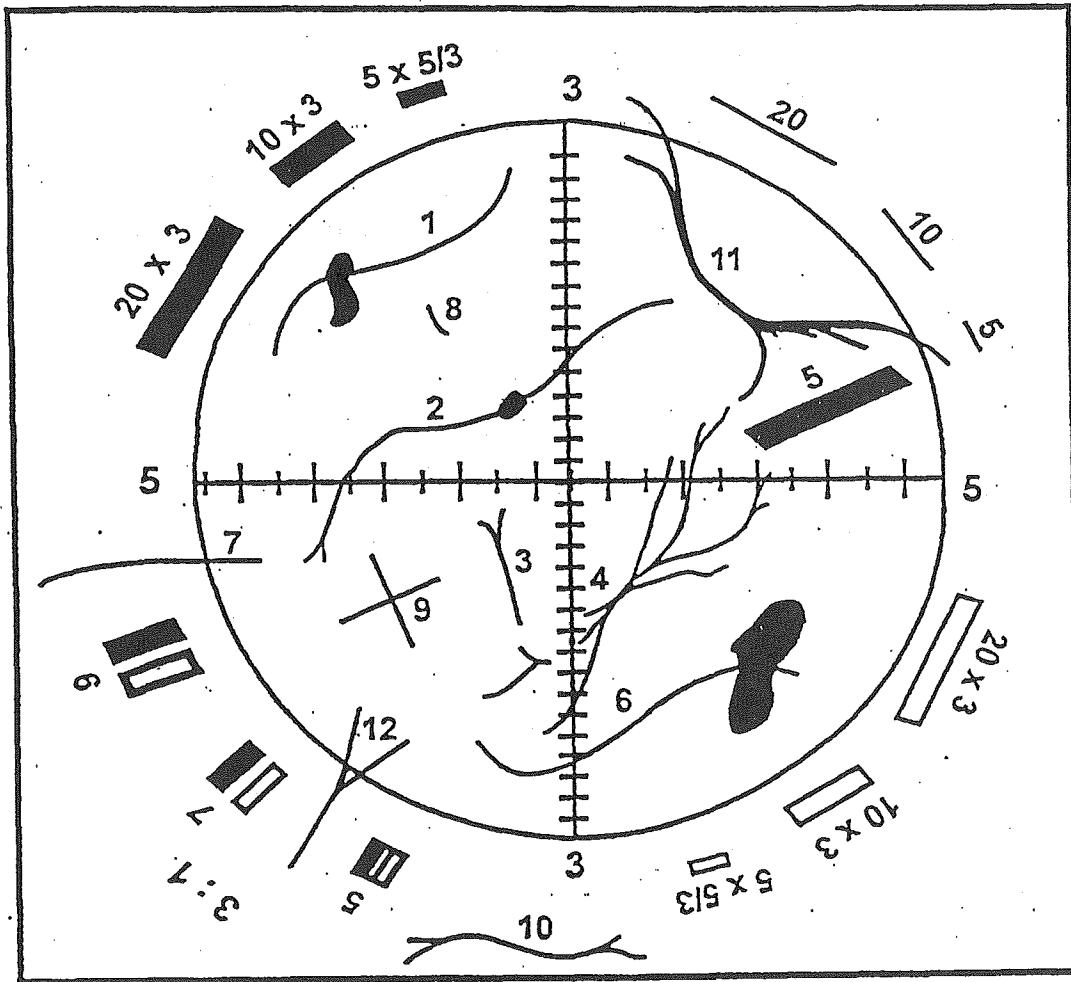


Figure 1: Walton-Beckett Graticule with some explanatory fibers.

Counts for the Fibers in the Figure

Structure No.	Count	Explanation
1 to 6	1	Single fibers all contained within the circle.
7	1/2	Fiber crosses circle once.
8	0	Fiber too short.
9	2	Two crossing fibers.
10	0	Fiber outside graticule.
11	0	Fiber crosses graticule twice.
12	1/2	Although split, fiber only crosses once.

(b) Equipment

(i) Phase contrast microscope with 10x, 16x and 40x objectives, 10x wide-field eyepieces, G-22 Walton-Beckett graticule, Whipple disk, polarizer, analyzer and first order red or gypsum plate, 100 Watt illuminator, rotating position condenser with oversize phase rings, central stop dispersion objective, Kohler illumination and a rotating mechanical stage. (See Figure 1).

(ii) Stereo microscope with reflected light illumination, transmitted light illumination, polarizer, analyzer and first order red or gypsum plate, and rotating stage.

(iii) Negative pressure hood for the stereo microscope

(iv) Muffle furnace capable of 600 degrees C

(v) Drying oven capable of 50-150 degrees C

(vi) Aluminum specimen pans

(vii) Tongs for handling samples in the furnace

(viii) High dispersion index of refraction oils (Special for dispersion staining.)

n = 1.550

n = 1.585

n = 1.590

n = 1.605

n = 1.620

n = 1.670

n = 1.680

n = 1.690

(ix) A set of index of refraction oils from about n = 1.350 to n = 2.000 in n = 0.005 increments. (Standard for Becke line analysis.)

(x) Glass slides with painted or frosted ends 1 x 3 inches 1mm thick, precleaned.

(xi) Cover Slips 22 x 22 mm, #1 1/2

- (xii) Paper clips or dissection needles
- (xiii) Hand grinder
- (xiv) Scalpel with both #10 and #11 blades
- (xv) 0.1 molar HCl
- (xvi) Decalcifying solution (Baxter Scientific Products)

Ethylenediaminetetraacetic Acid,

- (xvii) Tetrasodium....0.7 g/l
- Sodium Potassium Tartrate....8.0 mg/liter
- Hydrochloric Acid....99.2 g/liter
- Sodium Tartrate....0.14 g/liter
- Tetrahydrofuran (THF)

- (xviii) Hotplate capable of 60 degrees C

- (xix) Balance

- (xx) Hacksaw blade

- (xxi) Ruby mortar and pestle

(c) Sample Pre-Preparation

Sample preparation begins with pre-preparation which may include chemical reduction of the matrix, heating the sample to dryness or heating in the muffle furnace. The end result is a sample which has been reduced to a powder that is sufficiently fine to fit under the cover slip. Analyze different phases of samples separately, e.g., tile and the tile mastic should be analyzed separately as the mastic may contain asbestos while the tile may not.

(i) Wet Samples

Samples with a high water content will not give the proper dispersion colors and must be dried prior to sample mounting. Remove the lid of the scintillation vial, place the bottle in the drying oven and heat at 100 degrees C to dryness (usually about 2 h). Samples which are not submitted to the lab in glass must be removed and placed in glass vials or aluminum weighing pans before placing them in the drying oven.

(ii) Samples With Organic Interference-Muffle Furnace

These may include samples with tar as a matrix, vinyl asbestos tile, or any other organic that can be reduced by heating. Remove the sample from the vial and weigh in a balance to determine the weight of the submitted portion. Place the sample in a muffle furnace at 500 degrees C for 1 to 2 h or until all obvious organic material has been removed. Retrieve, cool and weigh again to determine the weight loss on ignition. This is necessary to determine the asbestos content of the submitted sample, because the analyst will be looking at a reduced sample.

Notes: Heating above 600 degrees C will cause the sample to undergo a structural change which, given sufficient time, will convert the chrysotile to forsterite. Heating even at lower temperatures for 1 to 2 h may have a measurable effect on the optical properties of the minerals. If the analyst is unsure of what to expect, a sample of standard asbestos should be heated to the same temperature for the same length of time so that it can be examined for the proper interpretation.

(iii) Samples With Organic Interference-THF

Vinyl asbestos tile is the most common material treated with this solvent, although, substances containing tar will sometimes yield to this treatment. Select a portion of the material and then grind it up if possible. Weigh the sample and place it in a test tube. Add sufficient THF to dissolve the organic matrix. This is usually about 4 to 5 mL. Remember, THF is highly flammable. Filter the remaining material through a tared silver membrane, dry and weigh to determine how much is left after the solvent extraction. Further process the sample to remove carbonate or mount directly.

(iv) Samples With Carbonate Interference

Carbonate material is often found on fibers and sometimes must be removed in order to perform dispersion

microscopy. Weigh out a portion of the material and place it in a test tube. Add a sufficient amount of 0.1 M HCl or decalcifying solution in the tube to react all the carbonate as evidenced by gas formation; i.e., when the gas bubbles stop, add a little more solution. If no more gas forms, the reaction is complete. Filter the material out through a tared reaction membrane, dry and weigh to determine the weight lost.

(d) Sample Preparation

Samples must be prepared so that accurate determination can be made of the asbestos type and amount present. The following steps are carried out in the low-flow hood (a low-flow hood has less than 50 fpm flow):

(i) If the sample has large lumps, is hard, or cannot be made to lie under a cover slip, the grain size must be reduced. Place a small amount between two slides and grind the material between them or grind a small amount in a clean mortar and pestle. The choice of whether to use an alumina, ruby, or diamond mortar depends on the hardness of the material. Impact damage can alter the asbestos mineral if too much mechanical shock occurs. (Freezer mills can completely destroy the observable crystallinity of asbestos and should not be used). For some samples, a portion of material can be shaved off with a scalpel, ground off with a hand grinder or hacksaw blade.

The preparation tools should either be disposable or cleaned thoroughly. Use vigorous scrubbing to loosen the fibers during the washing. Rinse the implements with copious amounts of water and air-dry in a dust-free environment.

(ii) If the sample is powder or has been reduced as in (i) above, it is ready to mount. Place a glass slide on a piece of optical tissue and write the identification on the painted or frosted end. Place two drops of index of refraction medium $n = 1.550$ on the slide. (The medium $n = 1.550$ is chosen because it is the matching index for chrysotile.) Dip the end of a clean paper-clip or dissecting needle into the droplet of refraction medium on the slide to moisten it. Then dip the probe into the powder sample. Transfer what sticks on the probe to the slide. The material on the end of the probe should have a diameter of about 3 mm for a good mount. If the material is very fine, less sample may be appropriate. For nonpowder samples such as fiber mats, forceps should be used to transfer a small amount of material to the slide. Stir the material in the medium on the slide, spreading it out and making the preparation as uniform as possible. Place a cover-slip on the preparation by gently lowering onto the slide and allowing it to fall "trapdoor" fashion on the preparation to push out any bubbles. Press gently on the cover slip to even out the distribution of particulate on the slide. If there is insufficient mounting oil on the slide, one or two drops may be placed near the edge of the coverslip on the slide. Capillary action will draw the necessary amount of liquid into the preparation. Remove excess oil with the point of a laboratory wiper.

Treat at least two different areas of each phase in this fashion. Choose representative areas of the sample. It may be useful to select particular areas or fibers for analysis. This is useful to identify asbestos in severely inhomogeneous samples.

When it is determined that amphiboles may be present, repeat the above process using the appropriate high-dispersion oils until an identification is made or all six asbestos minerals have been ruled out. Note that percent determination must be done in the index medium 1.550 because amphiboles tend to disappear in their matching mediums.

(e) Analytical procedure

Note: This method presumes some knowledge of mineralogy and optical petrography.

The analysis consists of three parts: The determination of whether there is asbestos present, what type is present and the determination of how much is present. The general flow of the analysis is:

(i) Gross examination.

(ii) Examination under polarized light on the stereo microscope.

(iii) Examination by phase-polar illumination on the compound phase microscope.

(iv) Determination of species by dispersion stain. Examination by Becke line analysis may also be used; however, this is usually more cumbersome for asbestos determination.

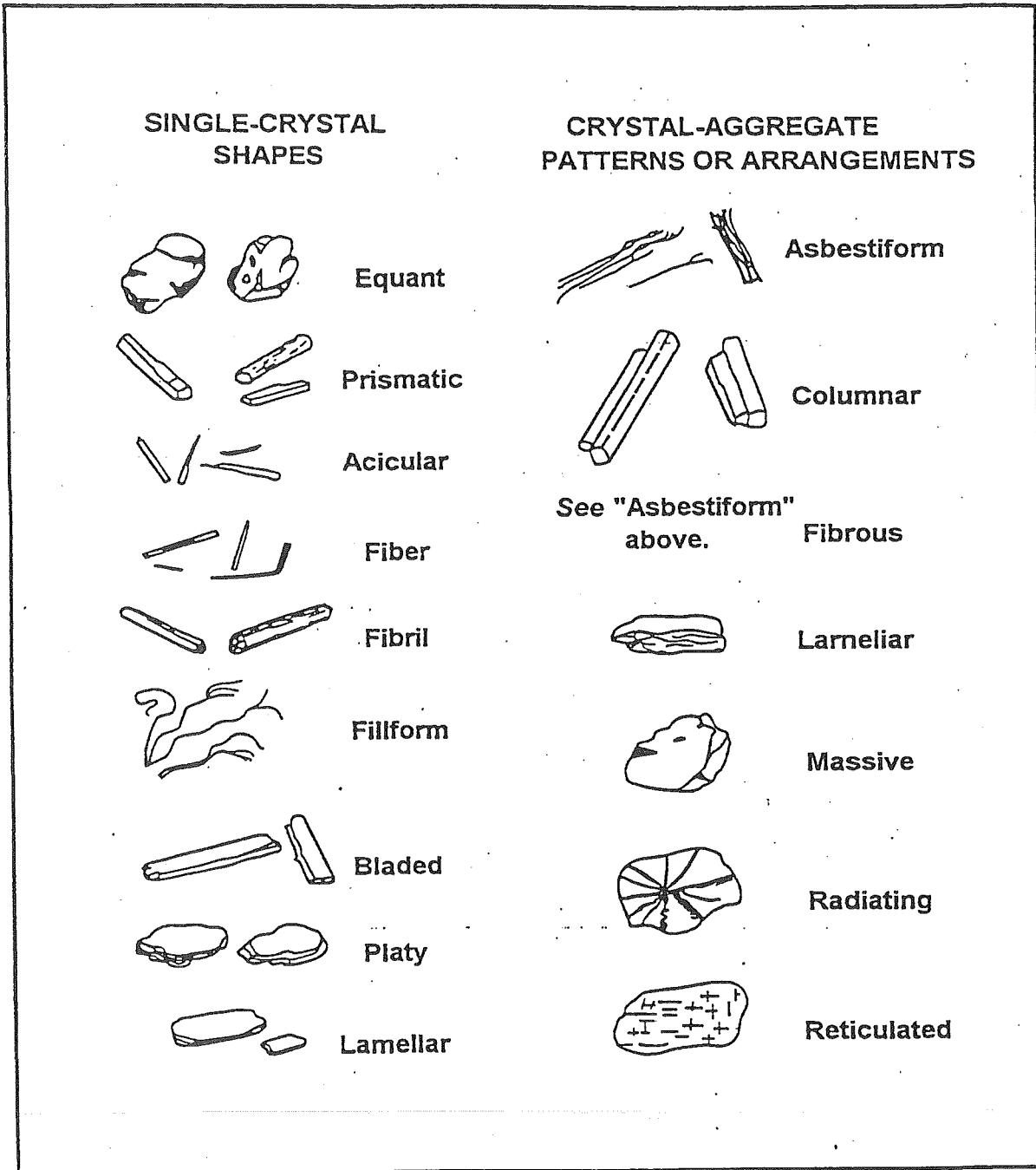


Figure 1. Particle definitions showing mineral growth habits.
From the U.S. Bureau of Mines.

(v) Difficult samples may need to be analyzed by SEM or TEM, or the results from those techniques combined with light microscopy for a definitive identification. Identification of a particle as asbestos requires that it be asbestiform. Description of particles should follow the suggestion of Campbell. (Figure 2)

For the purpose of regulation, the mineral must be one of the six minerals covered and must be in the asbestos growth habit. Large specimen samples of asbestos generally have the gross appearance of wood. Fibers are easily parted from it. Asbestos fibers are very long compared with their widths. The fibers have a very high tensile strength as demonstrated by bending without breaking. Asbestos fibers exist in bundles that are easily parted, show longitudinal fine structure and may be tufted at the ends showing "bundle of sticks" morphology. In the microscope some of these properties may not be observable. Amphiboles do not always show striations along their length even when they are asbestos. Neither will they always show tufting. They generally do not show a curved nature except for very long fibers. Asbestos and asbestiform minerals are usually characterized in groups by extremely high aspect ratios (greater than 100:1). While aspect ratio analysis is useful for characterizing populations of fibers, it cannot be used to identify individual fibers of intermediate to short aspect ratio. Observation of many fibers is often necessary to determine whether a sample consists of "cleavage fragments" or of asbestos fibers.

Most cleavage fragments of the asbestos minerals are easily distinguishable from true asbestos fibers. This is because true cleavage fragments usually have larger diameters than 1 micron. Internal structure of particles larger than this usually shows them to have no internal fibrillar structure. In addition, cleavage fragments of the monoclinic amphiboles show inclined extinction under crossed polars with no compensator. Asbestos fibers usually show extinction at zero degrees or ambiguous extinction if any at all. Morphologically, the larger cleavage fragments are obvious by their blunt or stepped ends showing prismatic habit. Also, they tend to be acicular rather than filiform.

Where the particles are less than 1 micron in diameter and have an aspect ratio greater than or equal to 3:1, it is recommended that the sample be analyzed by SEM or TEM if there is any question whether the fibers are cleavage fragments or asbestiform particles.

Care must be taken when analyzing by electron microscopy because the interferences are different from those in light microscopy and may structurally be very similar to asbestos. The classic interference is between anthophyllite and biopyribole or intermediate fiber. Use the same morphological clues for electron microscopy as are used for light microscopy, e.g. fibril splitting, internal longitudinal striation, fraying, curvature, etc.

(vi) Gross examination:

Examine the sample, preferably in the glass vial. Determine the presence of any obvious fibrous component. Estimate a percentage based on previous experience and current observation. Determine whether any pre-preparation is necessary. Determine the number of phases present. This step may be carried out or augmented by observation at 6x to 40x under a stereo microscope.

(vii) After performing any necessary pre-preparation, prepare slides of each phase as described above. Two preparations of the same phase in the same index medium can be made side-by-side on the same glass for convenience. Examine with the polarizing stereo microscope. Estimate the percentage of asbestos based on the amount of birefringent fiber present.

(viii) Examine the slides on the phase-polar microscopes at magnifications of 160x and 400x. Note the morphology of the fibers. Long, thin, very straight fibers with little curvature are indicative of fibers from the amphibole family. Curved, wavy fibers are usually indicative of chrysotile. Estimate the percentage of asbestos on the phase-polar microscope under conditions of crossed polars and a gypsum plate. Fibers smaller than 1.0 microns in thickness must be identified by inference to the presence of larger, identifiable fibers and morphology. If no larger fibers are visible, electron microscopy should be performed. At this point, only a tentative identification can be made. Full identification must be made with dispersion microscopy. Details of the tests are included in the appendices.

(ix) Once fibers have been determined to be present, they must be identified. Adjust the microscope for dispersion mode and observe the fibers. The microscope has a rotating stage, one polarizing element, and a system for generating dark-field dispersion microscopy (see subsection (4)(f) of this appendix). Align a fiber with its length parallel to the polarizer and note the color of the Becke lines. Rotate the stage to bring the fiber length perpendicular to the polarizer and note the color. Repeat this process for every fiber or fiber bundle examined. The colors must be consistent with the colors generated by standard asbestos reference materials for a positive identification. In $n=1.550$, amphiboles will generally show a yellow to straw-yellow color indicating that the fiber indices of refraction are higher than the liquid. If long, thin fibers are noted and the colors are yellow, prepare further slides as above in the suggested matching liquids listed below:

Type of asbestos	Index of refraction
Chrysotile	$n = 1.550$.
Amosite	$n = 1.670$ or 1.680 .
Crocidolite	$n = 1.690$.
Anthophyllite	$n = 1.605$ and 1.620 .
Tremolite	$n = 1.605$ and 1.620 .
Actinolite	$n = 1.620$.

Where more than one liquid is suggested, the first is preferred; however, in some cases this liquid will not give good dispersion color. Take care to avoid interferences in the other liquid; e.g., wollastonite in $n = 1.620$ will give the same colors as tremolite. In $n = 1.605$ wollastonite will appear yellow in all directions. Wollastonite may be determined under crossed polars as it will change from blue to yellow as it is rotated along its fiber axis by tapping on the cover slip. Asbestos minerals will not change in this way.

Determination of the angle of extinction may, when present, aid in the determination of anthophyllite from tremolite. True asbestos fibers usually have 0 degree extinction or ambiguous extinction, while cleavage fragments have more definite extinction.

Continue analysis until both preparations have been examined and all present species of asbestos are identified. If there are no fibers present, or there is less than 0.1% present, end the analysis with the minimum number of slides (2).

(x) Some fibers have a coating on them which makes dispersion microscopy very difficult or impossible. Becke line analysis or electron microscopy may be performed in those cases. Determine the percentage by light microscopy. TEM analysis tends to overestimate the actual percentage present.

(xi) Percentage determination is an estimate of occluded area, tempered by gross observation. Gross observation information is used to make sure that the high magnification microscopy does not greatly over- or under-estimate the amount of fiber present. This part of the analysis requires a great deal of experience. Satisfactory models for asbestos content analysis have not yet been developed, although some models based on metallurgical grain-size determination have found some utility. Estimation is more easily handled in situations where the grain sizes visible at about 160x are about the same and the sample is relatively homogeneous.

View all of the area under the cover slip to make the percentage determination. View the fields while moving the stage, paying attention to the clumps of material. These are not usually the best areas to perform dispersion microscopy because of the interference from other materials. But, they are the areas most likely to represent the accurate percentage in the sample. Small amounts of asbestos require slower scanning and more frequent analysis of individual fields.

Report the area occluded by asbestos as the concentration. This estimate does not generally take into consideration the difference in density of the different species present in the sample. For most samples this is adequate. Simulation studies with similar materials must be carried out to apply microvisual estimation for that purpose and is beyond the scope of this procedure.

(xii) Where successive concentrations have been made by chemical or physical means, the amount reported is the percentage of the material in the "as submitted" or original state. The percentage determined by microscopy is multiplied by the fractions remaining after pre-preparation steps to give the percentage in the original sample. For example:

Step 1. 60% remains after heating at 550 degrees C for 1 h.

Step 2. 30% of the residue of step 1 remains after dissolution of carbonate in 0.1 m HCl.

Step 3. Microvisual estimation determines that 5% of the sample is chrysotile asbestos.

The reported result is:

$$R = (\text{Microvisual result in percent}) \times (\text{Fraction remaining after step 2}) \times (\text{Fraction remaining of original sample after step 1})$$

$$R = (5) \times (.30) \times (.60) = 0.9\%$$

(xiii) Report the percent and type of asbestos present. For samples where asbestos was identified, but is less than 1.0%, report "Asbestos present, less than 1.0%." There must have been at least two observed fibers or fiber bundles in the two preparations to be reported as present. For samples where asbestos was not seen, report as "None Detected."

(4) Auxiliary Information

Because of the subjective nature of asbestos analysis, certain concepts and procedures need to be discussed in more depth. This information will help the analyst understand why some of the procedures are carried out the way they are.

(a) Light

Light is electromagnetic energy. It travels from its source in packets called quanta. It is instructive to consider light as a plane wave. The light has a direction of travel. Perpendicular to this and mutually perpendicular to each other, are two vector components. One is the magnetic vector and the other is the electric vector. We shall only be concerned with the electric vector. In this description, the interaction of the vector and the mineral will describe all the observable phenomena. From a light source such a microscope illuminator, light travels in all different direction from the filament.

In any given direction away from the filament, the electric vector is perpendicular to the direction of travel of a light ray. While perpendicular, its orientation is random about the travel axis. If the electric vectors from all the light rays were lined up by passing the light through a filter that would only let light rays with electric vectors oriented in one direction pass, the light would then be POLARIZED.

Polarized light interacts with matter in the direction of the electric vector. This is the polarization direction. Using this property it is possible to use polarized light to probe different materials and identify them by how they interact with light. The speed of light in a vacuum is a constant at about 2.99×10^8 m/s. When light travels in different materials such as air, water, minerals or oil, it does not travel at this speed. It travels slower. This slowing is a function of both the material through which the light is traveling and the wavelength or frequency of the light. In general, the more dense the material, the slower the light travels. Also, generally, the higher the frequency, the slower the light will travel. The ratio of the speed of light in a vacuum to that in a material is called the index of refraction (n). It is usually measured at 589 nm (the sodium D line). If white light (light containing all the visible wavelengths) travels through a material, rays of longer wavelengths will travel faster than those of shorter wavelengths, this separation is called dispersion. Dispersion is used as an identifier of materials as described in Section (4)(f).

(b) Material Properties

Materials are either amorphous or crystalline. The difference between these two descriptions depends on the positions of the atoms in them. The atoms in amorphous materials are randomly arranged with no long range order. An example of an amorphous material is glass. The atoms in crystalline materials, on the other hand, are in regular arrays and have long range order. Most of the atoms can be found in highly predictable locations. Examples of crystalline material are salt, gold, and the asbestos minerals.

It is beyond the scope of this method to describe the different types of crystalline materials that can be found, or the full description of the classes into which they can fall. However, some general crystallography is provided below to give a foundation to the procedures described.

With the exception of anthophyllite, all the asbestos minerals belong to the monoclinic crystal type. The unit cell is the basic repeating unit of the crystal and for monoclinic crystals can be described as having three unequal sides, two

90 degree angles and one angle not equal to 90 degrees. The orthorhombic group, of which anthophyllite is a member has three unequal sides and three 90 degree angles. The unequal sides are a consequence of the complexity of fitting the different atoms into the unit cell. Although the atoms are in a regular array, that array is not symmetrical in all directions. There is long range order in the three major directions of the crystal. However, the order is different in each of the three directions. This has the effect that the index of refraction is different in each of the three directions. Using polarized light, we can investigate the index of refraction in each of the directions and identify the mineral or material under investigation. The indices alpha, beta, and gamma are used to identify the lowest, middle, and highest index of refraction respectively. The x direction, associated with alpha is called the fast axis. Conversely, the z direction is associated with gamma and is the slow direction. Crocidolite has alpha along the fiber length making it "length-fast." The remainder of the asbestos minerals have the gamma axis along the fiber length. They are called "length-slow." This orientation to fiber length is used to aid in the identification of asbestos.

(c) Polarized Light Technique

Polarized light microscopy as described in this section uses the phase-polar microscope described in Section (3)(b). A phase contrast microscope is fitted with two polarizing elements, one below and one above the sample. The polarizers have their polarization directions at right angles to each other. Depending on the tests performed, there may be a compensator between these two polarizing elements. Light emerging from a polarizing element has its electric vector pointing in the polarization direction of the element. The light will not be subsequently transmitted through a second element set at a right angle to the first element. Unless the light is altered as it passes from one element to the other, there is no transmission of light.

(d) Angle of Extinction

Crystals which have different crystal regularity in two or three main directions are said to be anisotropic. They have a different index of refraction in each of the main directions. When such a crystal is inserted between the crossed polars, the field of view is no longer dark but shows the crystal in color. The color depends on the properties of the crystal. The light acts as if it travels through the crystal along the optical axes. If a crystal optical axis were lined up along one of the polarizing directions (either the polarizer or the analyzer) the light would appear to travel only in that direction, and it would blink out or go dark. The difference in degrees between the fiber direction and the angle at which it blinks out is called the angle of extinction. When this angle can be measured, it is useful in identifying the mineral. The procedure for measuring the angle of extinction is to first identify the polarization direction in the microscope. A commercial alignment slide can be used to establish the polarization directions or use anthophyllite or another suitable mineral. This mineral has a zero degree angle of extinction and will go dark to extinction as it aligns with the polarization directions. When a fiber of anthophyllite has gone to extinction, align the eyepiece reticle or graticule with the fiber so that there is a visual cue as to the direction of polarization in the field of

view. Tape or otherwise secure the eyepiece in this position so it will not shift.

After the polarization direction has been identified in the field of view, move the particle of interest to the center of the field of view and align it with the polarization direction. For fibers, align the fiber along this direction. Note the angular reading of the rotating stage. Looking at the particle, rotate the stage until the fiber goes dark or "blinks out." Again note the reading of the stage. The difference in the first reading and the second is an angle of extinction.

The angle measured may vary as the orientation of the fiber changes about its long axis. Tables of mineralogical data usually report the maximum angle of extinction. Asbestos forming minerals, when they exhibit an angle of extinction, usually do show an angle of extinction close to the reported maximum, or as appropriate depending on the substitution chemistry.

(e) Crossed Polars With Compensator

When the optical axes of a crystal are not lined up along one of the polarizing directions (either the polarizer or the analyzer) part of the light travels along one axis and part travels along the other visible axis. This is characteristic of birefringent materials.

The color depends on the difference of the two visible indices of refraction and the thickness of the crystal. The maximum difference available is the difference between the alpha and the gamma axes. This maximum difference is usually tabulated as the birefringence of the crystal.

For this test, align the fiber at 45 degrees to the polarization directions in order to maximize the contribution to each of the optical axes. The colors seen are called retardation colors. They arise from the recombination of light which has traveled through the two separate directions of the crystal. One of the rays is retarded behind the other since the light in that direction travels slower. On recombination, some of the colors which make up white light are enhanced by constructive interference and some are suppressed by destructive interference. The result is a color dependent on the difference between the indices and the thickness of the crystal. The proper colors, thicknesses, and retardations are shown on a Michel-Levy chart. The three items, retardation, thickness and birefringence are related by the following relationship: Lambda

$$R = t (n_{\gamma} - \alpha)$$

R = retardation, t = crystal thickness in micron, and alpha, gamma = indices of refraction.

Examination of the equation for asbestos minerals reveals that the visible colors for almost all common asbestos minerals and fiber sizes are shades of gray and black. The eye is relatively poor at discriminating different shades of gray. It is very good at discriminating different colors. In order to compensate for the low retardation, a compensator is added to the light train between the polarization elements. The compensator used for this test is a gypsum plate of known thickness and birefringence. Such a compensator when oriented at 45 degrees to the polarizer direction, provides a retardation of 530 nm of the 530 nm wavelength color. This enhances the red color and gives the background a characteristic red to red-magenta color. If this "full-wave" compensator is in place

when the asbestos preparation is inserted into the light train, the colors seen on the fibers are quite different. Gypsum, like asbestos has a fast axis and a slow axis. When a fiber is aligned with its fast axis in the same direction as the fast axis of the gypsum plate, the ray vibrating in the slow direction is retarded by both the asbestos and the gypsum. This results in a higher retardation than would be present for either of the two minerals. The color seen is a second order blue. When the fiber is rotated 90 degrees using the rotating stage, the slow direction of the fiber is now aligned with the fast direction of the gypsum and the fast direction of the fiber is aligned with the slow direction of the gypsum. Thus, one ray vibrates faster in the fast direction of the gypsum, and slower in the slow direction of the fiber; the other ray will vibrate slower in the slow direction of the gypsum and faster in the fast direction of the fiber. In this case, the effect is subtractive and the color seen is a first order yellow. As long as the fiber thickness does not add appreciably to the color, the same basic colors will be seen for all asbestos types except crocidolite. In crocidolite the colors will be weaker, may be in the opposite directions, and will be altered by the blue absorption color natural to crocidolite. Hundreds of other materials will give the same colors as asbestos, and therefore, this test is not definitive for asbestos. The test is useful in discriminating against fiberglass or other amorphous fibers such as some synthetic fibers. Certain synthetic fibers will show retardation colors different than asbestos; however, there are some forms of polyethylene and aramid which will show morphology and retardation colors similar to asbestos minerals. This test must be supplemented with a positive identification test when birefringent fibers are present which can not be excluded by morphology. This test is relatively ineffective for use on fibers less than 1 micron in diameter. For positive confirmation TEM or SEM should be used if no larger bundles or fibers are visible.

(f) Dispersion Staining

Dispersion microscopy or dispersion staining is the method of choice for the identification of asbestos in bulk materials. Becke line analysis is used by some laboratories and yields the same results as does dispersion staining for asbestos and can be used in lieu of dispersion staining. Dispersion staining is performed on the same platform as the phase-polar analysis with the analyzer and compensator removed. One polarizing element remains to define the direction of the light so that the different indices of refraction of the fibers may be separately determined. Dispersion microscopy is a dark-field technique when used for asbestos. Particles are imaged with scattered light. Light which is unscattered is blocked from reaching the eye either by the back field image mask in a McCrone objective or a back field image mask in the phase condenser. The most convenient method is to use the rotating phase condenser to move an oversized phase ring into place. The ideal size for this ring is for the central disk to be just larger than the objective entry aperture as viewed in the back focal plane. The larger the disk, the less scattered light reaches the eye. This will have the effect of diminishing the intensity of dispersion color and will shift the actual color seen. The colors seen vary even on microscopes from the same manufacturer. This is due to the different bands of wavelength exclusion by different mask sizes. The

mask may either reside in the condenser or in the objective back focal plane. It is imperative that the analyst determine by experimentation with asbestos standards what the appropriate colors should be for each asbestos type. The colors depend also on the temperature of the preparation and the exact chemistry of the asbestos. Therefore, some slight differences from the standards should be allowed. This is not a serious problem for commercial asbestos uses. This technique is used for identification of the indices of refraction for fibers by recognition of color. There is no direct numerical readout of the index of refraction. Correlation of color to actual index of refraction is possible by referral to published conversion tables. This is not necessary for the analysis of asbestos. Recognition of appropriate colors along with the proper morphology are deemed sufficient to identify the commercial asbestos minerals. Other techniques including SEM, TEM, and XRD may be required to provide additional information in order to identify other types of asbestos.

Make a preparation in the suspected matching high dispersion oil, e.g., $n=1.550$ for chrysotile. Perform the preliminary tests to determine whether the fibers are birefringent or not. Take note of the morphological character. Wavy fibers are indicative of chrysotile while long, straight, thin, frayed fibers are indicative of amphibole asbestos. This can aid in the selection of the appropriate matching oil. The microscope is set up and the polarization direction is noted as in Section (4)(d). Align a fiber with the polarization direction. Note the color. This is the color parallel to the polarizer. Then rotate the fiber rotating the stage 90 degrees so that the polarization direction is across the fiber. This is the perpendicular position. Again note the color. Both colors must be consistent with standard asbestos minerals in the correct direction for a positive identification of asbestos. If only one of the colors is correct while the other is not, the identification is not positive. If the colors in both directions are bluish-white, the analyst has chosen a matching index oil which is higher than the correct matching oil, e.g. the analyst has used $n=1.620$ where chrysotile is present. The next lower oil (Section (3)(e)) should be used to prepare another specimen. If the color in both directions is yellow-white to straw-yellow-white, this indicates that the index of the oil is lower than the index of the fiber, e.g. the preparation is in $n=1.550$ while anthophyllite is present. Select the next higher oil (Section (3)(e)) and prepare another slide. Continue in this fashion until a positive identification of all asbestos species present has been made or all possible asbestos species have been ruled out by negative results in this test. Certain plant fibers can have similar dispersion colors as asbestos. Take care to note and evaluate the morphology of the fibers or remove the plant fibers in preparation. Coating material on the fibers such as carbonate or vinyl may destroy the dispersion color. Usually, there will be some outcropping of fiber which will show the colors sufficient for identification. When this is not the case, treat the sample as described in Section (3)(c) and then perform dispersion staining. Some samples will yield to Becke line analysis if they are coated or electron microscopy can be used for identification.

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WAC 296-62-07755 Appendix K—Smoking cessation program information for asbestos, tremolite, anthophyllite, and actinolite—Nonmandatory. The following organizations provide smoking cessation information and program material:

(1) The National Cancer Institute operates a toll-free Cancer Information Service (CIS) with trained personnel to help you. Call 1-800-4-CANCER* to reach the CIS office serving your area, or write: Office of Cancer Communications, National Cancer Institute, National Institutes of Health, Building 31, Room 10A24, Bethesda, Maryland 20892.

(2) American Cancer Society, 3340 Peachtree Road, N.E., Atlanta, Georgia 30062, (404) 320-3333. The American Cancer Society (ACS) is a voluntary organization composed of 58 divisions and 3,100 local units. Through "The Great American Smokeout" in November, the annual Cancer Crusade in April, and numerous educational materials, ACS helps people learn about the health hazards of smoking and become successful ex-smokers.

(3) American Heart Association, 7320 Greenville Avenue, Dallas, Texas 75231, (214) 750-5300. The American Heart Association (AHA) is a voluntary organization with 130,000 members (physicians, scientists, and laypersons) in 55 states and regional groups. AHA produces a variety of publications and audiovisual materials about the effects of smoking on the heart. AHA also has developed a guidebook for incorporating a weight-control component into smoking cessation programs.

(4) American Lung Association, 1740 Broadway, New York, New York 10019, (212) 245-8000. A voluntary organization of 7,500 members (physicians, nurses, and laypersons), the American Lung Association (ALA) conducts numerous public information programs about the health effect of smoking. ALA has 59 state and 85 local units. The organization actively supports legislation and information campaigns for nonsmokers' rights and provides help for smokers who want to quit, for example, through "Freedom From Smoking," a self-help smoking cessation program.

(5) Office on Smoking and Health, United States Department of Health and Human Services, 5600 Fishers Lane, Park Building, Room 110, Rockville, Maryland 20857. The Office on Smoking and Health (OSH) is the Department of Health and Human Services' lead agency in smoking control. OSH has sponsored distribution of publications on smoking-related topics, such as free flyers on relapse after initial quitting, helping a friend or family member quit smoking, the health hazards of smoking, and the effects of parental smoking on teenagers.

*In Hawaii, on Oahu call 524-1234 (call collect from neighboring islands), Spanish-speaking staff members are available during daytime hours to callers from the following areas: California, Florida, Georgia, Illinois, New Jersey (area code 210), New York, and Texas. Consult your local telephone directory for listings of local chapters.

[Statutory Authority: Chapter 49.17 RCW. 91-03-044 (Order 90-18), § 296-62-07755, filed 1/10/91, effective 2/12/91.]

PART J—BIOLOGICAL AGENTS

WAC 296-62-080 Biological agents. (1) Definition. Biological agents are organisms or their by-products.

(2) Protection from exposure. Workmen shall be protected from exposure to hazardous concentrations of biological agents which may arise from processing, handling or using materials or waste.

[Order 73-3, § 296-62-080, filed 5/7/73; Order 70-8, § 296-62-080, filed 7/31/70, effective 9/1/70; Rule 8.010, effective 8/1/63.]

WAC 296-62-08001 Bloodborne pathogens. (1) Scope and application. This section applies to all occupational exposure to blood or other potentially infectious materials as defined by subsection (2) of this section.

(2) Definitions. For purposes of this section, the following shall apply:

"Blood" means human blood, human blood components, and products made from human blood.

"Bloodborne pathogens" means pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).

"Clinical laboratory" means a workplace where diagnostic or other screening procedures are performed on blood or other potentially infectious materials.

"Contaminated" means the presence or the reasonably anticipated presence of blood or other potentially infectious materials on an item or surface.

"Contaminated laundry" means laundry which has been soiled with blood or other potentially infectious materials or may contain contaminated sharps.

"Contaminated sharps" means any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

"Decontamination" means the use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use, or disposal.

"Director" means the director of the Washington state department of labor and industries; the state designee for the Washington state plan.

"Engineering controls" means controls (e.g., sharps disposal containers, self-sheathing needles) that isolate or remove the bloodborne pathogens hazard from the workplace.

"Exposure incident" means a specific eye, mouth, other mucous membrane, nonintact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.

"Handwashing facilities" means a facility providing an adequate supply of running potable water, soap and single use towels or hot air drying machines.

"Licensed healthcare professional" is a person whose legally permitted scope of practice allows him or her to inde-

pendently perform the activities required by subsection (6) of this section, entitled Hepatitis B vaccination and post-exposure evaluation and follow-up.

"HBV" means hepatitis B virus.

"HIV" means human immunodeficiency virus.

"Occupational exposure" means reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of an employee's duties.

"Other potentially infectious materials" means:

(a) The following human body fluids: Semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, any body fluid that is visibly contaminated with blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids;

(b) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and

(c) HIV-containing cell or tissue cultures, organ cultures, and HIV- or HBV-containing culture medium or other solutions; and blood, organs, or other tissues from experimental animals infected with HIV or HBV.

"Parenteral" means piercing mucous membranes or the skin barrier through such events as needlesticks, human bites, cuts, and abrasions.

"Personal protective equipment" is specialized clothing or equipment worn by an employee for protection against a hazard. General work clothes (e.g., uniforms, pants, shirts, or blouses) not intended to function as protection against a hazard are not considered to be personal protective equipment.

"Production facility" means a facility engaged in industrial-scale, large-volume or high concentration production of HIV or HBV.

"Regulated waste" means liquid or semi-liquid blood or other potentially infectious materials; contaminated items that would release blood or other potentially infectious materials in a liquid or semi-liquid state if compressed; items that are caked with dried blood or other potentially infectious materials and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or other potentially infectious materials.

"Research laboratory" means a laboratory producing or using research-laboratory-scale amounts of HIV or HBV. Research laboratories may produce high concentrations of HIV or HBV but not in the volume found in production facilities.

"Source individual" means any individual, living or dead, whose blood or other potentially infectious materials may be a source of occupational exposure to the employee. Examples include, but are not limited to, hospital and clinic patients; clients in institutions for the developmentally disabled; trauma victims; clients of drug and alcohol treatment facilities; residents of hospices and nursing homes; human remains; and individuals who donate or sell blood or blood components.

"Sterilize" means the use of a physical or chemical procedure to destroy all microbial life including highly resistant bacterial endospores.

"Universal precautions" are an approach to infection control. According to the concept of universal precautions, all human blood and certain human body fluids are treated as if known to be infectious for HIV, HBV, and other blood-borne pathogens.

"Work practice controls" means controls that reduce the likelihood of exposure by altering the manner in which a task is performed (e.g., prohibiting recapping of needles by a two-handed technique).

(3) Exposure control.

(a) Exposure control plan.

(i) Each employer having an employee(s) with occupational exposure as defined by subsection (2) of this section shall establish a written exposure control plan designed to eliminate or minimize employee exposure.

(ii) The exposure control plan shall contain at least the following elements:

(A) The exposure determination required by (b) of this subsection;

(B) The schedule and method of implementation for subsection (4) of this section, Methods of compliance; subsection (5) of this section, HIV and HBV research laboratories and production facilities; subsection (6) of this section, Hepatitis B vaccination and post-exposure evaluation and follow-up; subsection (7) of this section, Communication of hazards to employees; and subsection (8) of this section, Recordkeeping; and

(C) The procedure for the evaluation of circumstances surrounding exposure incidents as required by subsection (6)(c)(i) of this section.

(iii) Each employer shall ensure that a copy of the exposure control plan is accessible to employees in accordance with WAC 296-62-05209.

(iv) The exposure control plan shall be reviewed and updated at least annually, and whenever necessary to reflect new or modified tasks and procedures which affect occupational exposure, and to reflect new or revised employee positions with occupational exposure.

(v) The exposure control plan shall be made available to the director upon request for examination and copying.

(b) Exposure determination.

(i) Each employer who has an employee(s) with occupational exposure as defined by subsection (2) of this section shall prepare an exposure determination. This exposure determination shall contain the following:

(A) A list of all job classifications in which all employees in those job classifications have occupational exposure;

(B) A list of job classifications in which some employees have occupational exposure; and

(C) A list of all tasks and procedures or groups of closely related tasks and procedures in which occupational exposure occurs, and that are performed by employees in job classifications listed in accordance with the provisions of (b)(i)(B) of this subsection.

(ii) This exposure determination shall be made without regard to the use of personal protective equipment.

(4) Methods of compliance.

(a) General. Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. Under circumstances in which differentiation

between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

(b) Engineering and work practice controls.

(i) Engineering and work practice controls shall be used to eliminate or minimize employee exposure. Where occupational exposure remains after institution of these controls, personal protective equipment shall also be used.

(ii) Engineering controls shall be examined and maintained or replaced on a regular schedule to ensure their effectiveness.

(iii) Employers shall provide handwashing facilities which are readily accessible to employees.

(iv) When provision of handwashing facilities is not feasible, the employer shall provide either an appropriate anti-septic hand cleanser in conjunction with clean cloth/paper towels or antiseptic towelettes. When antiseptic hand cleansers or towelettes are used, hands shall be washed with soap and running water as soon as feasible.

(v) Employers shall ensure that employees wash their hands immediately or as soon as feasible after removal of gloves or other personal protective equipment.

(vi) Employers shall ensure that employees wash hands and any other skin with soap and water, or flush mucous membranes with water immediately or as soon as feasible following contact of such body areas with blood or other potentially infectious materials.

(vii) Contaminated needles and other contaminated sharps shall not be bent, recapped, or removed except as noted in (b)(vii)(A) and (B) of this subsection. Shearing or breaking of contaminated needles is prohibited.

(A) Contaminated needles and other contaminated sharps shall not be bent, recapped or removed unless the employer can demonstrate that no alternative is feasible or that such action is required by a specific medical or dental procedure.

(B) Such bending, recapping or needle removal must be accomplished through the use of a mechanical device or a one-handed technique.

(viii) Immediately or as soon as possible after use, contaminated reusable sharps shall be placed in appropriate containers until properly reprocessed. These containers shall be:

(A) Puncture resistant;

(B) Labeled or color-coded in accordance with this standard;

(C) Leakproof on the sides and bottom; and

(D) In accordance with the requirements set forth in (d)(ii)(E) of this subsection for reusable sharps.

(ix) Eating, drinking, smoking, applying cosmetics, or lip balm, and handling contact lenses are prohibited in work areas where there is a reasonable likelihood of occupational exposure.

(x) Food and drink shall not be kept in refrigerators, freezers, shelves, cabinets, or on countertops or benchtops where blood or other potentially infectious materials are present.

(xi) All procedures involving blood or other potentially infectious materials shall be performed in such a manner as to minimize splashing, spraying, spattering, and generation of droplets of these substances.

(xii) Mouth pipetting/suctioning of blood or other potentially infectious materials is prohibited.

(xiii) Specimens of blood or other potentially infectious materials shall be placed in a container which prevents leakage during collection, handling, processing, storage, transport, or shipping.

(A) The container for storage, transport, or shipping shall be labeled or color-coded according to subsection (7)(a)(i) of this section and closed prior to being stored, transported, or shipped. When a facility utilizes universal precautions in the handling of all specimens, the labeling/color-coding of specimens is not necessary provided containers are recognizable as containing specimens. This exemption only applies while such specimens/containers remain within the facility. Labeling or color-coding in accordance with subsection (7)(a)(i) of this section is required when such specimens/containers leave the facility.

(B) If outside contamination of the primary container occurs, the primary container shall be placed within a second container which prevents leakage during handling, processing, storage, transport, or shipping and is labeled or color-coded according to the requirements of this standard.

(C) If the specimen could puncture the primary container, the primary container shall be placed within a secondary container which is punctured-resistant in addition to the above characteristics.

(xiv) Equipment which may become contaminated with blood or other potentially infectious materials shall be examined prior to servicing or shipping and shall be decontaminated as necessary, unless the employer can demonstrate that decontamination of such equipment or portions of such equipment is not feasible.

(A) A readily observable label in accordance with subsection (7)(a)(i)(H) of this section shall be attached to the equipment stating which portions remain contaminated.

(B) The employer shall ensure that this information is conveyed to all affected employees, the servicing representative, and/or the manufacturer, as appropriate, prior to handling, servicing, or shipping so that appropriate precautions will be taken.

(c) Personal protective equipment.

(i) Provision. When there is occupational exposure, the employer shall provide, at no cost to the employee, appropriate personal protective equipment such as, but not limited to, gloves, gowns, laboratory coats, face shields or masks and eye protection, and mouthpieces, resuscitation bags, pocket masks, or other ventilation devices. Personal protective equipment will be considered "appropriate" only if it does not permit blood or other potentially infectious materials to pass through to or reach the employee's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time which the protective equipment will be used.

(ii) Use. The employer shall ensure that the employee uses appropriate personal protective equipment unless the employer shows that the employee temporarily and briefly declined to use personal protective equipment when, under rare and extraordinary circumstances, it was the employee's professional judgment that in the specific instance its use would have prevented the delivery of health care or public

safety services or would have posed an increased hazard to the safety of the worker or the co-worker. When the employee makes this judgment, the circumstances shall be investigated and documented in order to determine whether changes can be instituted to prevent such occurrences in the future.

(iii) Accessibility. The employer shall ensure that appropriate personal protective equipment in the appropriate sizes is readily accessible at the worksite or is issued to employees. Hypoallergenic gloves, glove liners, powderless gloves, or other similar alternatives shall be readily accessible to those employees who are allergic to the gloves normally provided.

(iv) Cleaning, laundering, and disposal. The employer shall clean, launder, and dispose of personal protective equipment required by subsections (4) and (5) of this section, at no cost to the employee.

(v) Repair and replacement. The employer shall repair or replace personal protective equipment as needed to maintain its effectiveness, at no cost to the employee.

(vi) If a garment(s) is penetrated by blood or other potentially infectious materials, the garment(s) shall be removed immediately or as soon as feasible.

(vii) All personal protective equipment shall be removed prior to leaving the work area.

(viii) When personal protective equipment is removed it shall be placed in an appropriately designated area or container for storage, washing, decontamination, or disposal.

(ix) Gloves. Gloves shall be worn when it can be reasonably anticipated that the employee may have hand contact with blood, other potentially infectious materials, mucous membranes, and nonintact skin; when performing vascular access procedures except as specified in (c)(ix)(D) of this subsection; and when handling or touching contaminated items or surfaces.

(A) Disposable (single use) gloves such as surgical or examination gloves, shall be replaced as soon as practical when contaminated or as soon as feasible if they are torn, punctured, or when their ability to function as a barrier is compromised.

(B) Disposable (single use) gloves shall not be washed or decontaminated for re-use.

(C) Utility gloves may be decontaminated for re-use if the integrity of the glove is not compromised. However, they must be discarded if they are cracked, peeling, torn, punctured, or exhibit other signs of deterioration or when their ability to function as a barrier is compromised.

(D) If an employer in a volunteer blood donation center judges that routine gloving for all phlebotomies is not necessary then the employer shall:

(I) Periodically reevaluate this policy;

(II) Make gloves available to all employees who wish to use them for phlebotomy;

(III) Not discourage the use of gloves for phlebotomy; and

(IV) Require that gloves be used for phlebotomy in the following circumstances:

—When the employee has cuts, scratches, or other breaks in his or her skin;

—When the employee judges that hand contamination with blood may occur, for example, when performing phlebotomy on an uncooperative source individual; and

—When the employee is receiving training in phlebotomy.

(x) Masks, eye protection, and face shields. Masks in combination with eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated and eye, nose, or mouth contamination can be reasonably anticipated.

(xi) Gowns, aprons, and other protective body clothing. Appropriate protective clothing such as, but not limited to, gowns, aprons, lab coats, clinic jackets, or similar outer garments shall be worn in occupational exposure situations. The type and characteristics will depend upon the task and degree of exposure anticipated.

(xii) Surgical caps or hoods and/or shoe covers or boots shall be worn in instances when gross contamination can reasonably be anticipated (e.g., autopsies, orthopaedic surgery).

(d) Housekeeping.

(i) General. Employers shall ensure that the worksite is maintained in a clean and sanitary condition. The employer shall determine and implement an appropriate written schedule for cleaning and method of decontamination based upon the location within the facility, type of surface to be cleaned, type of soil present, and tasks or procedures being performed in the area.

(ii) All equipment and environmental and working surfaces shall be cleaned and decontaminated after contact with blood or other potentially infectious materials.

(A) Contaminated work surfaces shall be decontaminated with an appropriate disinfectant after completion of procedures; immediately or as soon as feasible when surfaces are overtly contaminated or after any spill of blood or other potentially infectious materials; and at the end of the workshift if the surface may have become contaminated since the last cleaning.

(B) Protective coverings, such as plastic wrap, aluminum foil, or imperviously-backed absorbent paper used to cover equipment and environmental surfaces, shall be removed and replaced as soon as feasible when they become overtly contaminated or at the end of the workshift if they may have become contaminated during the shift.

(C) All bins, pails, cans, and similar receptacles intended for reuse which have a reasonable likelihood for becoming contaminated with blood or other potentially infectious materials shall be inspected and decontaminated on a regularly scheduled basis and cleaned and decontaminated immediately or as soon as feasible upon visible contamination.

(D) Broken glassware which may be contaminated shall not be picked up directly with the hands. It shall be cleaned up using mechanical means, such as a brush and dust pan, tongs, or forceps.

(E) Reusable sharps that are contaminated with blood or other potentially infectious materials shall not be stored or processed in a manner that requires employees to reach by hand into the containers where these sharps have been placed.

(iii) Regulated waste.

(A) Contaminated sharps discarding and containment.
(I) Contaminated sharps shall be discarded immediately or as soon as feasible in containers that are:

—Closable;

—Puncture resistant;

—Leakproof on sides and bottom; and

—Labeled or color-coded in accordance with subsection (7)(a)(i) of this section.

(II) During use, containers for contaminated sharps shall be:

—Easily accessible to personnel and located as close as is feasible to the immediate area where sharps are used or can be reasonably anticipated to be found (e.g., laundries);

—Maintained upright throughout use; and

—Replaced routinely and not be allowed to overfill.

(III) When moving containers of contaminated sharps from the area of use, the containers shall be:

—Closed immediately prior to removal or replacement to prevent spillage or protrusion of contents during handling, storage, transport, or shipping;

—Placed in a secondary container if leakage is possible.

The second container shall be:

•Closable;

•Constructed to contain all contents and prevent leakage during handling, storage, transport, or shipping; and

•Labeled or color-coded according to subsection (7)(a)(i) of this section.

(IV) Reusable containers shall not be opened, emptied, or cleaned manually or in any other manner which would expose employees to the risk of percutaneous injury.

(B) Other regulated waste containment.

(I) Regulated waste shall be placed in containers which are:

—Closable;

—Constructed to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping;

—Labeled or color-coded in accordance with subsection (7)(a)(i) of this section; and

—Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

(II) If outside contamination of the regulated waste container occurs, it shall be placed in a second container. The second container shall be:

—Closable;

—Constructed to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping;

—Labeled or color-coded in accordance with subsection (7)(a)(i) of this section; and

—Closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping.

(C) Disposal of all regulated waste shall be in accordance with applicable regulations of the United States, states and territories, and political subdivisions of states and territories.

(iv) Laundry.

(A) Contaminated laundry shall be handled as little as possible with a minimum of agitation.

(I) Contaminated laundry shall be bagged or containerized at the location where it was used and shall not be sorted or rinsed in the location of use.

(II) Contaminated laundry shall be placed and transported in bags or containers labeled or color-coded in accordance with subsection (7)(a)(i) of this section. When a facility utilizes universal precautions in the handling of all soiled laundry, alternative labeling or color-coding is sufficient if it permits all employees to recognize the containers as requiring compliance with universal precautions.

(III) Whenever contaminated laundry is wet and presents a reasonable likelihood of soak-through or leakage from the bag or container, the laundry shall be placed and transported in bags or containers which prevent soak-through and/or leakage of fluids to the exterior.

(B) The employer shall ensure that employees who have contact with contaminated laundry wear protective gloves and other appropriate personal protective equipment.

(C) When a facility ships contaminated laundry off-site to a second facility which does not utilize universal precautions in the handling of all laundry, the facility generating the contaminated laundry must place such laundry in bags or containers which are labeled or color-coded in accordance with subsection (7)(a)(i) of this section.

(5) HIV and HBV research laboratories and production facilities.

(a) This subsection applies to research laboratories and production facilities engaged in the culture, production, concentration, experimentation, and manipulation of HIV and HBV. It does not apply to clinical or diagnostic laboratories engaged solely in the analysis of blood, tissues, or organs. These requirements apply in addition to the other requirements of the standard.

(b) Research laboratories and production facilities shall meet the following criteria:

(i) Standard microbiological practices. All regulated waste shall either be incinerated or decontaminated by a method such as autoclaving known to effectively destroy bloodborne pathogens.

(ii) Special practices.

(A) Laboratory doors shall be kept closed when work involving HIV or HBV is in progress.

(B) Contaminated materials that are to be decontaminated at a site away from the work area shall be placed in a durable, leakproof, labeled, or color-coded container that is closed before being removed from the work area.

(C) Access to the work area shall be limited to authorized persons. Written policies and procedures shall be established whereby only persons who have been advised of the potential biohazard, who meet any specific entry requirements, and who comply with all entry and exit procedures shall be allowed to enter the work areas and animal rooms.

(D) When other potentially infectious materials or infected animals are present in the work area or containment module, a hazard warning sign incorporating the universal biohazard symbol shall be posted on all access doors. The hazard warning sign shall comply with subsection (7)(a)(ii) of this section.

(E) All activities involving other potentially infectious materials shall be conducted in biological safety cabinets or

other physical-containment devices within the containment module. No work with these other potentially infectious materials shall be conducted on the open bench.

(F) Laboratory coats, gowns, smocks, uniforms, or other appropriate protective clothing shall be used in the work area and animal rooms. Protective clothing shall not be worn outside of the work area and shall be decontaminated before being laundered.

(G) Special care shall be taken to avoid skin contact with other potentially infectious materials. Gloves shall be worn when handling infected animals and when making hand contact with other potentially infectious materials is unavoidable.

(H) Before disposal all waste from work areas and from animal rooms shall either be incinerated or decontaminated by a method such as autoclaving known to effectively destroy bloodborne pathogens.

(I) Vacuum lines shall be protected with liquid disinfectant traps and high-efficiency particulate air (HEPA) filters or filters of equivalent or superior efficiency and which are checked routinely and maintained or replaced as necessary.

(J) Hypodermic needles and syringes shall be used only for parenteral injection and aspiration of fluids from laboratory animals and diaphragm bottles. Only needle-locking syringes or disposable syringe-needle units (i.e., the needle is integral to the syringe) shall be used for the injection or aspiration of other potentially infectious materials. Extreme caution shall be used when handling needles and syringes. A needle shall not be bent, sheared, replaced in the sheath or guard, or removed from the syringe following use. The needle and syringe shall be promptly placed in a puncture-resistant container and autoclaved or decontaminated before reuse or disposal.

(K) All spills shall be immediately contained and cleaned up by appropriate professional staff or others properly trained and equipped to work with potentially concentrated infectious materials.

(L) A spill or accident that results in an exposure incident shall be immediately reported to the laboratory director or other responsible person.

(M) A biosafety manual shall be prepared or adopted and periodically reviewed and updated at least annually or more often if necessary. Personnel shall be advised of potential hazards, shall be required to read instructions on practices and procedures, and shall be required to follow them.

(iii) Containment equipment.

(A) Certified biological safety cabinets (Class I, II, or III) or other appropriate combinations of personal protection or physical containment devices, such as special protective clothing, respirators, centrifuge safety cups, sealed centrifuge rotors, and containment caging for animals, shall be used for all activities with other potentially infectious materials that pose a threat of exposure to droplets, splashes, spills, or aerosols.

(B) Biological safety cabinets shall be certified when installed, whenever they are moved and at least annually.

(c) HIV and HBV research laboratories shall meet the following criteria:

(i) Each laboratory shall contain a facility for hand washing and an eyewash facility which is readily available within the work area.

(ii) An autoclave for decontamination of regulated waste shall be available.

(d) HIV and HBV production facilities shall meet the following criteria:

(i) The work areas shall be separated from areas that are open to unrestricted traffic flow within the building. Passage through two sets of doors shall be the basic requirement for entry into the work area from access corridors or other contiguous areas. Physical separation of the high-containment work area from access corridors or other areas or activities may also be provided by a double-doored clothes-change room (showers may be included), airlock, or other access facility that requires passing through two sets of doors before entering the work area.

(ii) The surfaces of doors, walls, floors, and ceilings in the work area shall be water resistant so that they can be easily cleaned. Penetrations in these surfaces shall be sealed or capable of being sealed to facilitate decontamination.

(iii) Each work area shall contain a sink for washing hands and a readily available eye wash facility. The sink shall be foot, elbow, or automatically operated and shall be located near the exit door of the work area.

(iv) Access doors to the work area or containment module shall be self-closing.

(v) An autoclave for decontamination of regulated waste shall be available within or as near as possible to the work area.

(vi) A ducted exhaust-air ventilation system shall be provided. This system shall create directional airflow that draws air into the work area through the entry area. The exhaust air shall not be recirculated to any other area of the building, shall be discharged to the outside, and shall be dispersed away from occupied areas and air intakes. The proper direction of the airflow shall be verified (i.e., into the work area).

(e) Training requirements. Additional training requirements for employees in HIV and HBV research laboratories and HIV and HBV production facilities are specified in subsection (7)(b)(ix) of this section.

(6) Hepatitis B vaccination and post-exposure evaluation and follow-up.

(a) General.

(i) The employer shall make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident.

(ii) The employer shall ensure that all medical evaluations and procedures including the hepatitis B vaccine and vaccination series and post-exposure evaluation and follow-up, including prophylaxis, are:

(A) Made available at no cost to the employee;

(B) Made available to the employee at a reasonable time and place;

(C) Performed by or under the supervision of a licensed physician or by or under the supervision of another licensed healthcare professional; and

(D) Provided according to recommendations of the United States Public Health Service current at the time these

evaluations and procedures take place, except as specified by this subsection (6).

(iii) The employer shall ensure that all laboratory tests are conducted by an accredited laboratory at no cost to the employee.

(b) Hepatitis B vaccination.

(i) Hepatitis B vaccination shall be made available after the employee has received the training required in subsection (7)(b)(vii)(I) of this section and within ten working days of initial assignment to all employees who have occupational exposure unless the employee has previously received the complete hepatitis B vaccination series, antibody testing has revealed that the employee is immune, or the vaccine is contraindicated for medical reasons.

(ii) The employer shall not make participation in a pre-screening program a prerequisite for receiving hepatitis B vaccination.

(iii) If the employee initially declines hepatitis B vaccination but at a later date while still covered under the standard decides to accept the vaccination, the employer shall make available hepatitis B vaccination at that time.

(iv) The employer shall assure that employees who decline to accept hepatitis B vaccination offered by the employer sign the statement in WAC 296-62-08050, appendix A.

(v) If a routine booster dose(s) of hepatitis B vaccine is recommended by the United States Public Health Service at a future date, such booster dose(s) shall be made available in accordance with (a)(ii) of this subsection.

(c) Post-exposure evaluation and follow-up. Following a report of an exposure incident, the employer shall make immediately available to the exposed employee a confidential medical evaluation and follow-up, including at least the following elements:

(i) Documentation of the route(s) of exposure, and the circumstances under which the exposure incident occurred;

(ii) Identification and documentation of the source individual, unless the employer can establish that identification is infeasible or prohibited by state or local law;

(A) The source individual's blood shall be tested as soon as feasible and after consent is obtained in order to determine HBV and HIV infectivity. If consent is not obtained, the employer shall establish that legally required consent cannot be obtained. When the source individual's consent is not required by law, the source individual's blood, if available, shall be tested and the results documented.

(B) When the source individual is already known to be infected with HBV or HIV, testing for the source individual's known HBV or HIV status need not be repeated.

(C) Results of the source individual's testing shall be made available to the exposed employee, and the employee shall be informed of applicable laws and regulations concerning disclosure of the identity and infectious status of the source individual.

(iii) Collection and testing of blood for HBV and HIV serologic status;

(A) The exposed employee's blood shall be collected as soon as feasible and tested after consent is obtained.

(B) If the employee consents to baseline blood collection, but does not give consent at that time for HIV serologic

testing, the sample shall be preserved for at least ninety days. If, within ninety days of the exposure incident, the employee elects to have the baseline sample tested, such testing shall be done as soon as feasible.

(iv) Post-exposure prophylaxis, when medically indicated, as recommended by the United States Public Health Service;

(v) Counseling; and

(vi) Evaluation of reported illnesses.

(d) Information provided to the healthcare professional.

(i) The employer shall ensure that the healthcare professional responsible for the employee's hepatitis B vaccination is provided a copy of this regulation.

(ii) The employer shall ensure that the healthcare professional evaluating an employee after an exposure incident is provided the following information:

(A) A copy of this regulation;

(B) A description of the exposed employee's duties as they relate to the exposure incident;

(C) Documentation of the route(s) of exposure and circumstances under which exposure occurred;

(D) Results of the source individual's blood testing, if available; and

(E) All medical records relevant to the appropriate treatment of the employee including vaccination status which are the employer's responsibility to maintain.

(e) Healthcare professional's written opinion. The employer shall obtain and provide the employee with a copy of the evaluating healthcare professional's written opinion within fifteen days of the completion of the evaluation.

(i) The healthcare professional's written opinion for hepatitis B vaccination shall be limited to whether hepatitis B vaccination is indicated for an employee, and if the employee has received such vaccination.

(ii) The healthcare professional's written opinion for post-exposure evaluation and follow-up shall be limited to the following information:

(A) That the employee has been informed of the results of the evaluation; and

(B) That the employee has been told about any medical conditions resulting from exposure to blood or other potentially infectious materials which require further evaluation or treatment.

(iii) All other findings or diagnoses shall remain confidential and shall not be included in the written report.

(f) Medical recordkeeping. Medical records required by this standard shall be maintained in accordance with subsection (8)(a) of this section.

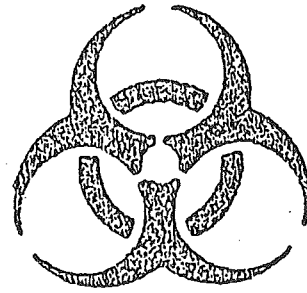
(7) Communication of hazards to employees.

(a) Labels and signs.

(i) Labels.

(A) Warning labels shall be affixed to containers of regulated waste, refrigerators and freezers containing blood or other potentially infectious material; and other containers used to store, transport or ship blood or other potentially infectious materials, except as provided in (a)(i)(E), (F), and (G) of this subsection.

(B) Labels required by this section shall include the following legend:



BIOHAZARD

(C) These labels shall be fluorescent orange or orange-red or predominantly so, with lettering and symbols in a contrasting color.

(D) Labels shall be affixed as close as feasible to the container by string, wire, adhesive, or other method that prevents their loss or unintentional removal.

(E) Red bags or red containers may be substituted for labels.

(F) Containers of blood, blood components, or blood products that are labeled as to their contents and have been released for transfusion or other clinical use are exempted from the labeling requirements of subsection (7) of this section.

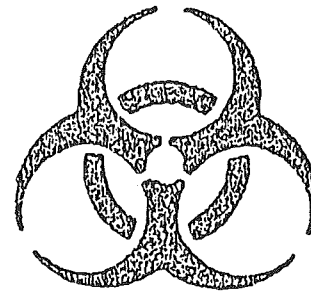
(G) Individual containers of blood or other potentially infectious materials that are placed in a labeled container during storage, transport, shipment or disposal are exempted from the labeling requirement.

(H) Labels required for contaminated equipment shall be in accordance with this subitem and shall also state which portions of the equipment remain contaminated.

(I) Regulated waste that has been decontaminated need not be labeled or color-coded.

(ii) Signs.

(A) The employer shall post signs at the entrance to work areas specified in subsection (5) of this section, entitled HIV and HBV research laboratory and production facilities, which shall bear the following legend:



BIOHAZARD

(Name of the Infectious Agent)

(Special requirements for entering the area)

(Name, telephone number of the laboratory director or other responsible person.)

(B) These signs shall be fluorescent orange-red or predominantly so, with lettering and symbols in a contrasting color.

(b) Information and training.

(i) Employers shall ensure that all employees with occupational exposure participate in a training program which must be provided at no cost to the employee and during working hours.

(ii) Training shall be provided as follows:

(A) At the time of initial assignment to tasks where occupational exposure may take place;

(B) Within ninety days after the effective date of the standard; and

(C) At least annually thereafter.

(iii) For employees who have received training on blood-borne pathogens in the year preceding the effective date of the standard, only training with respect to the provisions of the standard which were not included need be provided.

(iv) Annual training for all employees shall be provided within one year of their previous training.

(v) Employers shall provide additional training when changes such as modification of tasks or procedures or institution of new tasks or procedures affect the employee's occupational exposure. The additional training may be limited to addressing the new exposures created.

(vi) Material appropriate in content and vocabulary to educational level, literacy, and language of employees shall be used.

(vii) The training program shall contain at a minimum the following elements:

(A) An accessible copy of the regulatory text of this standard and an explanation of its contents;

(B) A general explanation of the epidemiology and symptoms of bloodborne diseases;

(C) An explanation of the modes of transmission of bloodborne pathogens;

(D) An explanation of the employer's exposure control plan and the means by which the employee can obtain a copy of the written plan;

(E) An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials;

(F) An explanation of the use and limitations of methods that will prevent or reduce exposure including appropriate engineering controls, work practices, and personal protective equipment;

(G) Information on the types, proper use, location, removal, handling, decontamination and disposal of personal protective equipment;

(H) An explanation of the basis for selection of personal protective equipment;

(I) Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;

(J) Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;

(K) An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;

(1999 Ed.)

(L) Information on the post-exposure evaluation and follow-up that the employer is required to provide for the employee following an exposure incident;

(M) An explanation of the signs and labels and/or color coding required by (a) of this subsection; and

(N) An opportunity for interactive questions and answers with the person conducting the training session.

(viii) The person conducting the training shall be knowledgeable in the subject matter covered by the elements contained in the training program as it relates to the workplace that the training will address.

(ix) Additional initial training for employees in HIV and HBV laboratories and production facilities. Employees in HIV or HBV research laboratories and HIV or HBV production facilities shall receive the following initial training in addition to the above training requirements:

(A) The employer shall assure that employees demonstrate proficiency in standard microbiological practices and techniques and in the practices and operations specific to the facility before being allowed to work with HIV or HBV.

(B) The employer shall assure that employees have prior experience in the handling of human pathogens or tissue cultures before working with HIV or HBV.

(C) The employer shall provide a training program to employees who have no prior experience in handling human pathogens. Initial work activities shall not include the handling of infectious agents. A progression of work activities shall be assigned as techniques are learned and proficiency is developed. The employer shall assure that employees participate in work activities involving infectious agents only after proficiency has been demonstrated.

(8) Recordkeeping.

(a) Medical records.

(i) The employer shall establish and maintain an accurate record for each employee with occupational exposure, in accordance with WAC 296-62-052.

(ii) This record shall include:

(A) The name and Social Security number of the employee;

(B) A copy of the employee's hepatitis B vaccination status including the dates of all the hepatitis B vaccinations and any medical records relative to the employee's ability to receive vaccination as required by subsection (6)(b) of this section;

(C) A copy of all results of examinations, medical testing, and follow-up procedures as required by subsection (6)(c) of this section;

(D) The employer's copy of the healthcare professional's written opinion as required by subsection (6)(e) of this section; and

(E) A copy of the information provided to the healthcare professional as required by subsection (6)(d)(ii)(B), (C), and (D) of this section.

(iii) Confidentiality. The employer shall ensure that employee medical records required by (a) of this subsection are:

(A) Kept confidential; and

(B) Not disclosed or reported without the employee's express written consent to any person within or outside the

workplace except as required by this section or as may be required by law.

(iv) The employer shall maintain the records required by subsection (8) of this section for at least the duration of employment plus thirty years in accordance with WAC 296-62-052.

(b) Training records.

(i) Training records shall include the following information:

- (A) The dates of the training sessions;
- (B) The contents or a summary of the training sessions;
- (C) The names and qualifications of persons conducting the training; and
- (D) The names and job titles of all persons attending the training sessions.

(ii) Training records shall be maintained for three years from the date on which the training occurred.

(c) Availability.

(i) The employer shall ensure that all records required to be maintained by this section shall be made available upon request to the director for examination and copying.

(ii) Employee training records required by this section shall be provided upon request for examination and copying to employees, to employee representatives, and to the director.

(iii) Employee medical records required by this section shall be provided upon request for examination and copying to the subject employee, to anyone having written consent of the subject employee, to the director in accordance with WAC 296-62-052.

(d) Transfer of records.

(i) The employer shall comply with the requirements involving transfer of records set forth in WAC 296-62-052.

(ii) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall notify the director, at least three months prior to their disposal and transmit them to the director, if required by the director to do so, within that three-month period.

(9) Dates.

(a) Effective date. The standard shall become effective on May 26, 1992.

(b) The exposure control plan required by subsection (3) of this section shall be completed on or before June 26, 1992.

(c) Subsection (7)(b) of this section, entitled Information and training; and subsection (7)(h) of this section, entitled Recordkeeping; shall take effect on or before July 27, 1992.

(d) Subsection (4)(b) of this section, entitled Engineering and work practice controls; subsection (4)(c) of this section, entitled Personal protective equipment; subsection (4)(d) of this section, entitled Housekeeping; subsection (5) of this section, entitled HIV and HBV research laboratories and production facilities; subsection (6) of this section, entitled Hepatitis B vaccination and post-exposure evaluation and follow-up; and subsection (7)(a) of this section, entitled Labels and signs; shall take effect August 27, 1992.

[Statutory Authority: Chapter 49.17 RCW. 93-01-067 (Order 92-15), § 296-62-08001, filed 12/11/92, effective 1/15/93; 92-08-100 (Order 92-01), § 296-62-08001, filed 4/1/92, effective 5/5/92.]

WAC 296-62-08050 Appendix A—Hepatitis B vaccine declination—Mandatory. I understand that due to my occupational exposure to blood or other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine, at no charge to myself. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

[Statutory Authority: Chapter 49.17 RCW. 92-08-100 (Order 92-01), § 296-62-08050, filed 4/1/92, effective 5/5/92.]

Part J-1—PHYSICAL AGENTS

WAC 296-62-090 Physical agents.

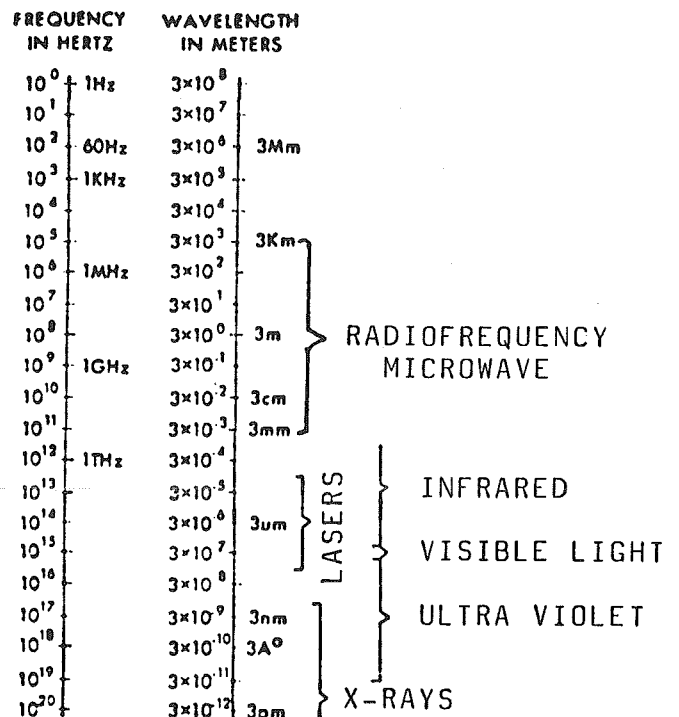
[Order 73-3, § 296-62-090, filed 5/7/73; Order 70-8, § 296-62-090, filed 7/31/70, effective 9/1/70; Rule 9.010, effective 8/1/63.]

WAC 296-62-09001 Definitions. (1) "Physical agents" shall mean, but are not limited to: Illumination, ionizing radiation, nonionizing radiation, pressure, vibration, temperature and humidity, and noise.

(2) "Illumination" means radiant energy evaluated according to its capacity to produce visual sensation.

(3) "Nonionizing radiation" as related to industrial sources, means electromagnetic radiation within the spectral range of approximately 200 nanometers to 3 kilometers including ultraviolet, visible, infrared and radiofrequency/microwave radiation. The electromagnetic spectrum is shown graphically in Figure 1 below.

ELECTROMAGNETIC SPECTRUM
Figure 1



(4) Pressure is a barometric force. Positive pressure would be that above 14.7 lbs. per square inch absolute and negative pressure would be that below 14.7 lbs. per square inch absolute. 14.7 lbs. per square inch equals 760 mm. mercury.

(5) "Vibration" means rapid movement to and fro or oscillating movement.

(6) "Noise" means unwanted sound or loud discordant or disagreeable sound or sounds.

(7) "Temperature" means the degree of hotness or coldness measured by use of a thermometer.

(8) "Radiant heat" means infrared radiation emitted from hot surfaces.

(9) "Relative humidity" means the percent of moisture in the air compared to the maximum amount of moisture the air could contain at the same temperature.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-62-09001, filed 12/11/84; Order 73-3, § 296-62-09001, filed 5/7/73.]

WAC 296-62-09003 Lighting and illumination. (1) Lighting which is adequately adjusted to provide a margin of safety for all work tasks shall be provided and maintained.

(a) The minimum level of task lighting for all indoor activities shall be an average of 10 foot candles measured 30 inches above the floor or at the task.

(b) The minimum level of task lighting for all outdoor activities shall be an average of five foot candles measured thirty inches above the working surface or at the task.

(2) If general lighting is not provided throughout the work area, the employer shall provide illumination which is adequately adjusted to provide visibility of nearby objects which might be potential hazards or to see to operate emergency control or other equipment. The minimum level of nontask lighting for all indoor and outdoor activities shall be an average of 3 foot candles measured 30 inches above the floor or working surface.

Note: This section establishes minimal levels of illumination for safety purposes only. Guidelines pertaining to optimal levels of lighting and illumination may be found in Practice for Industrial Lighting, ANSI/IES RP7-1979. The minimum levels specified in subsections (1) and (2) of this section represent averages with the lowest level in an area to be no less than fifty percent of the indicated value.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09003, filed 11/30/83; 82-13-045 (Order 82-22), § 296-62-09003, filed 6/11/82; Order 76-6, § 296-62-09003, filed 3/1/76; Order 73-3, § 296-62-09003, filed 5/7/73.]

WAC 296-62-09004 Ionizing radiation. (1) Definitions applicable to this section.

Note: Definitions also appear in some subsections.

(a) "Radiation" includes alpha rays, beta rays, gamma rays, x-rays, neutrons, high-speed electrons, high-speed protons, and other atomic particles; but such term does not include sound or radio waves, or visible light, or infrared or ultraviolet light.

(b) "Radioactive material" means any material which emits, by spontaneous nuclear disintegration, corpuscular or electromagnetic emanations.

(c) "Restricted area" means any area access to which is controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(d) "Unrestricted area" means any area access to which is not controlled by the employer for purposes of protection of individuals from exposure to radiation or radioactive materials.

(e) "Dose" means the quantity of ionizing radiation absorbed, per unit of mass, by the body or by any portion of the body. When the provisions in this section specify a dose during a period of time, the dose is the total quantity of radiation absorbed, per unit of mass, by the body or by any portion of the body during such period of time. Several different units of dose are in current use. Definitions of units used in this section are set forth in subdivisions (f) and (g) of this subsection.

(f) "Rad" means a measure of the dose of any ionizing radiation to body tissues in terms of the energy absorbed per unit of mass of the tissue. One rad is the dose corresponding to the absorption of 100 ergs per gram of tissue (1 millirad (mrad) = 0.001 rad).

(g) "Rem" means a measure of the dose of any ionizing radiation to body tissue in terms of its estimated biological effect relative to a dose of 1 roentgen (r) of x-rays (1 millirem (mrem) = 0.001 rem). The relation of the rem to other dose units depends upon the biological effect under consideration and upon the conditions for irradiation. Each of the following is considered to be equivalent to a dose of 1 rem:

(i) A dose of 1 roentgen due to x- or gamma radiation;

(ii) A dose of 1 rad due to x-, gamma, or beta radiation;

(iii) A dose of 0.1 rad due to neutrons or high energy protons;

(iv) A dose of 0.05 rad due to particles heavier than protons and with sufficient energy to reach the lens of the eye;

(v) If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron dose in rads, as provided in item (iii) of this subdivision, 1 rem of neutron radiation may, for purposes of the provisions in this section be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there is sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to 1 rem may be estimated from the following table:

Neutron Flux Dose Equivalents

Neutron energy (million electron volts (Mev))	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm ²)	Average flux to deliver in 40 hours (neutrons/cm ² per sec.)
Thermal	970 X 10 ⁶	670
0.0001	720 X 10 ⁶	500
0.005	820 X 10 ⁶	570
0.02	400 X 10 ⁶	280
0.1	120 X 10 ⁶	80
0.5	43 X 10 ⁶	30
1.0	26 X 10 ⁶	18

Neutron Flux Dose Equivalents

Neutron energy (million electron volts (Mev))	Number of neutrons per square centimeter equivalent to a dose of 1 rem (neutrons/cm ²)	Average flux to deliver 100 millirem in 40 hours (neutrons/cm ² per sec.)
2.5	29 X 10 ⁶	20
5.0	26 X 10 ⁶	18
7.5	24 X 10 ⁶	17
10	24 X 10 ⁶	17
10 to 30	14 X 10 ⁶	10

(h) For determining exposures to x- or gamma rays up to 3 Mev., the dose limits specified in this section may be assumed to be equivalent to the "air dose." For the purpose of this section "air dose" means that the dose is measured by a properly calibrated appropriate instrument in air at or near the body surface in the region of the highest dosage rate.

(i) "Curie" means a unit of measurement of radioactivity. One curie (Ci) is that quantity of radioactive material which decays at the rate of 2.2 x 10¹² disintegrations per minute (dpm).

- (i) One millicurie (mCi) = 10⁻³Ci
- (ii) One microcurie (uCi) = 10⁻⁶Ci
- (iii) One nanocurie (nCi) = 10⁻⁹Ci
- (iv) One picocurie (pCi) = 10⁻¹²Ci

(2) Nuclear Regulatory Commission licensees—NRC contractors operating NRC plants and facilities.

(a) Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended, under a license issued by the Nuclear Regulatory Commission and in accordance with the requirements of chapter 402-24 WAC shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.

(b) NRC contractors operating NRC plants and facilities: Any employer who possesses or uses source material, byproduct material, special nuclear material, or other radiation sources under a contract with the Nuclear Regulatory Commission for the operation of NRC plants and facilities and in accordance with the standards, procedures, and other requirements for radiation protection established by the commission for such contract pursuant to the Atomic Energy Act of 1954 as amended (42 U.S.C. 2011 et seq.) shall be deemed to be in compliance with the requirements of this section with respect to such possession and use.

(c) State licensees or registrants:

(i) Atomic Energy Act sources. Any employer who possesses or uses source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), and has registered such sources with the state shall be deemed to be in compliance with the radiation requirements of this section, insofar as his possession and use of such material is concerned.

(ii) Other sources. Any employer who possesses or uses radiation sources other than source material, byproduct material, or special nuclear material, as defined in the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.),

and has registered such sources with the state shall be deemed to be in compliance with the radiation requirements of this section insofar as his possession and use of such material is concerned.

(3) Exposure of individuals to radiation in restricted areas.

(a) Except as provided in subdivision (b) of this subsection, no employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or control a dose in excess of the limits specified in the following table:

	Rems per Calendar Quarter
EXPOSURE IN RESTRICTED AREAS	
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	1 1/4
Hand and forearms; feet and ankles	18 3/4
Skin of whole body	7 1/2

(b) An employer may permit an individual in a restricted area to receive doses to the whole body greater than those permitted under subdivision (a) of this subsection, so long as:

(i) During any calendar quarter the dose to the whole body shall not exceed 3 rems; and

(ii) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed 5 (N-18) rems, where "N" equals the individual's age in years at his last birthday; and

(iii) The employer maintains adequate past and current exposure records which show that the addition of such a dose will not cause the individual to exceed the amount authorized in this subdivision. As used in this subdivision "Dose to the whole body" shall be deemed to include any dose to the whole body, gonad, active blood-forming organs, head and trunk, or lens of the eye.

(c) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in the preceding table entitled "exposure in restricted areas."

(d) "Calendar quarter" means any 3-month period determined as follows:

(i) The first period of any year may begin on any date in January: *Provided*, That the second, third and fourth periods accordingly begin on the same date in April, July, and October, respectively, and that the fourth period extends into January of the succeeding year, if necessary to complete a 3-month quarter. During the first year of use of this method of determination, the first period for that year shall also include any additional days in January preceding the starting date for the first period; or

(ii) The first period in a calendar year of 13 complete, consecutive calendar weeks; the second period in a calendar year of 13 complete consecutive weeks; the third period in a calendar year of 13 complete, consecutive calendar weeks; the fourth period in a calendar year of 13 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included within the last complete cal-

endar week of that year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included within the last complete calendar week of the previous year; or

(iii) The four periods in a calendar year may consist of the first 14 complete, consecutive calendar weeks; the next 12 complete, consecutive calendar weeks, the next 14 complete, consecutive calendar weeks, and the last 12 complete, consecutive calendar weeks. If at the end of a calendar year there are any days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete calendar week of the year. If at the beginning of any calendar year there are days not falling within a complete calendar week of that year, such days shall be included (for purposes of this section) within the last complete week of the previous year.

(e) No employer shall change the method used by him to determine calendar quarters except at the beginning of a calendar year.

(4) Exposure to airborne radioactive material.

(a) No employer shall possess, use or transport radioactive material in such a manner as to cause any employee, within a restricted area, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table I of WAC 402-24-220, Appendix A. The limits given in Table I are for exposure to the concentrations specified for 40 hours in any workweek of 7 consecutive days. In any such period where the number of hours of exposure is less than 40 the limits specified in the table may be increased proportionately. In any such period where the number of hours of exposure is greater than 40, the limits specified in the table shall be decreased proportionately.

(b) No employer shall possess, use, or transfer radioactive material in such a manner as to cause any individual within a restricted area, who is under 18 years of age, to be exposed to airborne radioactive material in an average concentration in excess of the limits specified in Table II of WAC 402-24-220, Appendix A.

For purposes of this subdivision, concentrations may be averaged over periods not greater than 1 week.

(c) "Exposed" as used in this subdivision means that the individual is present in an airborne concentration. No allowance shall be made for the use of protective clothing or equipment, or particle size.

(5) Precautionary procedures and personal monitoring.

(a) Every employer shall make such surveys as may be necessary for him to comply with the provisions in this section. "Survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions. When appropriate, such evaluation includes a physical survey of the location of materials and equipment, and measurements of levels of radiation or concentrations of radioactive material present.

(b) Every employer shall supply appropriate personnel monitoring equipment, such as film badges, pocket chambers, pocket dosimeters, or film rings, to, and shall require the use of such equipment by:

(i) Each employee who enters a restricted area under such circumstances that he receives, or is likely to receive, a

dose in any calendar quarter in excess of 25 percent of the applicable value specified in subsection (3)(a) of this section; and

(ii) Each employee under 18 years of age who enters a restricted area under such circumstances that he receives, or is likely to receive a dose in any calendar quarter in excess of 5 percent of the applicable value specified in subsection (3)(a) of this section; and

(iii) Each employee who enters a high radiation area.

(c) As used in this section:

(i) "Personnel monitoring equipment" means devices designed to be worn or carried by an individual for the purpose of measuring the dose received (e.g., film badges, pocket chambers, pocket dosimeters, film rings, etc.);

(ii) "Radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any 1 hour a dose in excess of 5 millirem, or in any 5 consecutive days a dose in excess of 100 millirem; and

(iii) "High radiation area" means any area, accessible to personnel, in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 100 millirem.

(6) Caution signs, labels and signals.

(a) General.

(i) Symbols prescribed by this subsection shall use the conventional radiation caution colors (magenta or purple on yellow background). The symbol prescribed by this subsection is the conventional three-bladed design:

RADIATION SYMBOL

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.

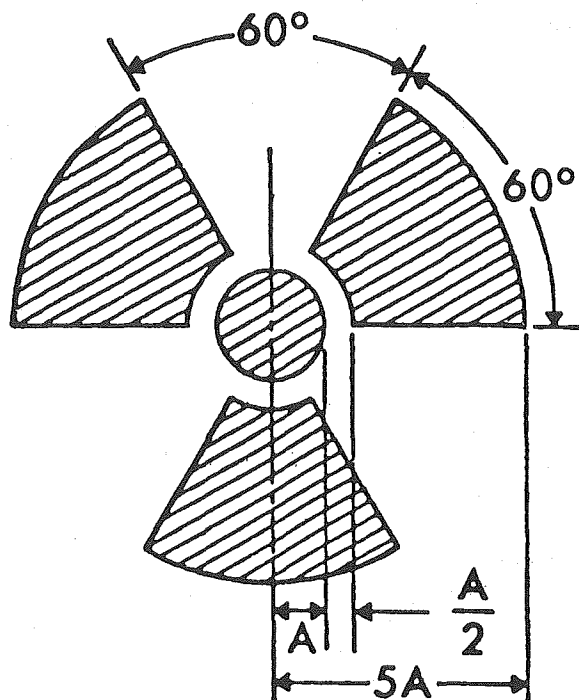


FIGURE G-10

(ii) In addition to the contents of signs and labels prescribed in this subsection, employers may provide on or near such signs and labels any additional information which may be appropriate in aiding individuals to minimize exposure to radiation or to radioactive material.

(b) Radiation area. Each radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION
RADIATION AREA

(c) High radiation area.

(i) Each high radiation area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol and the words:

CAUTION
HIGH RADIATION AREA

(ii) Each high radiation area shall be equipped with a control device which shall either cause the level of radiation to be reduced below that at which an individual might receive a dose of 100 millirems in 1 hour upon entry into the area or shall energize a conspicuous visible or audible alarm signal in such a manner that the individual entering and the employer or a supervisor of the activity are made aware of the entry. In the case of a high radiation area established for a period of 30 days or less, such control device is not required.

(d) Airborne radioactivity area.

(i) As used in the provisions of this section, "airborne radioactivity area" means:

(A) Any room, enclosure, or operating area in which airborne radioactive materials, composed wholly or partly of radioactive material, exist in concentrations in excess of the amounts specified in column 1 of Table I of WAC 402-24-220, Appendix A.

(B) Any room, enclosure, or operating area in which airborne radioactive materials exist in concentrations which, averaged over the number of hours in any week during which individuals are in the area, exceed 25 percent of the amounts specified in column 1 of Table I of WAC 402-24-220, Appendix A.

(ii) Each airborne radioactivity area shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION
AIRBORNE RADIOACTIVITY AREA

(e) Additional requirements.

(i) Each area or room in which radioactive material is used or stored and which contains any radioactive material (other than natural uranium or thorium) in any amount exceeding 10 times the quantity of such material specified in WAC 402-24-230, Appendix B shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION

RADIOACTIVE MATERIALS

(ii) Each area or room in which natural uranium or thorium is used or stored in an amount exceeding 100 times the quantity of such material specified in chapter 402-24 WAC shall be conspicuously posted with a sign or signs bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION

RADIOACTIVE MATERIALS

(f) Containers.

(i) Each container in which is transported, stored, or used a quantity of any radioactive material (other than natural uranium or thorium) greater than the quantity of such material specified in WAC 402-24-230, Appendix B shall bear a durable, clearly visible label bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION

RADIOACTIVE MATERIALS

(ii) Each container in which natural uranium or thorium is transported, stored, or used in a quantity greater than 10 times the quantity specified in WAC 402-24-230, Appendix B shall bear a durable, clearly visible label bearing the radiation caution symbol described in subdivision (a) of this subsection and the words:

CAUTION

RADIOACTIVE MATERIALS

(iii) Notwithstanding the provisions of items (i) and (ii) of this subdivision a label shall not be required:

(A) If the concentration of the material in the container does not exceed that specified in column 2 of Table I of WAC 402-24-220, Appendix A.

(B) For laboratory containers, such as beakers, flasks, and test tubes, used transiently in laboratory procedures, when the user is present.

(iv) Where containers are used for storage, the labels required in this subdivision shall state also the quantities and kinds of radioactive materials in the containers and the date of measurement of the quantities.

(7) Immediate evacuation warning signal.

(a) Signal characteristics.

(i) The signal shall be a midfrequency complex sound wave amplitude modulated at a subsonic frequency. The complex sound wave in free space shall have a fundamental frequency f^1 between 450 and 500 hertz (Hz) modulated at a subsonic rate between 4 and 5 hertz.

(ii) The signal generator shall not be less than 75 decibels at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iii) A sufficient number of signal units shall be installed such that the requirements of item (i) of this subdivision are met at every location where an individual may be present whose immediate, rapid, and complete evacuation is essential.

(iv) The signal shall be unique in the plant or facility in which it is installed.

(v) The minimum duration of the signal shall be sufficient to insure that all affected persons hear the signal.

(vi) The signal-generating system shall respond automatically to an initiating event without requiring any human action to sound the signal.

(b) Design objectives.

(i) The signal-generating system shall be designed to incorporate components which enable the system to produce the desired signal each time it is activated within one-half second of activation.

(ii) The signal-generating system shall be provided with an automatically activated secondary power supply which is adequate to simultaneously power all emergency equipment to which it is connected, if operation during power failure is necessary, except in those systems using batteries as the primary source of power.

(iii) All components of the signal-generating system shall be located to provide maximum practicable protection against damage in case of fire, explosion, corrosive atmosphere, or other environmental extremes consistent with adequate system performance.

(iv) The signal-generating system shall be designed with the minimum number of components necessary to make it function as intended, and should utilize components which do not require frequent servicing such as lubrication or cleaning.

(v) Where several activating devices feed activating information to a central signal generator, failure of any activating device shall not render the signal-generator system inoperable to activating information from the remaining devices.

(vi) The signal-generating system shall be designed to enhance the probability that alarm occurs only when immediate evacuation is warranted. The number of false alarms shall not be so great that the signal will come to be disregarded and shall be low enough to minimize personal injuries or excessive property damage that might result from such evacuation.

(c) Testing.

(i) Initial tests, inspections, and checks of the signal-generating system shall be made to verify that the fabrication and installation were made in accordance with design plans and specifications and to develop a thorough knowledge of the performance of the system and all components under normal and hostile conditions.

(ii) Once the system has been placed in service, periodic tests, inspections, and checks shall be made to minimize the possibility of malfunction.

(iii) Following significant alterations or revisions to the system, tests and checks similar to the initial installation tests shall be made.

(iv) Tests shall be designed to minimize hazards while conducting the tests.

(v) Prior to normal operation the signal-generating system shall be checked physically and functionally to assure reliability and to demonstrate accuracy and performance. Specific tests shall include:

(A) All power sources.

(B) Calibration and calibration stability.

(C) Trip levels and stability.

(D) Continuity of function with loss and return of required services such as AC or DC power, air pressure, etc.

(E) All indicators.

(F) Trouble indicator circuits and signals, where used.

(G) Air pressure (if used).

(H) Determine that sound level of the signal is within the limit of item (a)(ii) of this subsection at all points that require immediate evacuation.

(vi) In addition to the initial startup and operating tests, periodic scheduled performance tests and status checks must be made to insure that the system is at all times operating within design limits and capable of the required response. Specific periodic tests or checks or both shall include:

(A) Adequacy of signal activation device.

(B) All power sources.

(C) Function of all alarm circuits and trouble indicator circuits including trip levels.

(D) Air pressure (if used).

(E) Function of entire system including operation without power where required.

(F) Complete operational tests including sounding of the signal and determination that sound levels are adequate.

(vii) Periodic tests shall be scheduled on the basis of need, experience, difficulty, and disruption of operations. The entire system should be operationally tested at least quarterly.

(viii) All employees whose work may necessitate their presence in an area covered by the signal shall be made familiar with the actual sound of the signal—preferably as it sounds at their work location. Before placing the system into operation, all employees normally working in the area shall be made acquainted with the signal by actual demonstration at their work locations.

(8) Exceptions from posting requirements. Notwithstanding the provisions of subsection (6) of this section:

(a) A room or area is not required to be posted with a caution sign because of the presence of a sealed source, provided the radiation level 12 inches from the surface of the source container or housing does not exceed 5 millirem per hour.

(b) Rooms or other areas in onsite medical facilities are not required to be posted with caution signs because of the presence of patients containing radioactive material, provided that there are personnel in attendance who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive material in excess of the limits established in the provisions of this section.

(c) Caution signs are not required to be posted at areas or rooms containing radioactive materials for periods of less than 8 hours: *Provided*, That

(i) The materials are constantly attended during such periods by an individual who shall take the precautions necessary to prevent the exposure of any individual to radiation or radioactive materials in excess of the limits established in the provisions of this section; and

(ii) Such area or room is subject to the employer's control.

(9) Exemptions for radioactive materials packaged for shipment. Radioactive materials packaged and labeled in accordance with regulations of the Department of Transportation published in 49 CFR Chapter I, are exempt from the labeling and posting requirements of this section during ship-

ment, provided that the inside containers are labeled in accordance with the provisions of subsection (6) of this section.

(10) Instruction of personnel, posting.

(a) Employers regulated by the Nuclear Regulatory Commission shall be governed by 10 CFR Part 20 standards. Employers conducting business in Washington state shall be governed by the requirements of the laws and regulations of the state. All other employers shall be regulated by the following:

(b) All individuals working in or frequenting any portion of a radiation area shall be informed of the occurrence of radioactive materials or of radiation in such portions of the radiation area; shall be instructed in the safety problems associated with exposure to such materials or radiation and in precautions or devices to minimize exposure; shall be instructed in the applicable provisions of this section for the protection of employees from exposure to radiation or radioactive materials; and shall be advised of reports of radiation exposure which employees may request pursuant to the regulations in this section.

(c) Each employer to whom this section applies shall post a current copy of its provisions and a copy of the operating procedures applicable to the work conspicuously in such locations as to insure that employees working in or frequenting radiation areas will observe these documents on the way to and from their place of employment, or shall keep such documents available for examination of employees upon request.

(11) Storage of radioactive materials. Radioactive materials stored in a nonradiation area shall be secured against unauthorized removal from the place of storage.

(12) Waste disposal. No employer shall dispose of radioactive material except as provided for in WAC 402-24-130.

(13) Notification of incidents.

(a) Immediate notification. Each employer shall immediately notify the industrial hygiene section, division of industrial safety and health for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; subsection (2)(b) of this section by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 25 rems or more of radiation; exposure of the skin of the whole body of any individual to 150 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms of any individual to 375 rems or more of radiation; or

(ii) The release of radioactive material in concentrations which, if averaged over a period of 24 hours, would exceed 5,000 times the limit specified for such materials in Table II of WAC 402-24-220, Appendix A.

(iii) A loss of 1 working week or more of the operation of any facilities affected; or

(iv) Damage to property in excess of \$100,000.

(b) Twenty-four hour notification. Each employer shall within 24 hours following its occurrence notify the industrial hygiene section, division of industrial safety and health, for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; subsection (2)(b) of this section, by telephone or telegraph of any incident involving radiation which may have caused or threatens to cause:

(i) Exposure of the whole body of any individual to 5 rems or more of radiation; exposure of the skin of the whole body of any individual to 30 rems or more of radiation; or exposure of the feet, ankles, hands, or forearms to 75 rems or more of radiation; or

(ii) A loss of 1 day or more of the operation of any facilities; or

(iii) Damage to property in excess of \$10,000.

(14) Reports of overexposure and excessive levels and concentrations.

(a) In addition to any notification required by subsection (13) of this section each employer shall make a report in writing within 30 days to the industrial hygiene section division of industrial safety and health, for employees not protected by the Nuclear Regulatory Commission by means of 10 CFR Part 20; or under subsection (2)(b) of this section, of each exposure of an individual to radiation or concentrations of radioactive material in excess of any applicable limit in this section. Each report required under this subdivision shall describe the extent of exposure of persons to radiation or to radioactive material; levels of radiation and concentration of radioactive material involved, the cause of the exposure, levels of concentrations; and corrective steps taken or planned to assure against a recurrence.

(b) In any case where an employer is required pursuant to the provisions of this subsection to report to the industrial hygiene section, division of industrial safety and health, any exposure of an individual to radiation or to concentrations of radioactive material, the employer shall also notify such individual of the nature and extent of exposure. Such notice shall be in writing and shall contain the following statement: "You should preserve this report for future reference."

(15) Records.

(a) Every employer shall maintain records of the radiation exposure of all employees for whom personnel monitoring is required under subsection (5) of this section and advise each of his employees of his individual exposure on at least an annual basis.

(b) Every employer shall maintain records in the same units used in tables in subsection (2) of this section and WAC 402-24-220, Appendix A.

(16) Disclosure to former employee of individual employee's record.

(a) At the request of a former employee an employer shall furnish to the employee a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to subdivision (15)(a) of this section. Such report shall be furnished within 30 days from the time the request is made, and shall cover each calendar quarter of the individual's employment involving exposure to radiation or such lesser period as may be requested by the employee. The report shall also include the results of any calculations and analysis of radioactive material deposited in the body of the employee. The report shall be in writing and contain the following statement: "You should preserve this report for future reference."

(b) The former employee's request should include appropriate identifying data, such as social security number and dates and locations of employment.

(17) (Reserved)

(18) Radiation standards for mining.

(a) For the purpose of this subsection, a "working level" is defined as any combination of radon daughters in 1 liter of air which will result in the ultimate emission of 1.3×10^5 million electron volts of potential alpha energy. The numerical value of the "working level" is derived from the alpha energy released by the total decay of short-lived radon daughter products in equilibrium with 100 picocuries of radon 222 per liter of air. A working level month is defined as the exposure received by a worker breathing air at one working level concentration for 4-1/3 weeks of 40 hours each.

(b) Occupational exposure to radon daughters in mines shall be controlled so that no individual will receive an exposure of more than 2 working level months in any calendar quarter and no more than 4 working level months in any calendar year. Actual exposures shall be kept as far below these values as practicable.

(c)(i) For uranium mines, records of environmental concentrations in the occupied parts of the mine, and of the time spent in each area by each person involved in an underground work shall be established and maintained. These records shall be in sufficient detail to permit calculations of the exposures, in units of working level months, of the individuals and shall be available for inspection by the industrial hygiene section, division of safety and health or their authorized representatives.

(ii) For other than uranium mines and for surface workers in all mines, item (i) of this subdivision will be applicable: *Provided, however,* That if no environmental sample shows a concentration greater than 0.33 working level in any occupied part of the mine, the maintenance of individual occupancy records and the calculation of individual exposures will not be required.

(d)(i) At the request of an employee (or former employee) a report of the employee's exposure to radiation as shown in records maintained by the employer pursuant to subdivision (c) of this subsection shall be furnished to him. The report shall be in writing and contain the following statement:

"This report is furnished to you under the provisions of the state of Washington, Ionizing Radiation Safety and Health Standards (chapter 296-62 WAC). You should preserve this report for future reference."

(ii) The former employee's request should include appropriate identifying data, such as Social Security number and dates and locations of employment. See tables in WAC 402-24-220, Appendix A and 402-24-230, Appendix B.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 85-01-022 (Order 84-24), § 296-62-09004, filed 12/11/84; Order 75-15, § 296-62-09004, filed 4/18/75.]

WAC 296-62-09005 Nonionizing radiation. (1) Introduction. Employees shall be protected from exposure to hazardous levels of nonionizing radiation. Health standards have been established for ultraviolet, radiofrequency/microwave, and laser radiations which shall be used to promote a healthful working environment. These standards refer to levels of nonionizing radiation and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effects. They are based on the best available information from experimental studies.

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Because of the wide variations in individual susceptibility, exposure of an occasional individual at, or even below, the permissible limit, may result in discomfort, aggravation of a preexisting condition, or physiological damage.

(a) Permissible exposure limits (PELs) refer to a time weighted average (TWA) of exposure for an 8-hour work day within a 40-hour workweek. Exceptions are those limits which are given a ceiling value.

(b) These PELs should be interpreted and applied only by technically qualified persons.

(c) Ceiling value. There are nonionizing radiations which produce physiological responses from short intense exposure and the PELs for these radiations are more appropriately based on this particular hazard. Nonionizing radiations with this type of hazard are best controlled by a ceiling value which is a maximum level of exposure which shall not be exceeded.

(2) The employer shall establish and maintain a program for the control and monitoring of nonionizing radiation hazards. This program shall provide employees adequate supervision, training, facilities, equipment, and supplies, for the control and assessment of nonionizing radiation hazards.

(3) Radiofrequency/microwave radiation permissible exposure limits.

(a) Definition: "Partial body exposure" means the case in which only the hands and forearms or the feet and legs below the knee are exposed.

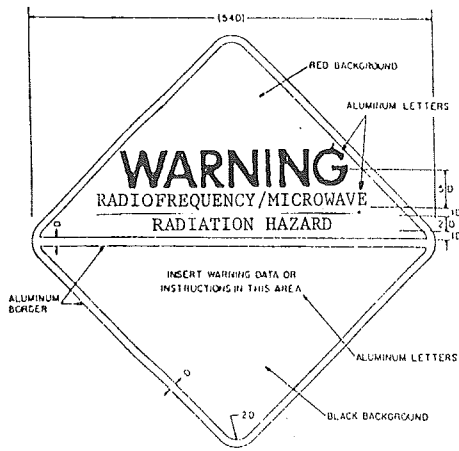
(b) Warning symbol.

(i) The warning symbol for radiofrequency/microwave radiation shall consist of a red isosceles triangle above an inverted black isosceles triangle, separated and outlined by an aluminum color border. The words "Warning - Radiofrequency/microwave radiation hazard" shall appear in the upper triangle. See Figure 1.

(ii) All areas where entry may result in an exposure to radiofrequency/microwave radiation in excess of the PEL shall have a warning symbol prominently displayed at their entrance.

(iii) American National Standard Safety Color Code for Marking Physical Hazards and the Identification of Certain Equipment, Z53.1-1953, shall be used for color specification. All lettering and the border shall be of aluminum color.

(iv) The inclusion and choice of warning information or precautionary instructions is at the discretion of the user. If such information is included it shall appear in the lower triangle of the warning symbol.



1. Place handling and mounting instructions on reverse side.
2. D = Scaling Unit.
3. Lettering: Ratio of letter height to thickness of letter lines.
 Upper triangle: 5 to 1 Large
 6 to 1 Medium
 Lower triangle: 4 to 1 Small
 6 to 1 Medium
4. Symbol is square, triangles are right-angle isosceles.

Figure 1

Radiofrequency/Microwave Radiation Hazard Warning Symbol

the PEL incurred within each frequency interval shall be determined and the sum of these fractions shall not exceed unity.

(v) PELs given in Table I for frequencies between 300 kHz and 1 GHz may be exceeded for partial body exposures if the output power of the radiating device is 7 watts or less.

Table I. Radiofrequency/Microwave Radiation Permissible Exposure Limits (PELs).

Frequency(f)	Power Density*	Electric Field Strength Squared*	Magnetic Field Strength Squared*
0.3 to 3 MHz	mW/cm ²	V ² /m ²	A ² /m ²
3 to 30 MHz	100	400,000	2.5
30 to 300 MHz	900/f ²	4000(900/f ²)	0.025(900/f ²)
300 to 1500 MHz	1.0	4000	0.025
1.5 to 100 GHz	f/300	4000(f/300)	0.025(f/300)
	5.0	20,000	0.125

Note: f = frequency (MHz)
 * Ceiling value

(4) Laser radiation permissible exposure limits.

(a) Definitions.

(i) "Diffuse reflection" means a change of the spatial distribution of a beam of radiation when it is reflected in many directions by a surface or medium.

(ii) "Specular reflection" means a mirrorlike reflection.

(iii) "Accessible radiation" means laser radiation to which human access is possible.

(b) All lasers and laser systems shall be classified in accordance with the Federal Laser Product Performance Standards (21 CFR 1040.10) or, if manufactured prior to August 2, 1976, in accordance with ANSI Z136.1-1980.

(i) Class I. Laser systems that are considered to be incapable of producing damaging radiation levels and are thereby exempt from control measures. This is a no hazard category.

(ii) Class II. Visible wavelength laser systems that have a low hazard potential because of the expected aversion response. There is some possibility of injury if stared at. This is a low hazard category.

(iii) Class III. Laser systems in which intrabeam viewing of the direct beam or specular reflections of the beam may be hazardous. This class is further subdivided into IIIa and IIIb. This is a moderate hazard category.

(iv) Class IV. Laser systems whose direct or diffusely reflected radiation may be hazardous and where the beam may constitute a fire hazard. Class IV systems require the use of controls that prevent exposure of the eye and skin to specular or diffuse reflections of the beam. This is a high hazard category.

(c) Warning signs and classification labels shall be prepared in accordance with 21 CFR 1040.10 when classifying lasers and laser systems, and ANSI Z136.1 - 1980 when using classified lasers and laser systems. All signs and labels shall be conspicuously displayed.

(i) The signal word "CAUTION" shall be used with all signs and labels associated with Class II and Class IIIa lasers and laser systems.

(ii) The signal word "DANGER" shall be used with all signs and labels associated with Class IIIb and Class IV lasers and laser systems.

1. Cross-hatched area is to be magenta or purple.
2. Background is to be yellow.

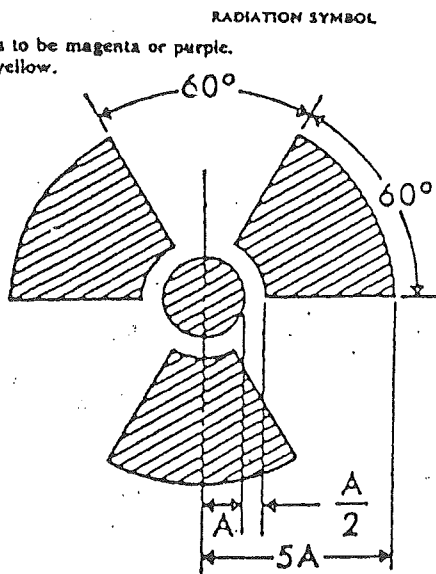


FIGURE G-10

(c) These PELs refer to radiofrequency/microwave radiation exposures in the frequency range of 300 kHz to 100 GHz. Based on current knowledge, it is believed that workers may be exposed at these PELs without adverse health effects.

(i) Table I gives the PELs in terms of the mean squared electric (E²) and magnetic (H²) field strengths and in terms of the equivalent plane-wave free-space power density, as a function of frequency.

(ii) The average exposure for any 6 minute (0.1 hour) period shall not exceed the PEL.

(iii) Measurements shall be made at distances of 5 cm or greater from any object.

(iv) For mixed or broadband fields at a number of frequencies for which there are different PELs, the fraction of

(d) Personal protective equipment shall be provided at no cost to the employee and shall be worn whenever operational conditions or maintenance of lasers may result in a potentially hazardous exposure.

(i) Protective eyewear shall be specifically designed for protection against radiation of the wavelength and radiant energy of the laser or laser system. Ocular exposure shall not exceed the recommendations of ANSI Z136.1 - 1980.

(ii) For Class IV lasers and laser systems protective eyewear shall be worn for all operational conditions or maintenance which may result in exposures to laser radiation.

(e) Engineering controls shall be used whenever feasible to reduce the accessible radiation levels for Class IV lasers and laser systems to a lower classification level. These controls may include, but are not limited to: Protective housings, interlocks, optical system attenuators, enclosed beam paths, remote controls, beam stops, and emission delays with audible warnings.

(f) All employees who may be exposed to laser radiation shall receive laser safety training. The training shall ensure that the employees are knowledgeable of the potential hazards and control measures for the laser equipment in use.

(5) Ultraviolet radiation.

(a) These permissible exposure limits refer to ultraviolet radiation in the spectral region between 200 and 400 nanometer (nm) and represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. These values for exposure of the eye or the skin apply to ultraviolet radiation from arcs, gas, and vapor discharges, and incandescent sources, but do not apply to ultraviolet lasers or solar radiation. These levels should not be used for determining exposure of photosensitive individuals to ultraviolet radiation. These values shall be used in the control of exposure to continuous sources where the exposure relation shall not be less than 0.1 sec.

(b) The permissible exposure limit for occupational exposure to ultraviolet radiation incident upon skin or eye where irradiance values are known and exposure time is controlled are as follows:

(i) For the near ultraviolet spectral region (320 to 400 nanometer (nm)), total irradiance incident upon the unprotected skin or eye shall not exceed 1.0 milliwatt/sq. centimeter for periods greater than 10^3 seconds (approximately 16 minutes) and for exposure times less than 10^3 seconds shall not exceed one Joule/sq. centimeter.

(ii) For the actinic ultraviolet spectral region (200 - 315 nm), radiant exposure incident upon the unprotected skin or eye shall not exceed the values given in Table 4 within an 8-hour period.

(iii) To determine the effective irradiance of a broadband source weighted against the peak of the spectral effectiveness curve (270 nanometer (nm)), the following weighting formulas shall be used.

$$E_{\text{eff}} = \sum (E\text{-Lambda}) (S\text{-Lambda}) (\Delta\text{-Lambda})$$

Where:

E_{eff} = effective irradiance relative to a monochromatic source at 270nm
 E-Lambda = spectral irradiance in Watts/sq. centimeter/nanometer.

$$E_{\text{eff}} = \sum (E\text{-Lambda}) (S\text{-Lambda}) (\Delta\text{-Lambda})$$

Where:

S-Lambda = relative spectral effectiveness (unitless)
 Delta-Lambda = band width in nanometers

(iv) Permissible exposure time in seconds for exposure to actinic ultraviolet radiation incident upon the unprotected skin or eye may be computed by dividing 0.003 Joules/sq. centimeter by E_{eff} in Watts/sq. centimeter. The exposure time may also be determined using Table 5 which provides exposure times corresponding to effective irradiances in $\mu\text{W}/\text{cm}^2$.

TABLE 4

Wavelength nanometer	PEL millijoules/sq. centimeters	Relative Spectral Effectiveness S Lambda
200	100	0.03
210	40	0.075
220	25	0.12
230	16	0.19
240	10	0.30
250	7.0	0.43
254	6.0	0.5
260	4.6	0.65
270	3.0	1.0
280	3.4	0.88
290	4.7	0.64
300	10	0.30
305	50	0.06
310	200	0.015
315	1000	0.003

TABLE 5

Duration of Exposure Per Day	Effective Irradiance E_{eff} ($\mu\text{W}/\text{cm}^2$)
8 hrs.	0.1
4 hrs.	0.2
2 hrs.	0.4
1 hr.	0.8
1/2 hr.	1.7
15 min.	3.3
10 min.	5
5 min.	10
1 min.	50
30 sec.	100
10 sec.	300
1 sec.	3,000
0.5 sec.	6,000
0.1 sec.	30,000

TABLE 6

Densities and Transmissions (in Percent); also Tolerances in Densities and Transmissions of Various Shades of Glasses for Protection Against Injurious Rays (Shades 3 to 8, inclusive, are for use in goggles, shades 10 to 14, inclusive, for welder's helmets and face shields)

TABLE 6

[CODIFICATION NOTE: The graphic presentation of this table has been varied slightly in order that it would fall within the printing specifications for the Washington Administrative Code. In the following table, the original table had columns relating to (1) "Optical Density" which is now "Part 1," (2) "Total Visible Luminous Transmittance" and "Maximum total Infrared" which are now "Part 2," (3) "Maximum Ultraviolet Transmission" which is now "Part 3," and (4) "Recommended Uses" which is now "Part 4." These columns were all positioned side by side. In the new WAC format these are split up into four separate tables.]

TABLE 6—Part 1

Shade No.	Optical Density		
	Minimum [C]O.D.	Standard O.D.	Maximum O.D.
3.0	.64	.857	1.06
4.0	1.07	1.286	1.49
5.0	1.50	1.714	1.92
6.0	1.93	2.143	2.35
7.0	2.36	2.572	2.78
8	2.79	3.000	3.21
9	3.22	3.429	3.63
10	3.64	3.857	4.06
11	4.07	4.286	4.49
12	4.50	4.715	4.92
13	4.93	5.143	5.35
14	5.36	5.571	5.78

TABLE 6—Part 2

Shade No.	Total Visible Luminous Transmittance			Maximum Total Infrared %
	Maximum %	Standard %	Minimum %	
3.0	22.9	13.9	8.70	9.0
4.0	8.51	5.18	3.24	5.0
5.0	3.16	1.93	1.20	2.5
6.0	1.18	.72	.45	1.5
7.0	.44	.27	.17	1.3
8	.162	.100	.062	1.0
9	.060	.037	.023	.8
10	.0229	.0139	.0087	.6
11	.0085	.0052	.0033	.5
12	.0032	.0019	.0012	.5
13	.00118	.00072	.00045	.4

TABLE 6—Part 2

Shade No.	Total Visible Luminous Transmittance			Maximum Total Infrared %
	Maximum %	Standard %	Minimum %	
14	.00044	.00027	.00017	.3

TABLE 6—Part 3
Maximum Ultraviolet Transmission

Shade No.	313mu %	334mu %	365mu %	405mu %
	3.0	.2	.2	.5	1.0
4.0	.2	.2	.5	1.0
5.0	.2	.2	.2	.5
6.0	.1	.1	.1	.5
7.0	.1	.1	.1	.5
8	.1	.1	.1	.5
9	.1	.1	.1	.5
10	.1	.1	.1	.5
11	.05	.05	.05	.1
12	.05	.05	.05	.1
13	.05	.05	.05	.1
14	.05	.05	.05	.1

TABLE 6—Part 4

Shade No.	Recommended Uses
3.0	Glare of reflected sunlight from snow, water, sand, etc., stray light from cutting and welding metal pouring and work around furnaces and foundries.
4.0	
5.0	Light acetylene cutting and welding; light electric spot welding.
6.0	
7.0	Acetylene cutting and medium welding; arc welding up to 30 amperes.
8	
9	Heavy acetylene welding; arc cutting and welding between 30 and 75 amperes.

TABLE 6—Part 4

Shade No.	Recommended Uses
10	
11	Arc cutting and welding between 75 and 200 amperes.
12	
13	Arc cutting and welding between 200 and 400 amperes.
14	Arc cutting and welding above 400 amperes.

- a. American Standard Safety Code for the Protection of Heads, Eyes, and Respiratory Organs.
 b. Standard density is defined as the logarithms (base 10) of the reciprocal of the transmission. Shade number is determined by the density according to the relations:

Shade number = $7/3 \text{ density} + 1$ with tolerances as given in the table.

Note: Safety glasses are available with lenses which protect the eyes against ultraviolet radiation.

[Statutory Authority: Chapter 49.17 RCW and RCW 49.17.040, [49.17].050 and [49.17].060, 92-22-067 (Order 92-06), § 296-62-09005, filed 10/30/92, effective 12/8/92. Statutory Authority: RCW 49.17.040 and 49.17.050, 85-01-022 (Order 84-24), § 296-62-09005, filed 12/11/84. Statutory Authority: RCW 49.17.040, 80-16-029 (Order 80-22), § 296-62-09005, filed 10/31/80. Statutory Authority: RCW 49.17.040, 49.17.050 and 49.17.240, 80-11-010 (Order 80-14), § 296-62-09005, filed 8/8/80; Order 73-3, § 296-62-09005, filed 5/7/73.]

Reviser's note: RCW 34.05.395 requires the use of underlining and deletion marks to indicate amendments to existing rules, and deems ineffectual changes not filed by the agency in this manner. The bracketed material in the above section does not appear to conform to the statutory requirement.

WAC 296-62-09007 Pressure. (1) Employees exposed to pressures above normal atmospheric pressure which may produce physiological injury shall adhere to decompression schedules or other tables as are or may be adopted by the department of labor and industries: for example, state of Washington "safety standards for compressed air work" and "safety standards for commercial diving operations." The employer shall provide and supervise the use of decompression equipment and schedules in accordance with applicable requirements.

(2) If no specific requirements prevail for an unusual condition, a plan based on the recommendations of professionally qualified advisors, experienced with hazards associated with such exposures, shall be followed by both the employer and employee.

[Statutory Authority: Chapter 49.17 RCW, 91-11-070 (Order 91-01), § 296-62-09007, filed 5/20/91, effective 6/20/91; Order 73-3, § 296-62-09007, filed 5/7/73.]

WAC 296-62-09009 Vibration. Reasonable precautions shall be taken to protect workmen against the hazardous effects of unavoidable exposure to vibrations.

[Order 73-3, § 296-62-09009, filed 5/7/73.]

WAC 296-62-09013 Temperature, radiant heat, or temperature-humidity combinations. (1) Workmen subjected to temperature extremes, radiant heat, humidity, or air velocity combinations which, over a period of time, are likely to produce physiological responses which are harmful shall

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be afforded protection by use of adequate controls, methods or procedures, or protective clothing. This shall not be construed to apply to normal occupations under atmospheric conditions which may be expected in the area except that special provisions which are required by other regulations for certain areas or occupations shall prevail.

[Order 73-3, § 296-62-09013, filed 5/7/73.]

PART K—HEARING CONSERVATION

WAC 296-62-09015 Hearing conservation. The employer shall administer a continuing effective hearing conservation program, as described in WAC 296-62-09015 through 296-62-09055 whenever employee noise exposures equal or exceed an 8-hour time-weighted average (TWA) sound level of 85 decibels (dB) measured on the A-scale weighting at slow response or, equivalently, a noise dose of fifty percent. For purposes of the hearing conservation program, employee noise exposures shall be computed in accordance with WAC 296-62-09055, Appendix E: Noise exposure computation, without regard to any attenuation provided by the use of personal protective equipment.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 83-24-013 (Order 83-34), § 296-62-09015, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09015, filed 1/15/82.]

WAC 296-62-09017 Definitions. These definitions apply to the following terms as used in WAC 296-62-09015 through 296-62-09055.

(1) **Audiogram** - A chart, graph, or table resulting from an audiometric test showing an individual's hearing threshold levels as a function of frequency.

(2) **Audiologist** - A professional, specializing in the study and rehabilitation of hearing, who is certified by the American Speech, Hearing, and Language Association or licensed by a state board of examiners.

(3) **Baseline audiogram** - The audiogram against which future audiograms are compared.

(4) **Criterion sound level** - A sound level of 90 decibels.

(5) **Decibel (dB)** - Unit of measurement of sound level.

(6) **Hertz (Hz)** - Unit of measurement of frequency, numerically equal to cycles per second.

(7) **Impulsive or impact noise** - Noise levels which involve maxima at intervals greater than one second. Where the intervals are less than one second, the noise levels shall be considered continuous.

(8) **Medical pathology** - A disorder or disease. For purposes of this regulation, a condition or disease affecting the ear, which should be treated by a physician specialist.

(9) **Noise dose** - The ratio, expressed as a percentage, of (a) the time integral, over a stated time or event, of the 0.6 power of the measured SLOW exponential time-averaged, squared A-weighted sound pressure and (b) the product of the criterion duration (8 hours) and the 0.6 power of the squared sound pressure corresponding to the criterion sound level (90 dB).

(10) **Noise dosimeter** - An instrument that integrates a function of sound pressure over a period of time in such a manner that it directly indicates a noise dose.

(11) **Otolaryngologist** - A physician specializing in diagnosis and treatment of disorders of the ear, nose and throat.

(12) Representative exposure - Measurements of an employee's noise dose or 8-hour time-weighted average sound level that the employer deems to be representative of the exposure of other employees in the workplace.

(13) Standard threshold shift - A hearing level change, relative to the baseline audiogram, of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear.

(14) Sound level - Ten times the common logarithm of the ratio of the the square of the measured A-weighted sound pressure to the square of the standard reference pressure of 20 micropascals. Unit: Decibels (dB). For use with this regulation, SLOW time response, in accordance with ANSI S1.4-1971 (R1976), is required unless specifically specified otherwise.

(15) Sound level meter - An instrument for the measurement of sound level.

(16) Time-weighted average sound level - That sound level, which if constant over an 8-hour period, would result in the same noise dose as if measured in the time varying noise level environment.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09017, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09017, filed 1/15/82.]

WAC 296-62-09019 Monitoring. (1) When reasonable information indicates that any employee's exposure may equal or exceed an 8-hour time-weighted average of 85 dBA, the employer shall obtain individual or representative exposure measurements for all employees who may be exposed at or above that level.

(2) The sampling strategy shall be designed to identify all employees required to be included in the hearing conservation program and to enable the proper selection of hearing protectors.

(3) Where circumstances such as high worker mobility, significant variations in sound level, or a significant component of impulse noise exist, the employer shall use representative personal sampling to comply with the monitoring requirements of this section unless the employer can establish that area sampling produces equivalent results.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09019, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09019, filed 1/15/82.]

WAC 296-62-09021 Method of noise measurement.

(1) Noise dosimeters which comply, as a minimum, with the provisions of subdivision (1)(a) of this section or sound level meters which comply, as a minimum, with the provisions of subdivision (1)(b) of this section shall be used whenever employee exposures are evaluated for the purpose of complying with WAC 296-62-09015 through 296-62-09055.

(a) Dosimeters. Dosimeters shall meet the Class 2A-90/80-5 requirements of the American National Standard Specification for Personal Noise Dosimeters, S1.25-1978.

(b) Sound level meters. Sound level meters shall meet the Type 2 requirements of the American National Standard Specification for Sound Level Meters, S1.4-1971 (R1976).

(2) All continuous, intermittent, and impulsive sound levels from 80 dBA to 130 dBA shall be integrated into the exposure computation.

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(3) Monitoring shall be repeated whenever a change in production, process, equipment or controls increases noise exposures to the extent that:

(a) Additional employees may be exposed at or above an 8-hour time-weighted average of 85 dBA; or

(b) The attenuation provided by hearing protectors being used by employees may be rendered inadequate to meet the requirements of WAC 296-62-09033.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09021, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09021, filed 1/15/82.]

WAC 296-62-09023 Calibration of monitoring equipment. Dosimeters and sound level meters used to monitor employee noise exposure shall be calibrated using the instrument manufacturer's calibration instructions before and after each day's use.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09023, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09023, filed 1/15/82.]

WAC 296-62-09024 Employee notification. The employer shall notify each employee exposed at or above an 8-hour time-weighted average of 85 dBA of the results of the monitoring.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09024, filed 11/30/83.]

WAC 296-62-09025 Observation of monitoring. The employer shall provide affected employees or their representatives with an opportunity to observe any measurements of employee noise exposure which are conducted pursuant to WAC 296-62-09019.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-09025, filed 1/15/82.]

WAC 296-62-09026 Noise control. (1) Whenever employee noise exposures equal or exceed an 8-hour time-weighted average of 90 dBA, feasible administrative or engineering controls shall be utilized.

(2) Upon request, the employer shall prepare and submit a written compliance plan to the director or his/her designee. This plan must include a description of the manner in which compliance will be achieved with respect to cited violations of WAC 296-62-09026(1) and shall include proposed abatement methods, anticipated completion dates, and provision for progress reports to the director or his/her designee.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09026, filed 11/30/83.]

WAC 296-62-09027 Audiometric testing program. (1) The employer shall establish and maintain a mandatory audiometric testing program as provided in this section for all employees whose exposures equal or exceed an 8-hour time-weighted average of 85 dBA.

(2) The program shall be provided at no cost to employees.

(3) Audiometric tests shall be performed by a licensed or certified audiologist, otolaryngologist, or other qualified physician, or by a technician who is certified by the Council of Accreditation in Occupational Hearing Conservation. A tech-

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nician who performs audiometric tests must be responsible to an audiologist, otolaryngologist or other qualified physician.

(4) All audiograms obtained pursuant to this section shall meet the requirements of WAC 296-62-09047, Appendix A: Audiometric measuring instruments.

(5) Baseline audiogram.

(a) Prior to or within 180 days after an employee's first exposure to noise at or above a time-weighted average of 85 dBA, the employer shall establish for each employee so exposed a valid baseline audiogram against which subsequent audiograms can be compared. Employers who utilize mobile test units are allowed up to one year to obtain a valid baseline audiogram for each exposed employee, provided that each employee so exposed shall be trained and shall wear suitable hearing protectors in accordance with WAC 296-62-09015 through 296-62-09055.

(b) Testing to establish a baseline audiogram shall be preceded by at least 14 hours without exposure to workplace noise.

This may be accomplished by use of hearing protectors; however, the employer shall notify employees of the need to avoid high levels of nonoccupational noise exposure during the 14-hour period immediately preceding the audiometric examination.

(6) Annual audiogram.

(a) At least annually (i.e. every 12-month interval) after obtaining the baseline audiogram, the employer shall obtain a new audiogram for each employee exposed at or above a time-weighted average of 85 dBA.

(b) Annual audiometric testing may be conducted at any time during the workshift.

(7) Evaluation of audiogram.

(a) Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if a standard threshold shift has occurred. This comparison may be made by a certified audiometric technician.

(b) If the annual audiogram indicates that an employee has suffered a standard threshold shift, the employer may obtain a retest within 30 days and consider the results of the retest as the annual audiogram.

(c) An audiologist, otolaryngologist or other qualified physician shall review audiograms which indicate a standard threshold shift to determine whether there is need for further evaluation. The employer shall provide to the person performing this evaluation the following information:

(i) A copy of the requirements for hearing conservation as set forth in WAC 296-62-09015 through 296-62-09055;

(ii) The baseline audiogram and most recent audiogram of the employee to be evaluated;

(iii) Measurements of background sound pressure levels in the audiometric test room as required in WAC 296-62-09049, Appendix B: Audiometric test rooms; and

(iv) Records of audiometer calibrations required by WAC 296-62-09029(5).

(d) Inform each employee of the results of his/her audiometric test and whether or not there has been a hearing level decrease or improvement since his/her previous test.

(8) Follow-up procedures. If a comparison of the annual audiogram to the baseline audiogram indicates a standard

threshold shift, the employer shall ensure that the following steps are taken:

(a) Employees not using hearing protectors shall be fitted with hearing protectors, trained in their use and care, and required to use them.

(b) Employees already using hearing protectors shall be refitted and retrained in the use of hearing protectors and provided with hearing protectors offering greater attenuation if necessary.

(c) Inform the employee in writing, within 21 days of the determination, of the existence of a standard threshold shift;

(d) Refer the employee, at no cost to the employee, for a clinical audiological evaluation or an otological examination, as appropriate, if additional testing is necessary or if the employer suspects that a medical pathology of the ear (as defined in WAC 296-62-09017) is caused or aggravated by the wearing of hearing protectors; and

(e) Inform the employee of the need for an otological examination if a medical pathology of the ear which is unrelated to the use of hearing protectors is suspected.

(9) Revised baseline. An annual audiogram may be substituted for the baseline audiogram when, in the judgment of the audiologist, otolaryngologist or other qualified physician who is evaluating the audiogram:

(a) The standard threshold shift revealed by the audiogram is persistent; or

(b) The hearing threshold shown in the annual audiogram indicates significant improvement over the baseline audiogram.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09027, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09027, filed 1/15/82.]

WAC 296-62-09029 Audiometric test requirements.

(1) Audiometric tests shall be pure tone, air conduction, hearing threshold examinations, with test frequencies including as a minimum 500, 1000, 2000, 3000, 4000, and 6000 Hz. Tests at each frequency shall be taken separately for each ear.

(2) Audiometric tests shall be conducted with audiometers (including microprocessor audiometers) that meet the specifications of, and are maintained and used in accordance with, American National Standard Specification for Audiometers, S3.6-1969(R1973).

(3) Pulsed-tone and self-recording audiometers, if used, shall meet the requirements specified in WAC 296-62-09047, Appendix A: Audiometric measuring instruments.

(4) Audiometric examinations shall be administered in a room meeting the requirements listed in WAC 296-62-09049, Appendix B: Audiometric test rooms.

(5) Audiometer calibration.

(a) The functional operation of the audiometer shall be checked before each day's use by testing a person with known, stable hearing thresholds, and by listening to the audiometer's output to make sure that the output is free from distorted or unwanted sounds. Deviations of 10 dB or greater shall require an acoustic calibration.

(b) Audiometer calibration shall be checked acoustically at least annually in accordance with WAC 296-62-09051, Appendix C: Acoustic calibration of audiometers. Test frequencies below 500 Hz and above 6000 Hz may be omitted from this check.

(c) An exhaustive calibration shall be performed at least every two years in accordance with sections 4.1.2; 4.1.3; 4.1.4.3; 4.2; 4.4.1; 4.4.2; 4.4.3; and 4.5 of the American National Standard Specification for Audiometers, S3.6-1969(R1973). Test frequencies below 500 Hz and above 6000 Hz may be omitted from the calibration.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09029, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09029, filed 1/15/82.]

WAC 296-62-09031 Hearing protectors. (1) Employers shall make hearing protectors available to all employees exposed to a time-weighted average of 85 dBA or greater at no cost to the employees. Hearing protectors shall be replaced as necessary.

(2) Employers shall ensure that hearing protectors are worn:

(a) By any employee who is exposed to an 8-hour time-weighted average of 85 dBA or greater; or

(b) By any employee who is exposed to noise above 115 dBA; or

(c) By any employee who is exposed to any impulsive or impact noise measured at or above 140 dB peak using an impulse sound level meter set to either the linear or C-scale.

(3) Employees shall be given the opportunity to select their hearing protectors from at least two different types (i.e. molded, self-molded, custom molded, or ear muffs) of suitable hearing protectors provided by the employer.

(4) The employer shall provide training in the use and care of all hearing protectors provided to employees.

(5) The employer shall ensure proper initial fitting and supervise the correct use of all hearing protectors.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09031, filed 11/30/83; 82-13-045 (Order 82-22), § 296-62-09031, filed 6/11/82; 82-03-023 (Order 82-1), § 296-62-09031, filed 1/15/82.]

WAC 296-62-09033 Hearing protector attenuation.

(1) The employer shall evaluate hearing protector attenuation for the specific noise environments in which the protector will be used by one of the methods described in WAC 296-62-09053, Appendix D: Methods for estimating the adequacy of hearing protector attenuation, or by other methods if approved by the director.

(2) Hearing protectors must attenuate employee exposure at least to a time-weighted average of 85 dBA or below.

(3) The adequacy of hearing protector attenuation shall be re-evaluated whenever employee noise exposures increase to the extent that the hearing protectors provided may no longer provide adequate attenuation. The employer shall provide more effective hearing protectors where necessary.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09033, filed 11/30/83; 82-13-045 (Order 82-22), § 296-62-09033, filed 6/11/82; 82-03-023 (Order 82-1), § 296-62-09033, filed 1/15/82.]

WAC 296-62-09035 Training program. (1) The employer shall institute a training program for all employees who are exposed to noise at or above an 8-hour time-weighted average of 85 dBA, and shall ensure employee participation in such program.

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(2) The training program shall be repeated annually for each employee included in the hearing conservation program. Information provided in the training program shall be updated to be consistent with changes in protective equipment and work processes.

(3) The employer shall ensure that each employee is informed of the following:

(a) The effects of noise on hearing;

(b) The purpose of hearing protectors, the advantages, disadvantages, and attenuation of various types, and instructions on selection, fitting, use, and care; and

(c) The purpose of audiometric testing, and an explanation of the test procedures.

(d) The right to access to records as specified in WAC 296-62-09041(5).

(4) A written description of the training program instituted shall be maintained by each employer.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09035, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09035, filed 1/15/82.]

WAC 296-62-09037 Access to information and training materials. (1) The employer shall make available to affected employees or their representatives copies of this standard and shall also post a copy in the workplace.

(2) The employer shall provide to affected employees any informational materials pertaining to this standard that are supplied to the employer by the director.

(3) The employer shall provide, upon request, all materials related to the employer's training and education program pertaining to this standard to the director.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-09037, filed 1/15/82.]

WAC 296-62-09039 Warning signs. (1) Signs shall be posted at entrances to or on the periphery of all well defined work areas in which employees may be exposed at or above 115 dBA.

(2) Warning signs shall clearly indicate that the area is a high noise area and that hearing protectors are required.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09039, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09039, filed 1/15/82.]

WAC 296-62-09041 Recordkeeping. (1) Exposure measurements. The employer shall maintain an accurate record of all employee exposure measurements required by this section.

(2) Audiometric tests.

(a) The employer shall retain a legible copy of all employee audiograms obtained pursuant to WAC 296-62-09027.

(b) This record shall include:

(i) Name and job classification of the employee;

(ii) Date of the audiogram;

(iii) The examiner's name;

(iv) Date of the last acoustic or exhaustive calibration of the audiometer; and

(v) Employee's most recent noise exposure assessment.

(3) Audiometric test rooms. The employer shall maintain accurate records of the measurements of the background sound pressure levels in audiometric test rooms.

(4) Record retention. The employer shall retain records required in this section for at least the following periods:

(a) Noise exposure measurement records shall be retained for two years.

(b) Audiometric test records shall be retained for the duration of the affected employee's employment.

(5) Access to records. All records required by this section shall be provided upon request to employees, former employees, representatives designated by the individual employee, and the director. The provisions of WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217 apply to access to records under this section.

(6) Transfer of records. If the employer ceases to do business, the employer shall transfer to the successor employer all records required to be maintained by this section, and the successor employer shall retain them for the remainder of the period prescribed in WAC 296-62-09041(4).

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09041, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09041, filed 1/15/82.]

WAC 296-62-09043 Appendices. WAC 296-62-09047, 296-62-09049, 296-62-09051, and 296-62-09053 and 296-62-09055, Appendices A, B, C, D, and E are incorporated as part of this section and the contents of these appendices are mandatory.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09043, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09043, filed 1/15/82.]

WAC 296-62-09045 Effective dates. (1) WAC 296-62-09015 through 296-62-09053 shall become effective 60 days after filing with the code reviser, unless otherwise noted below.

(2) Monitoring conducted pursuant to WAC 296-62-09019 shall be completed no later than 180 days from the effective date of the standard.

(3) Baseline audiograms required by WAC 296-62-09027 shall be completed no later than December 31, 1982.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-09045, filed 1/15/82.]

WAC 296-62-09047 Appendix A—Audiometric measuring instruments. (1) In the event that pulsed-tone audiometers are used, they shall have a tone on-time of at least 200 milliseconds.

(2) Self-recording audiometers shall comply with the following requirements:

(a) The chart upon which the audiogram is traced shall have lines at positions corresponding to all multiples of 10 dB hearing level within the intensity range spanned by the audiometer. The lines shall be equally spaced and shall be separated by at least 1/4 inch. Additional increments are optional. The audiogram pen tracings shall not exceed 2 dB in width.

(b) It shall be possible to set the stylus manually at the 10dB increment lines for calibration purposes.

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(c) The slewing rate for the audiometer attenuator shall not be more than 6 dB/sec except that an initial slewing rate greater than 6 dB/sec is permitted at the beginning of each new test frequency, but only until the second subject response.

(d) The audiometer shall remain at each required test frequency for 30 seconds (±3 seconds). The audiogram shall be clearly marked at each change of frequency and the actual frequency change of the audiometer shall not deviate from the frequency boundaries marked on the audiogram by more than ±3 seconds.

(e) It must be possible at each test frequency to place a horizontal line segment parallel to the time axis on the audiogram, such that the audiometric tracing crosses the line segment at least six times at the test frequency. At each test frequency the threshold shall be the average of the midpoints of the tracing excursions.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09047, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09047, filed 1/15/82.]

WAC 296-62-09049 Appendix B—Audiometric test rooms. Rooms used for audiometric testing shall not have background sound pressure levels exceeding those in Table B-1 when measured by equipment conforming at least to the Type 2 requirements of American National Standard Specification for Sound Level Meters, S1.4-1971 (R1976), and to the Class II requirements of American National Standard Specification for Octave, Half-Octave, and Third-Octave Band Filter Sets, S1.11-1971 (R1976).

TABLE B-1 - Maximum Allowable Octave-Band Sound Pressure Levels for Audiometric Test Rooms.

Octave-band center frequency (Hz)	500	1000	2000	4000	8000
Sound pressure level (dB)	40	40	47	57	62

[Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-09049, filed 1/15/82.]

WAC 296-62-09051 Appendix C—Acoustic calibration of audiometers. Audiometer calibration shall be checked acoustically, at least annually, according to the procedures described in this Appendix. The equipment necessary to perform these measurements is a sound level meter, octave-band filter set, and a National Bureau of Standards 9A coupler. In making these measurements, the accuracy of the calibrating equipment shall be sufficient to determine that the audiometer is within the tolerance permitted by American National Standard Specifications for Audiometers, S3.6-1969(R1973).

(1) Sound pressure output check.

(a) Place the earphone coupler over the microphone of the sound level meter and place the earphone on the coupler.

(b) Set the audiometer's hearing threshold level (HTL) dial to 70 dB.

(c) Measure the sound pressure level of the tones at each test frequency from 500 Hz through 6000 Hz for each earphone.

(d) At each frequency the readout on the sound level meter should correspond to the levels in Table C-1 or Table C-2, as appropriate, for the type of earphone, in the column entitled "sound level meter reading."

(2) Linearity check.

(a) With the earphone in place, set the frequency to 1000 Hz and the HTL dial on the audiometer to 70 dB.

(b) Measure the sound levels in the coupler at each 10dB decrement from 70 dB to 10 dB, noting the sound level meter reading at each setting.

(c) For each 10dB decrement on the audiometer the sound level meter should indicate a corresponding 10 dB decrease.

(d) This measurement may be made electrically with a voltmeter connected to the earphone terminals.

(3) Tolerances.

When any of the measured sound levels deviate from the levels in Table C-1 or Table C-2 by ±3 dB at any test frequency between 500 and 3000 Hz, 4 dB at 4000 Hz, or 5 dB at 6000 Hz, an exhaustive calibration is required.

Table C-1 - Reference threshold levels for telephonics - TDH-39 earphones

Frequency, Hz	Reference threshold level for TDH-39 earphones, dB	Sound level meter reading, dB
50011.5		81.5
1000	7	77
2000	9	79
3000	10	80
4000	9.5	79.5
6000	15.5	85.5

Table C-2 - Reference threshold levels for telephonics - TDH-49 Earphones

Frequency, Hz	Reference threshold level for TDH-49 earphones, dB	Sound level meter reading, dB
50013.5		83.5
1000	7.5	77.5
2000	11	81.0
3000	9.5	79.5
4000	10.5	80.5
6000	13.5	83.5

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09051, filed 11/30/83; 82-13-045 (Order 82-22), § 296-62-09051, filed 6/11/82; 82-03-023 (Order 82-1), § 296-62-09051, filed 1/15/82.]

WAC 296-62-09053 Appendix D—Methods for estimating the adequacy of hearing protector attenuation. (1) Hearing protector attenuation must be sufficient to reduce employee exposure to a TWA of 85 dBA.

(2) The most convenient method to use is the noise reduction rating (NRR) developed by the Environmental Protection Agency (EPA).

According to EPA regulation, the NRR must be shown on the hearing protector package. The NRR is then related to an individual worker's noise environment in order to assess the adequacy of the attenuation of a given hearing protector. This appendix describes two methods of using the NRR to determine whether a particular hearing protector provides adequate protection within a given exposure environment. Selection between the two procedures is dependent upon the employer's noise measuring instruments.

(3) When using the NRR to assess hearing protector adequacy, one of the following methods must be used:

(a) When using a dosimeter that is capable of making A-weighted measurements:

(i) Convert the A-weighted dose to TWA.

(ii) Subtract 7 dB from the NRR.

(iii) Subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(b) When using a sound level meter set to the A-weighting network:

(i) Obtain the employee's A-weighted TWA.

(ii) Subtract 7 dB from the NRR, and subtract the remainder from the A-weighted TWA to obtain the estimated A-weighted TWA under the ear protector.

(4) Other methods may be utilized if they are at least as effective as the NRR if approved by the director.

[Statutory Authority: RCW 49.17.040 and 49.17.050. 83-24-013 (Order 83-34), § 296-62-09053, filed 11/30/83; 82-03-023 (Order 82-1), § 296-62-09053, filed 1/15/82.]

WAC 296-62-09055 Appendix E—Noise exposure computation. (1) Computation of employee noise exposure.

(a) Noise dose is computed using Table E-1 as follows:

(i) When the sound level, L, is constant over the entire work shift, the noise dose, D, in percent, is given by: $D=100 C/T$ where C is the total length of the work day, in hours, and T is the reference duration corresponding to the measured sound level, L, as given in Table E-1 or by the formula shown as a footnote to that table.

(ii) When the workshift noise exposure is composed of two or more periods of noise at different levels, the total noise dose over the work day is given by: $D = 100(C_1/T_1 + C_2/T_2 + \dots + C_n/T_n)$, where C_n indicates the total time of exposure at a specific noise level, and T_n indicates the reference duration for that level as given by Table E-1.

(b) The 8-hour time-weighted average sound level (TWA), in decibels, may be computed from the dose, in percent, by means of the formula: $TWA = 16.61 \log_{10} (D/100)+90$. For an 8-hour workshift with the noise level constant over the entire shift, the TWA is equal to the measured sound level.

(c) A table relating dose and TWA is given in subsection (2) of this section.

TABLE E-1

A-weighted sound level, L (decibel)	Reference duration, T (hour)
80	32
81	27.9

TABLE E-1

A-weighted sound level, L (decibel)	Reference duration, T (hour)
82	24.3
83	21.1
84	18.4
85	16
86	13.9
87	12.1
88	10.6
89	9.2
90	8
91	7.0
92	6.2
93	5.3
94	4.6
95	4
96	3.5
97	3.0
98	2.6
99	2.3
100	2
101	1.7
102	1.5
103	1.4
104	1.3
105	1
106	0.87
107	0.76
108	0.66
109	0.57
110	0.5
111	0.44
112	0.38
113	0.33
114	0.29
115	0.25
116	0.22
117	0.19
118	0.16
119	0.14
120	0.125
121	0.11
122	0.095
123	0.082
124	0.072
125	0.063
126	0.054
127	0.047
128	0.041
129	0.036
130	0.031

In the above table the reference duration T, is computed by

$$T = \frac{8}{2(L-90)/5}$$

where L is the measured A-weighted sound level.

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(2) Conversion between "dose" and "8-hour time-weighted average" sound level.

(a) Compliance with WAC 296-62-09015 through 296-62-09055 of this regulation is determined by the amount of exposure to noise in the workplace. The amount of such exposure is usually measured with an audiodosimeter which gives a readout in terms of "dose." In order to better understand the requirements of these standards, dosimeter readings can be converted to an "8-hour time-weighted average (TWA) sound level."

(b) In order to convert the reading of a dosimeter into TWA, see Table E-2. This table applies to dosimeters that are set by the manufacturer to calculate dose or percent exposure according to the relationships in Table E-1. So, for example, a dose of 91 percent over an eight-hour day results in a TWA of 89.3 dB, and a dose of 50 percent corresponds to a TWA of 85 dB.

(c) If the dose as read on the dosimeter is less than or greater than the values found in Table E-2, the TWA may be calculated by using the formula: $TWA = 16.61 \log_{10} (D/100) + 90$ where TWA = 8-hour time-weighted average sound level and D = accumulated dose in percent exposure.

Table E-2 - Conversion from "percent noise exposure" or "dose" to "8-hour time-weighted average sound level"

(TWA)	
Dose or percent noise exposure	TWA (dBA)
10	73.4
15	76.3
20	78.4
25	80.0
30	81.3
35	82.4
40	83.2
45	84.2
50	85.0
55	85.7
60	86.3
65	86.9
70	87.4
75	87.9
80	88.4
81	88.5
82	88.6
83	88.7
84	88.7
85	88.8
86	88.9
87	89.0
88	89.1
89	89.2
90	89.2
91	89.3
92	89.4
93	89.5
94	89.6
95	89.6
96	89.7

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(TWA)		(TWA)	
Dose or percent noise exposure	TWA (dBA)	Dose or percent noise exposure	TWA (dBA)
97	89.8	380	99.6
98	89.9	390	99.8
99	89.9	400	100.0
100	90.0	410	100.2
101	90.1	420	100.4
102	90.1	430	100.5
103	90.2	440	100.7
104	90.3	450	100.8
105	90.4	460	101.0
106	90.4	470	101.2
107	90.5	480	101.3
108	90.6	490	101.5
109	90.6	500	101.6
110	90.7	510	101.8
111	90.8	520	101.9
112	90.8	530	102.0
113	90.9	540	102.2
114	90.9	550	102.3
115	91.1	560	102.4
116	91.1	570	102.6
117	91.1	580	102.7
118	91.2	590	102.8
119	91.3	600	102.9
120	91.3	610	103.0
125	91.6	620	103.2
130	91.9	630	103.3
135	92.2	640	103.4
140	92.4	650	103.5
145	92.7	660	103.6
150	92.9	670	103.7
155	93.2	680	103.8
160	93.4	690	103.9
165	93.6	700	104.0
170	93.8	710	104.1
175	94.0	720	104.2
180	94.2	730	104.3
185	94.4	740	104.4
190	94.6	750	104.5
195	94.8	760	104.6
200	95.0	770	104.7
210	95.4	780	104.8
220	95.7	790	104.9
230	96.0	800	105.0
240	96.3	810	105.1
250	96.6	820	105.2
260	96.9	830	105.3
270	97.2	840	105.4
280	97.4	850	105.4
290	97.7	860	105.5
300	97.9	870	105.6
310	98.2	880	105.7
320	98.4	890	105.8
330	98.6	900	105.8
340	98.8	910	105.9
350	99.0	920	106.0
360	99.2	930	106.1
370	99.4	940	106.2

(TWA)

Dose or percent noise exposure	TWA (dBA)
950	106.2
960	106.3
970	106.4
980	106.5
990	106.5
999	106.6

[Statutory Authority: RCW 49.17.040 and 49.17.050, 83-24-013 (Order 83-34), § 296-62-09055, filed 11/30/83.]

PART L—ATMOSPHERES, VENTILATION, EMERGENCY WASHING

WAC 296-62-100 Oxygen deficient atmospheres. (1)

Definition. A lack of sufficient oxygen is deemed to exist if the atmosphere at sea level has less than 19.5% oxygen by volume or has a partial pressure of oxygen of 148 millimeters of mercury (mm. Hg) or less. This may deviate when working at higher elevations and should be determined for an individual location. Factors such as acclimatization, physical conditions of the persons involved, etc., must be considered for such circumstances and conditions.

(2) Entering areas with possible oxygen deficient atmospheres. Workers entering any area where a lack of sufficient oxygen is probable shall be supplied with and shall use approved equipment (for specific requirements see applicable provisions of chapter 296-62 WAC) capable of providing safe respirable air, or prior to entry and at all times when workers are in such areas a sufficient supply of safe, respirable air shall be provided. All workers so exposed shall be under constant observation. If the oxygen content is unknown or may change during occupation, tests shall be required prior to and during occupation of questionable areas.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-100, filed 11/22/91, effective 12/24/91. RCW 49.17.040, 49.17.050, and 49.17.240. 81-16-015 (Order 81-20), § 296-62-100, filed 7/27/81; Order 73-3, § 296-62-100, filed 5/7/73; Order 70-8, § 296-62-100, filed 7/31/70, effective 9/1/70; Rule 10.010, effective 8/1/63.]

WAC 296-62-110 Ventilation.

[Order 73-3, § 296-62-110, filed 5/7/73; Order 70-8, § 296-62-110, filed 7/31/70, effective 9/1/70; Rules 11.010-11.030, effective 8/1/63.]

WAC 296-62-11001 Definition. Ventilation shall mean the provision, circulation or exhausting of air into or from an area or space.

(1) "Local exhaust ventilation" shall mean the mechanical removal of contaminated air from the point where the contaminant is being generated or liberated.

(2) "Dilution ventilation" means inducing and mixing uncontaminated air with contaminated air in such quantities that the resultant mixture in the breathing zone will not exceed the permissible exposure limit (PEL) specified for any contaminant.

(3) "Exhaust ventilation" means the general movement of air out of the area or permit-required confined space by mechanical or natural means.

(1999 Ed.)

(4) "Tempered makeup air" means air which has been conditioned by changing its heat content to obtain a specific desired temperature.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-11001, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-11001, filed 11/13/80; Order 73-3, § 296-62-11001, filed 5/7/73.]

WAC 296-62-11003 Ventilation guide. In addition to those mandatory controls as set forth in WAC 296-62-11015 through 296-62-11021, the Industrial Ventilation Manual of Recommended Practices as compiled and approved by the American Conference of Governmental Industrial Hygienists, applicable ANSI Standard or other National Consensus Standards recommended by the federal government, should be used as a guide for ventilation requirements.

[Order 73-3, § 296-62-11003, filed 5/7/73.]

WAC 296-62-11005 Adequate system. Adequate ventilation systems shall be installed as needed to control concentrations of airborne contaminants below applicable threshold limit values.

[Order 73-3, § 296-62-11005, filed 5/7/73.]

WAC 296-62-11007 Exhaust. Exhaust from ventilation systems shall discharge in such a manner that the contaminated air being exhausted will not present a health hazard to any workman or reenter buildings in harmful amounts.

[Order 73-3, § 296-62-11007, filed 5/7/73.]

WAC 296-62-11009 Make-up air quantity. Make-up air shall be of ample quantity to replace the exhausted air and shall be tempered when necessary.

[Order 73-3, § 296-62-11009, filed 5/7/73.]

WAC 296-62-11011 Design and operation. Ventilation systems shall be designed and operated in such a manner that employees will not be subjected to excessive air velocities.

[Statutory Authority: Chapter 49.17 RCW. 91-11-070 (Order 91-01), § 296-62-11011, filed 5/20/91, effective 6/20/91; Order 73-3, § 296-62-11011, filed 5/7/73.]

WAC 296-62-11013 Compatibility of systems. Make-up air systems shall be designed and operated in such a manner that they will not interfere with the effectiveness of the exhaust air system.

[Order 73-3, § 296-62-11013, filed 5/7/73.]

WAC 296-62-11015 Abrasive blasting. Abrasive blasting is covered in the General safety and health standards WAC 296-24-675, Safe practices of abrasive blasting operations (Part H-2).

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 98-02-006, § 296-62-11015, filed 12/26/97, effective 3/1/98. Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-11015, filed 11/22/91, effective 12/24/91. RCW 49.17.040, 49.17.050, and 49.17.240. 81-16-015 (Order 81-20), § 296-62-11015, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-11015, filed 8/8/80; Order 73-3, § 296-62-11015, filed 5/7/73.]

WAC 296-62-11017 Grinding, polishing, and buffing operations. (1) Definitions.

[Title 296 WAC—p. 1667]

(a) "Abrasive cutting-off wheels" means organic-bonded wheels, the thickness of which is not more than one forty-eighth of their diameter for those up to, and including, 20 inches in diameter, and not more than one-sixteenth of their diameter for those larger than 20 inches in diameter, used for a multitude of operations variously known as cutting, cutting off, grooving, slotting, coping, jointing, and the like. The wheels may be "solid" consisting of organic-bonded abrasive material throughout, "steel centered" consisting of a steel disc with a rim of organic-bonded material moulded around the periphery or of the "inserted tooth" type consisting of a steel disc with organic-bonded abrasive teeth or inserts mechanically secured around the periphery.

(b) "Belts" means all power-driven, flexible, coated bands used for grinding, polishing, or buffing purposes.

(c) "Branch pipe" means the part of an exhaust system piping that is connected directly to the hood or enclosure.

(d) "Cradle" means a movable fixture, upon which the part to be ground or polished is placed.

(e) "Disc wheels" means all power-driven rotatable discs faces with abrasive materials, artificial or natural, and used for grinding or polishing on the side of the assembled disc.

(f) "Entry loss" means the loss in static pressure caused by air flowing into a duct or hood. It is usually expressed in inches of water gauge.

(g) "Exhaust system" means a system consisting of branch pipes connected to hoods of enclosures, one or more header pipes, an exhaust fan, means for separating solid contaminants from the air flowing in the system, and a discharge stack to outside.

(h) "Grinding wheels" means all power-driven rotatable grinding or abrasive wheels, except disc wheels as defined in this standard, consisting of abrasive particles held together by artificial or natural bonds and used for peripheral grinding.

(i) "Header pipe (main pipe)" means a pipe into which one or more branch pipes enter and which connects such branch pipes to the remainder of the exhaust system.

(j) "Hoods and enclosures" means the partial or complete enclosure around the wheel or disc through which air enters an exhaust system during operation.

(k) "Horizontal double-spindle disc grinder" means a grinding machine carrying two power-driven, rotatable, coaxial, horizontal spindles upon the inside ends of which are mounted abrasive disc wheels for grinding two surfaces simultaneously.

(l) "Horizontal single-spindle disc grinder" means a grinding machine carrying an abrasive disc wheel upon one or both ends of a power-driven, rotatable single horizontal spindle.

(m) "Polishing and buffing wheels" means all power-driven rotatable wheels composed all or in part of textile fabrics, wood, felt, leather, paper, and may be coated with abrasives on the periphery of the wheel for purposes of polishing, buffing, and light grinding.

(n) "Portable grinder" means any power-driven rotatable grinding, polishing, or buffing wheel mounted in such manner that it may be manually manipulated.

(o) "Scratch brush wheels" means all power-driven rotatable wheels made from wire or bristles, and used for scratch cleaning and brushing purposes.

(p) "Swing-frame grinder" means any power-driven rotatable grinding, polishing, or buffing wheel mounted in such a manner that the wheel with its supporting framework can be manipulated over stationary objects.

(q) "Velocity pressure (vp)" means the kinetic pressure in the direction of flow necessary to cause a fluid at rest to flow at a given velocity. It is usually expressed in inches of water gauge.

(r) "Vertical spindle disc grinder" means a grinding machine having a vertical, rotatable power-driven spindle carrying a horizontal abrasive disc wheel.

(2) Application.

(a) Every establishment performing dry grinding, dry polishing, or buffing shall provide suitable hood or enclosures that are connected to exhaust systems.

(b) Such exhaust systems shall be operated continuously whenever such operations are carried on, and be capable of preventing contaminants from entering the breathing zone.

(3) Hood and branch pipe requirements.

(a) Hoods connected to exhaust systems shall be used, and such hoods shall be designed, located, and placed so that the dust or dirt particles shall fall or be projected into the hoods in the direction of the air flow. No wheels, discs, straps, or belts shall be operated in such manner and in such direction as to cause the dust and dirt particles to be thrown into the operator's breathing zone.

(b) Grinding wheels on floor stands, pedestals, benches, and special-purpose grinding machines and abrasive cutting-off wheels shall have not less than the minimum exhaust volumes shown in Table 8 with a recommended minimum duct velocity of 4,500 feet per minute in the branch and 3,500 feet per minute in the main. The entry losses from all hoods except the vertical-spindle disc grinder hood, shall equal 0.65 velocity pressure for a straight takeoff and 0.45 velocity pressure for a tapered takeoff. The entry loss for the vertical-spindle disc grinder hood is shown in Figure 3. (See Fig. 3 following this section.)

TABLE 8
GRINDING AND ABRASIVE CUTTING-OFF WHEELS

Wheel diameter (inches)	Wheel width (inches)	Minimum exhaust volume (feet ³ /min.)
To 9	1 1/2	220
Over 9 to 16	2	390
Over 16 to 19	3	500
Over 19 to 24	4	610
Over 24 to 30	5	880
Over 30 to 36	6	1,200

For any wheel wider than wheel diameter shown in Table 8, increase the exhaust volume by the ratio of the new width to the width shown.

Example:

If wheel width = 4 1/2 inches, then

$$\frac{4.5}{4} \times 610 = 686 \text{ (rounded to 690).}$$

(c) Scratch-brush wheels and all buffing and polishing wheels mounted on floor stands, pedestals, benches, or special-purpose machines shall have not less than the minimum exhaust volume shown in Table 9.

TABLE 9
BUFFING AND POLISHING WHEELS

Wheel diameter (inches)	Wheel width (inches)	Minimum exhaust volume (feet ³ /min.)
To 9	2	300
Over 9 to 16	3	500
Over 16 to 19	4	610
Over 19 to 24	5	740
Over 24 to 30	6	1,040
Over 30 to 36	6	1,200

(d) Grinding wheels or discs for horizontal single-spindle disc grinders shall be hooded to collect the dust or dirt generated by the grinding operation and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table 10.

TABLE 10
HORIZONTAL SINGLE-SPINDLE DISC GRINDER

Disc diameter (inches)	Exhaust volume (feet ³ /min.)
Up to 12	220
Over 12 to 19	390
Over 19 to 30	610
Over 30 to 36	880

(e) Grinding wheels or discs for horizontal double-spindle disc grinders shall have a hood enclosing the grinding chamber and the hood shall be connected to one or more branch pipes having exhaust volumes as shown in Table 11.

TABLE 11
HORIZONTAL DOUBLE-SPINDLE
DISC GRINDER

Disc diameter (inches)	Exhaust volume (feet ³ /min.)
Up to 19	610
Over 19 to 25	880
Over 25 to 30	1,200
Over 30 to 53	1,770
Over 53 to 72	6,280

(f) Grinding wheels or discs for vertical single-spindle disc grinders shall be encircled with hoods to remove the dust generated in the operation. The hoods shall be connected to one or more branch pipes having exhaust volumes as shown in Table 12.

TABLE 12
VERTICAL SPINDLE DISC GRINDER

Disc diameter (inches)	One-half or more of disc covered		Disc not covered	
	Num- ber ¹	Exhaust feet ³ /min.	Num- ber ¹	Exhaust feet ³ /min.
Up to 20	1	500	2	780
Over 20 to 30	2	780	2	1,480
Over 30 to 53	2	1,770	4	3,530
Over 53 to 72	2	3,140	5	6,010

¹Number of exhaust outlets around periphery of hood, or equal distribution provided by other means.

(g) Grinding and polishing belts shall be provided with hoods to remove dust and dirt generated in the operations and the hoods shall be connected to branch pipes having exhaust volumes as shown in Table 13.

TABLE 13
GRINDING AND POLISHING BELTS

Belts width (inches)	Exhaust volume (feet ³ /min.)
Up to 3	220
Over 3 to 5	300
Over 5 to 7	390
Over 7 to 9	500
Over 9 to 11	610
Over 11 to 13	740

(h) Cradles and swing-frame grinders. Where cradles are used for handling the parts to be ground, polished, or buffed, requiring large partial enclosures to house the complete operation, a minimum average air velocity of 150 feet per minute shall be maintained over the entire opening of the enclosure. Swing-frame grinders shall also be exhausted in the same manner as provided for cradles. (See Fig. 5 following this section.)

(i) Where the work is outside the hood, air volumes must be increased as shown in American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960 (Section 4, Exhaust Hoods).

(4) Exhaust systems.

(a) Exhaust systems for grinding, polishing, and buffing operations should be designed in accordance with American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(b) Exhaust systems for grinding, polishing, and buffing operations shall be tested in the manner described in American Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(c) All exhaust systems shall be provided with suitable dust collectors.

(5) Hood and enclosure design.

(a)(i) It is the dual function of grinding and abrasive cutting-off wheel hoods to protect the operator from the hazards of bursting wheels as well as to provide a means for the removal of dust and dirt generated. All hoods shall be not less in structural strength than specified in the American National Standard Code for the Use, Care, and Protection of Abrasive Wheels, B7.1-1970.

(ii) For grinding machines for which no standard hoods are available, hoods meeting the requirements of (5)(a)(i) above shall be developed and so located so as to comply with the requirements of this section.

(b) Exhaust hoods for floor stands, pedestals, and bench grinders shall be designed in accordance with Figure 4. (See Fig. 4 following this section.) The adjustable tongue shown in the figure shall be kept in working order and shall be adjusted within one-fourth inch of the wheel periphery at all times.

(c) Swing-frame grinders shall be provided with exhaust booths as indicated in Figure 5. (See Fig. 5 following this section.)

(d) Portable grinding operations, whenever the nature of the work permits, shall be conducted within a partial enclosure. The opening in the enclosure shall be no larger than is actually required in the operation and an average face air velocity of not less than 200 feet per minute shall be maintained.

(e) Hoods for polishing and buffing and scratch-brush wheels shall be constructed to conform as closely to Figure 6 as the nature of the work will permit. (See Fig. 6 following this section.)

(f) Cradle grinding and polishing operations shall be performed within a partial enclosure similar to Figure 7. (See Fig. 7 following this section.) The operator shall be positioned outside the working face of the opening of the enclosure. The face opening of the enclosure should not be any greater in area than that actually required for the performance of the operation and the average air velocity into the working face of the enclosure shall not be less than 150 feet per minute.

(g) Hoods for horizontal single-spindle disc grinders shall be constructed to conform as closely as possible to the hood shown in Figure 8. (See Fig. 8 following this section.) It is essential that there be a space between the back of the wheel and the hood, and a space around the periphery of the wheel of at least 1 inch in order to permit the suction to act around the wheel periphery. The opening on the side of the disc shall be no larger than is required for the grinding oper-

ation, but must never be less than twice the area of the branch outlet.

(h) Horizontal double-spindle disc grinders shall have a hood encircling the wheels and grinding chamber similar to that illustrated in Figure 9. (See Fig. 9 following this section.) The openings for passing the work into the grinding chamber should be kept as small as possible, but must never be less than twice the area of the branch outlets.

(i) Vertical-spindle disc grinders shall be encircled with a hood so constructed that the heavy dust is drawn off a surface of the disc and the lighter dust exhausted through a continuous slot at the top of the hood as shown in Figure 3. (See Fig. 3 following this section.)

(j) Grinding and polishing belt hoods shall be constructed as close to the operation as possible. The hood should extend almost to the belts, and 1-inch wide openings should be provided on either side. Figure 10 shows a typical hood for a belt operation. (See Fig. 10 following this section.)

(6) Scope. This paragraph, prescribes the use of exhaust hood enclosures and systems in removing dust, dirt, fumes, and gases generated through the grinding, polishing, or buffing of ferrous and nonferrous metals.

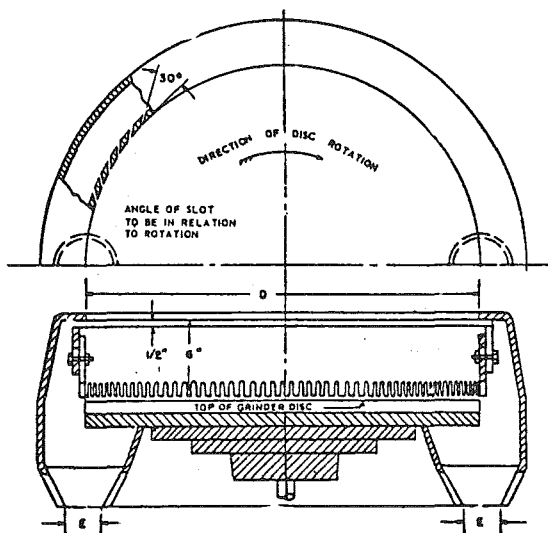


Fig. 3

Fig. 3 Vertical Spindle Disc Grinder Exhaust Hood and Branch Pipe Connections

Dia D, Inches		Exhaust E		Volume Exhausted at 4,500 ft/min ft ³ /min	Note
Min.	Max	No. Pipes	Dia		
	20	1	4 1/2	500	When one-half or more of the disc can be hooded, use exhaust ducts as shown at the left.
Over 20	30	2	4	780	
Over 30	72	2	6	1,770	
Over 53	72	2	8	3,140	
	20	2	4	780	When no hood can be used over disc, use exhaust ducts as shown at left.
Over 20	30	2	5 1/2	1,480	
Over 30	53	4	6	3,530	
Over 53	72	5	7	6,010	

Entry loss = 1.0 slot velocity pressure + 0.5 branch velocity pressure
 Minimum slot velocity = 2,000 ft/min - 1/2-inch slot width

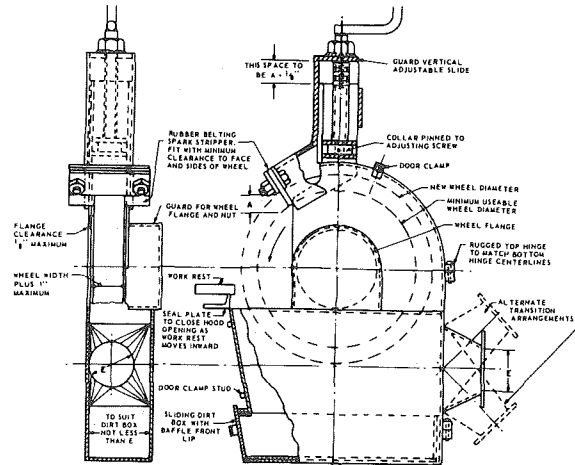


Fig. 4

Standard Grinder Hood

Wheel Dimension			Exhaust Outlet Inches	Volume of Air at 4,500 ft/min
Diameter, Inches		Width, Inches		
Min = d	Max = D	Max	E	
	9	1 1/2	3	220
Over 9	16	2	4	390
Over 16	19	3	4 1/2	500
Over 19	24	4	5	610
Over 24	30	5	6	880
Over 30	36	6	7	1,200

Entry loss = 0.45 velocity pressure for tapered takeoff
0.65 velocity pressure for straight takeoff

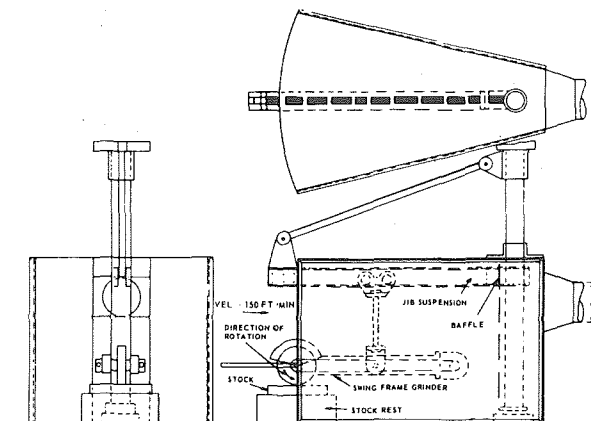


Fig. 5

A method of Applying an Exhaust Enclosure to Swing-Frame Grinders

Note: Baffle to reduce front opening as much as possible

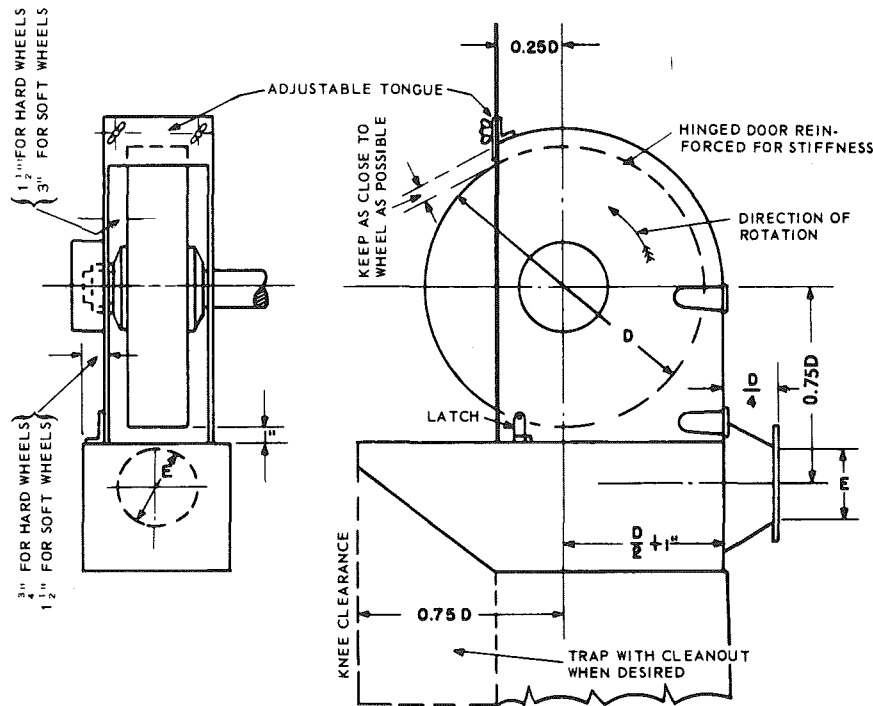


Fig. 6

Standard Buffing and Polishing Hood

Wheel Dimension, Inches			Exhaust Outlet Inches	Volume of Air at 4,500 ft/min
Diameter		Width		
Min = d	Max = D	Max	E	
	9	2	3 1/2	300
Over 9	16	3	4	500
Over 16	19	4	5	610
Over 19	24	5	5 1/2	740
Over 24	30	6	6 1/2	1,040
Over 30	36	6	7	1,200

Entry loss = 0.45 velocity pressure for tapered takeoff
 0.65 velocity pressure for straight takeoff

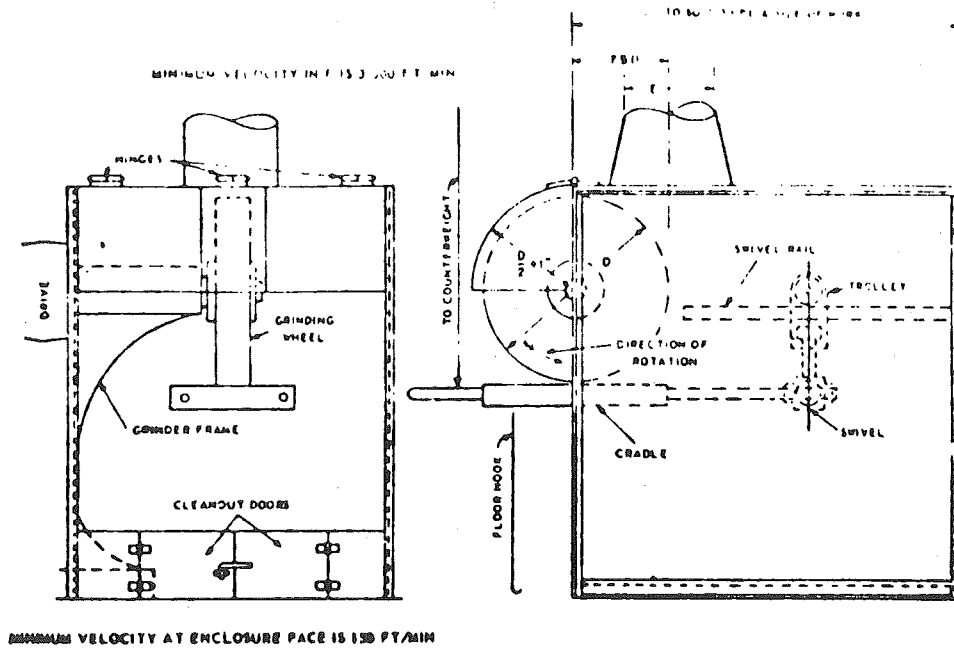


Fig. 7

Cradle Polishing or Grinding Enclosure

Entry loss = 0.45 velocity pressure for tapered takeoff

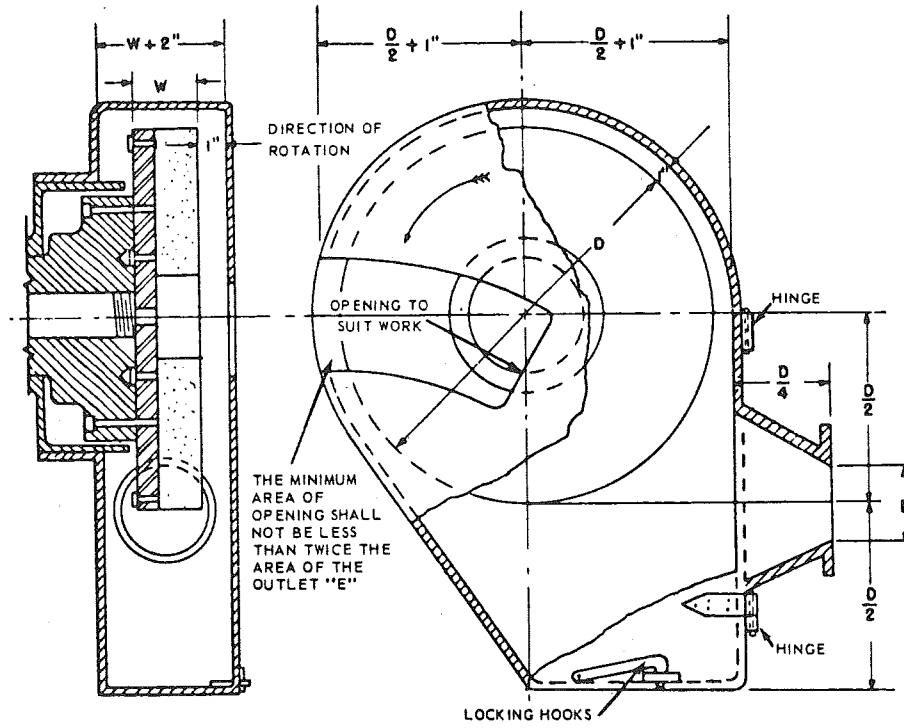


Fig. 8

Horizontal Single-Spindle Disc Grinder
Exhaust Hood and Branch Pipe Connection

Dia. D. Inches		Exhaust E Dia. Inches	Volume Exhausted at 4,500 ft/min ft ³ /min
Min	Max		
	12	3	220
Over 12	19	4	390
Over 19	30	5	610
Over 30	36	6	880

Note: If grinding wheels are used for disc grinding purposes, hoods must conform to structural strength and materials as described in 9.1.

Entry loss = 0.45 velocity pressure for tapered takeoff

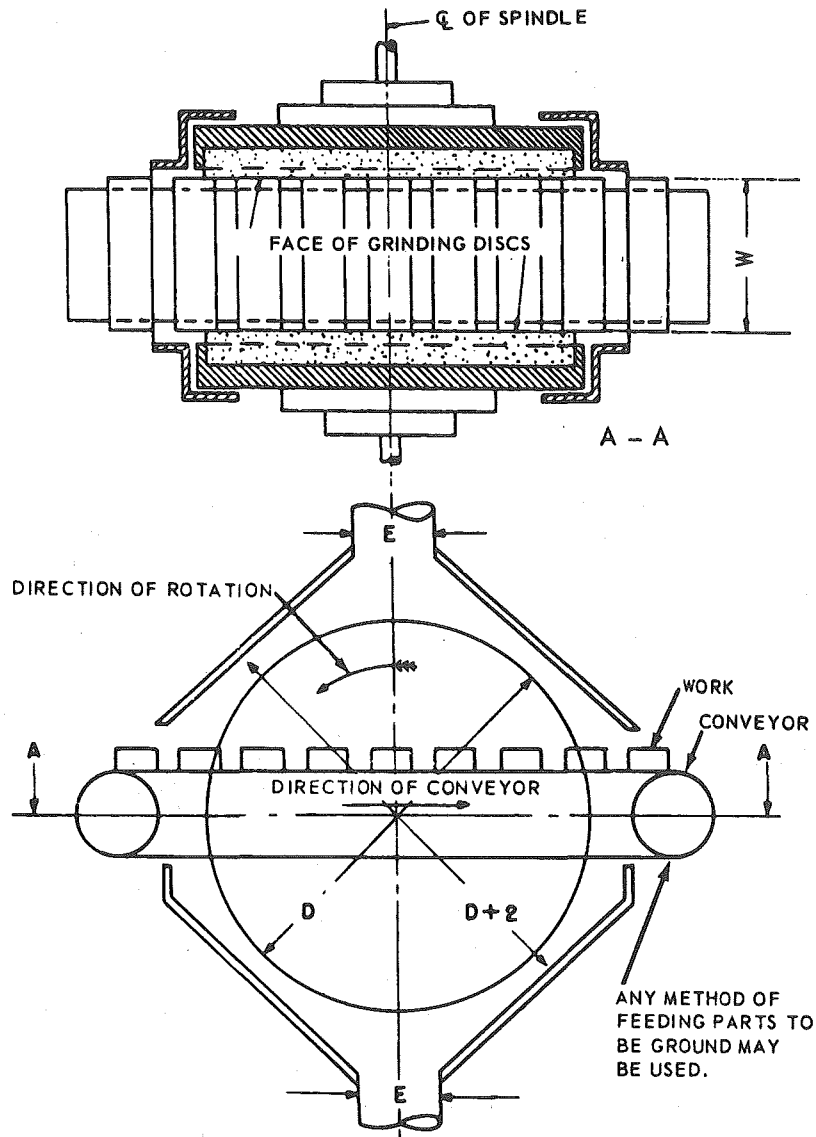


Fig. 9

Horizontal Double-Spindle Disc Grinder
Exhaust Hood and Branch Pipe Connection

Disc Dia. Inches		Exhaust E		Volume Exhausted at 4,500 ft/min ft ³ /min	Note
Min.	Max	No. Pipes	Dia		
	19	1	5	610	When width "W" permits, exhaust ducts should be as near heaviest grinding as possible.
Over 19	25	1	6	880	
Over 25	30	1	7	1,200	
Over 30	53	2	6	1,770	
Over 53	72	4	8	6,280	

Entry loss = 0.45 velocity pressure for tapered takeoff

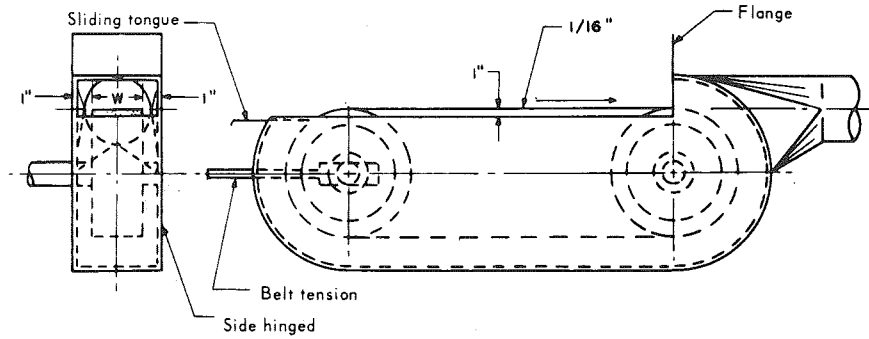


Fig. 10

A Typical Hood for a Belt Operation

Belt Width w. Inches	Exhaust Volume. ft ³ /min
up to 3	220
3 to 5	300
5 to 7	390
7 to 9	500
9 to 11	610
11 to 13	740

Minimum duct velocity = 4.500 ft./min. branch.
3.500 ft./min. main.

Entry loss = 0.45 velocity pressure for tapered takeoff
0.65 velocity pressure for straight takeoff

[Order 73-3, § 296-62-11017 and diagrams, filed 5/7/73.]

WAC 296-62-11019 Spray-finishing operations. (1)

Definitions.

(a) "Spray-finishing operations" means employment of methods wherein organic or inorganic materials are utilized in dispersed form from deposit on surfaces to be coated, treated or cleaned. Such methods of deposit may involve either automatic, manual, or electrostatic deposition but do not include metal spraying or metallizing, dipping, flow coating, roller coating, tumbling, centrifuging, or spray washing and degreasing as conducted in self-contained washing and degreasing machines or systems.

(b) "Spray booth" spray booths are defined and described in WAC 296-24-370 through 296-24-37007. (See sections 103, 104, and 105 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.)

(c) "Spray room" means a room in which spray-finishing operations not conducted in a spray booth are performed separately from other areas.

(d) "Minimum maintained velocity" means the velocity of air movement which must be maintained in order to meet minimum specified requirements for health and safety.

(2) Location and application. Spray booths or spray rooms are to be used to enclose or confine all operations. Spray-finishing operations shall be located as provided in sections 201 through 206 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.

(3) Design and construction of spray booths.

(a) Spray booths shall be designed and constructed in accordance with WAC 296-24-370 through 296-24-37007 (see sections 301-304 and 306-310 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969), for general construction specifications.

Note: For a more detailed discussion of fundamentals relating to this subject, see ANSI Z9.2-1960.

(i) Lights, motors, electrical equipment and other sources of ignition shall conform to the requirements of WAC 296-24-370. (See section 310 and chapter 4 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.)

(ii) In no case shall combustible material be used in the construction of a spray booth and supply or exhaust duct connected to it.

(b) Unobstructed walkways shall not be less than 6 1/2 feet high and shall be maintained clear of obstruction from any work location in the booth to a booth exit or open booth front. In booths where the open front is the only exit, such exits shall be not less than 3 feet wide. In booths having multiple exits, such exits shall not be less than 2 feet wide, provided that the maximum distance from the work location to the exit is 25 feet or less. Where booth exits are provided with doors, such doors shall open outward from the booth.

(c) Baffles, distribution plates, and dry-type overspray collectors shall conform to the requirements of WAC 296-24-370. (See sections 304 and 305 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969.)

(i) Overspray filters shall be installed and maintained in accordance with the requirements of WAC 296-24-370, (See section 305 of the Standard for Spray Finishing Using Flammable and Combustible Materials, NFPA No. 33-1969), and shall only be in a location easily accessible for inspection, cleaning, or replacement.

(ii) Where effective means, independent of the overspray filters are installed which will result in design air distribution across the booth cross section, it is permissible to operate the booth without the filters in place.

(d)(i) For wet or water-wash spray booths, the water-chamber enclosure, within which intimate contact of contaminated air and cleaning water or other cleaning medium is

maintained, if made of steel, shall be 18 gauge or heavier and adequately protected against corrosion.

(ii) Chambers may include scrubber spray nozzles, headers, troughs, or other devices. Chambers shall be provided with adequate means for creating and maintaining scrubbing action for removal of particulate matter from the exhaust air stream.

(e) Collecting tanks shall be of welded steel construction or other suitable noncombustible material. If pits are used as collecting tanks, they shall be concrete, masonry, or other material having similar properties.

(i) Tanks shall be provided with weirs, skimmer plates, or screens to prevent sludge and floating paint from entering the pump suction box. Means for automatically maintaining the proper water level shall also be provided. Fresh water inlets shall not be submerged. They shall terminate at least one pipe diameter above the safety overflow level of the tank.

(ii) Tanks shall be so constructed as to discourage accumulation of hazardous deposits.

(f) Pump manifolds, risers, and headers shall be adequately sized to insure sufficient water flow to provide efficient operation of the water chamber.

(4) Design and construction of spray rooms.

(a) Spray rooms, including floors, shall be constructed of masonry, concrete, or other noncombustible material.

(b) Spray rooms shall have noncombustible fire doors and shutters.

(c) Spray rooms shall be adequately ventilated so that the atmosphere in the breathing zone of the operator shall be maintained in accordance with the requirements of (6)(b) of this section.

(d) Spray rooms used for production spray-finishing operations shall conform to the requirements of spray booths.

(5) Ventilation.

(a) Ventilation shall be provided in accordance with provisions of WAC 296-24-370, (See chapter 5 of the Standard for Spray Finishing Using Flammable or Combustible Materials, NFPA No. 33-1969), and in accordance with the following:

(i) Where a fan plenum is used to equalize or control the distribution of exhaust air movement through the booth, it shall be of sufficient strength or rigidity to withstand the differential air pressure or other superficially imposed loads for which the equipment is designed and also to facilitate cleaning. Construction specifications shall be at least equivalent to those of (5)(c) of this section.

(ii) All fan ratings shall be in accordance with Air Moving and Conditioning Association Standard Test Code for Testing Air Moving Devices, Bulletin 210, April 1962.

(b) Inlet or supply ductwork used to transport makeup air to spray booths or surrounding areas shall be constructed of noncombustible materials.

(i) If negative pressure exists within inlet ductwork, all seams and joints shall be sealed if there is a possibility of infiltration of harmful quantities of noxious gases, fumes, or mists from areas through which ductwork passes.

(ii) Inlet ductwork shall be sized in accordance with volume flow requirements and provide design air requirements at the spray booth.

(iii) Inlet ductwork shall be so supported throughout its length to sustain at least its own weight plus any negative pressure which is exerted upon it under normal operating conditions.

(c) Ducts shall be so constructed as to provide structural strength and stability at least equivalent to sheet steel of not less than the following thickness:

DIAMETER OR GREATER DIMENSION	(U.S. gauge)
Up to 8 inches inclusive	No. 24
Over 8 inches to 18 inches inclusive	No. 22
Over 18 inches to 30 inches inclusive	No. 20
Over 30 inches	No. 18

(i) Exhaust ductwork shall be adequately supported throughout its length to sustain its weight plus any normal accumulation in interior during normal operating conditions and any negative pressure exerted upon it.

(ii) Exhaust ductwork shall be sized in accordance with good design practice which shall include consideration of fan capacity, length of duct, number of turns and elbows, variation in size, volume, and character of materials being exhausted. See American National Standard Z9.2-1960 for further details and explanation concerning elements of design.

(iii) Longitudinal joints in sheet steel ductwork shall be either lock-seamed, riveted, or welded. For other than steel construction, equivalent securing of joints shall be provided.

(iv) Circumferential joints in ductwork shall be substantially fastened together and lapped in the direction of airflow. At least every fourth joint shall be provided with connecting flanges, bolted together or of equivalent fastening security.

(v) Inspection or clean-out doors shall be provided for every 9 to 12 feet of running length for ducts up to 12 inches in diameter, but the distance between clean-out doors may be greater for larger pipes. (See 8.3.21 of American National Standard Z9.1-1960.) A clean-out door or doors shall be provided for servicing the fan, and where necessary, a drain shall be provided.

(vi) Where ductwork passes through a combustible roof or wall, the roof or wall shall be protected at the point of penetration by open space or fire-resistive material between the duct and the roof or wall. When ducts pass through fire-walls, they shall be provided with automatic fire dampers on both sides of the wall, except that three-eighth-inch steel plates may be used in lieu of automatic fire dampers for ducts not exceeding 18 inches in diameter.

(vii) Ductwork used for ventilating any process covered in this standard shall not be connected to ducts ventilating any other process or any chimney or flue used for conveying any products of combustion.

(6) Velocity and air flow requirements.

(a) Except where a spray booth has an adequate air replacement system, the velocity of air into all openings of a spray booth shall be not less than that specified in Table 14 for the operating conditions specified. An adequate air replacement system is one which introduces replacement air upstream or above the object being sprayed and is so designed that the velocity of air in the booth cross section is

not less than that specified in Table 14 when measured upstream or above the object being sprayed.

TABLE 14
MINIMUM MAINTAINED VELOCITIES
INTO SPRAY BOOTHS

Operating Airflow conditions for object completely inside booth	Crossdraft f.p.m.	Velocities, f.p.m.	
		Design	Range
Electrostatic and automatic airless operation contained in booth without operator.	Negligible	50 large booth	50-75
		100 small booth	75-125
Air-operated guns, manual or automatic	Up to 50	100 large booth	75-125
		150 small booth	125-175
Air-operated guns, manual or automatic	Up to 100	150 large booth	125-175
		200 small booth	150-250

Notes:

- (1) Attention is invited to the fact that the effectiveness of the spray booth is dependent upon the relationship of the depth of the booth to its height and width.
- (2) Crossdrafts can be eliminated through proper design and such design should be sought. Crossdrafts in excess of 100 fpm (feet per minute) should not be permitted.
- (3) Excessive air pressures result in loss of both efficiency and material waste in addition to creating a backlash that may carry overspray and fumes into adjacent work areas.
- (4) Booths should be designed with velocity shown in the column headed "Design." However, booths operating with velocities shown in the column headed "Range" are in compliance with this standard.

(b) In addition to the requirements in (6)(a) of this section the total air volume exhausted through a spray booth shall be such as to dilute solvent vapor to at least 25 percent of the lower explosive limit of the solvent being sprayed. An example of the method of calculating this volume is given below.

Example: To determine the lower explosive limits of the most common solvents used in spray finishing, see Table 15. Column 1 gives the number of cubic feet of vapor per gallon of solvent and column 2 gives the lower explosive limit (LEL) in percentage by volume of air. Note that the quantity of solvent will be diminished by the quantity of solids and nonflammable contained in the finish.

To determine the volume of air in cubic feet necessary to dilute the vapor from 1 gallon of solvent to 25 percent of the lower explosive limit, apply the following formula:

$$\text{Dilution volume required per gallon of solvent} = \frac{4 (100 - \text{LEL}) (\text{cubic feet of vapor per gallon})}{\text{LEL}}$$

Using toluene as the solvent.

- (1) LEL of toluene from Table 15, column 2, is 1.4 percent.
- (2) Cubic feet of vapor per gallon from Table 15, column 1, is 30.4 cubic feet per gallon.
- (3) Dilution volume required=

$$\frac{4 (100 - 1.4) 30.4}{1.4} = 8,564 \text{ cubic feet.}$$

(4) To convert to cubic feet per minute of required ventilation, multiply the dilution volume required per gallon of solvent by the number of gallons of solvent evaporated per minute.

TABLE 15
LOWER EXPLOSIVE LIMIT OF SOME
COMMONLY USED SOLVENTS

Solvent	Cubic feet of vapor per gallon of liquid at 70°F.	Lower explosive limit in percent by volume of air at 70°F.
	Column 1	Column 2
Acetone	44.0	2.6
Amyl Acetate (iso)	21.6	1.0 ¹
Amyl Alcohol (n)	29.6	1.2
Amyl Alcohol (iso)	29.6	1.2
Benzene	36.8	1.4 ¹
Butyl Acetate (n)	24.8	1.7
Butyl Alcohol (n)	35.2	1.4
Butyl Cellosolve	24.8	1.1
Cellosolve	33.6	1.8
Cellosolve Acetate	23.2	1.7
Cyclohexanone	31.2	1.1 ¹
1,1 Dichloroethylene	42.4	5.6
1,2 Dichloroethylene	42.4	9.7
Ethyl Acetate	32.8	2.5
Ethyl Alcohol	55.2	4.3
Ethyl Lactate	28.0	1.5 ¹
Methyl Acetate	40.0	3.1
Methyl Alcohol	80.8	7.3
Methyl Cellosolve	40.8	2.5
Methyl Ethyl Ketone	36.0	1.8
Methyl n-Propyl Ketone	30.4	1.5
Naphtha (VM&P) (76°Naphtha)	22.4	0.9
Naphtha (100° Flash) Safety Solvent-Stoddard Solvent	23.2	1.1
Propyl Acetate (n)	27.2	2.0
Propyl Acetate (iso)	28.0	1.8
Propyl Alcohol (n)	44.8	2.1
Propyl Alcohol (iso)	44.0	2.0
Toluene	30.4	1.4
Turpentine	20.8	0.8
Xylene (o)	26.4	1.0

¹At 212°F.

(c)(i) When an operator must position himself in a booth downstream of the object being sprayed, an air supplied respirator or other type of respirator listed in the applicable provisions of chapter 296-62 WAC for the material being sprayed should be used by the operator.

(ii) Where downdraft booths are provided with doors, such doors shall be closed when spray painting.

(7) Make-up air.

(a) Clean fresh air, free of contamination from adjacent industrial exhaust systems, chimneys, stacks, or vents, shall be supplied to a spray booth or room in quantities equal to the volume of air exhausted through the spray booth.

(b) Where a spray booth or room receives make-up air through self-closing doors, dampers, or louvers, they shall be fully open at all times when the booth or room is in use for spraying. The velocity of air through such doors, dampers, or louvers shall not exceed 200 feet per minute. If the fan char-

acteristics are such that the required air flow through the booth will be provided, higher velocities through the doors, dampers, or louvers may be used.

(c)(i) Where the air supply to a spray booth or room is filtered, the fan static pressure shall be calculated on the assumption that the filters are dirty to the extent that they require cleaning or replacement.

(ii) The rating of filters shall be governed by test data supplied by the manufacturer of the filter. A pressure gauge shall be installed to show the pressure drop across the filters. This gauge shall be marked to show the pressure drop at which the filters require cleaning or replacement. Filters shall be replaced or cleaned whenever the pressure drop across them becomes excessive or whenever the air flow through the face of the booth falls below that specified in Table 14.

(d)(i) Means of heating make-up air to any spray booth or room, before or at the time spraying is normally performed, shall be provided in all places where the outdoor temperature may be expected to remain below 55° F. for appreciable periods of time during the operation of the booth except where adequate and safe means of radiant heating for all operating personnel affected is provided. The replacement air during the heating seasons shall be maintained at not less than 65° F. at the point of entry into the spray booth or spray room. When otherwise unheated make-up air would be at a temperature of more than 10° F. below room temperature, its temperature shall be regulated as provided in section 3.6 of ANSI Z9.2-1960.

(ii) As an alternative to an air replacement system complying with the preceding section, general heating of the building in which the spray room or booth is located may be employed provided that all occupied parts of the building are maintained at not less than 65° F. when the exhaust system is in operation or the general heating system supplemented by other sources of heat may be employed to meet this requirement.

(iii) No means of heating make-up air shall be located in a spray booth.

(iv) Where make-up air is heated by coal or oil, the products of combustion shall not be allowed to mix with the make-up air, and the products of combustion shall be conducted outside the building through a flue terminating at a point remote from all points where make-up air enters the building.

(v) Where make-up air is heated by gas, and the products of combustion are not mixed with the make-up air but are conducted through an independent flue to a point outside the building remote from all points where make-up air enters the building, it is not necessary to comply with (7)(d)(vi) of this section.

(vi) Where make-up air to any manually operated spray booth or room is heated by gas and the products of combustion are allowed to mix with the supply air, the following precautions must be taken:

(A) The gas must have a distinctive and strong enough odor to warn workmen in a spray booth or room of its presence if in an unburned state in the make-up air.

(B) The maximum rate of gas supply to the make-up air heater burners must not exceed that which would yield in excess of 200 p.p.m. (parts per million) of carbon monoxide

or 2,000 p.p.m. of total combustible gases in the mixture if the unburned gas upon the occurrence of flame failure were mixed with all of the make-up air supplied.

(C) A fan must be provided to deliver the mixture of heated air and products of combustion from the plenum chamber housing the gas burners to the spray booth or room.

(8) Scope. Spray booths or spray rooms are to be used to enclose or confine all spray finishing operations covered by this paragraph. This paragraph does not apply to the spraying of the exteriors of buildings, fixed tanks, or similar structures, nor to small portable spraying apparatus not used repeatedly in the same location.

[Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 81-16-015 (Order 81-20), § 296-62-11019, filed 7/27/81; Order 73-3, § 296-62-11019, filed 5/7/73.]

WAC 296-62-11021 Open surface tanks. (1) General.

(a) This section applies to all operations involving the immersion of materials in liquids, or in the vapors of such liquids, for the purpose of cleaning or altering the surface or adding to or imparting a finish thereto or changing the character of the materials, and their subsequent removal from the liquid or vapor, draining, and drying. These operations include washing, electroplating, anodizing, pickling, quenching, dyeing, dipping, tanning, dressing, bleaching, degreasing, alkaline cleaning, stripping, rinsing, digesting, and other similar operations.

(b) Except where specific construction specifications are prescribed in this section, hoods, ducts, elbows, fans, blowers, and all other exhaust system parts, components, and supports thereof shall be so constructed as to meet conditions of service and to facilitate maintenance and shall conform in construction to the specifications contained in American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(2) Classification of open-surface tank operations.

(a) Open-surface tank operations shall be classified into 16 classes, numbered A-1 to D-4, inclusive.

(b) Determination of class. Class is determined by two factors, hazard potential designated by a letter from A to D, inclusive, and rate of gas, vapor, or mist evolution designated by a number from 1 to 4, inclusive (for example, B.3).

(c) Hazard potential is an index, on a scale of from A to D, inclusive, of the severity of the hazard associated with the substance contained in the tank because of the toxic, flammable, or explosive nature of the vapor, gas, or mist produced therefrom. The toxic hazard is determined from the concentration, measured in parts by volume of a gas or vapor, per million parts by volume of contaminated air (ppm), or in milligrams of mist per cubic meter of air (mg/m³), below which ill effects are unlikely to occur to the exposed worker. The concentrations shall be those in WAC 296-62-075 through 296-62-07515.

(d) The relative fire or explosion hazard is measured in degrees Fahrenheit in terms of the closed-cup flash point of the substance in the tank. Detailed information on the prevention of fire hazards in dip tanks may be found in Dip Tanks Containing Flammable or Combustible Liquids, NFPA No. 34-1966, National Fire Protection Association. Where the tank contains a mixture of liquids, other than organic solvents, whose effects are additive, the hygienic standard of the

most toxic component (for example, the one having the lowest ppm or mg/m³) shall be used, except where such substance constitutes an insignificantly small fraction of the mixture. For mixtures of organic solvents, their combined effect, rather than that of either individually, shall determine the hazard potential. In the absence of information to the contrary, the effects shall be considered as additive. If the sum of the ratios of the airborne concentration of that contaminant exceeds unity, the toxic concentration shall be considered to have been exceeded. (See Note A of (2)(e) of this section.)

(e) Hazard potential shall be determined from Table 16, with the value indicating greater hazard being used. When the hazardous material may be either a vapor with a permissible exposure limit in ppm or a mist with a TLV in mg/m³, the TLV indicating the greater hazard shall be used (for example, A takes precedence over B or C; B over C; C over D).

Note A:

$$\frac{c_1}{PEL} + \frac{c_2}{PEL} + \frac{c_3}{PEL} + \dots + \frac{c_N}{PEL} > 1$$

where:

c = Concentration measured at the operation in ppm.

TABLE 16
DETERMINATION OF HAZARD POTENTIAL

Hazard potential	Toxicity Group			
	Gas or vapor (ppm)	Mist (mg/m ³)		Flash point (in degrees F.)
A	0 - 10	0	- 0.1	.....
B	11 - 100	0.11	- 1.0	Under 100
C	101 - 500	1.1	- 10	100-200
D	Over 500	Over	10	Over 200

(f) Rate of gas, vapor, or mist evolution is a numerical index, on a scale of from 1 to 4, inclusive, both of the relative capacity of the tank to produce gas, vapor, or mist and of the relative energy with which it is projected or carried upwards from the tank. Rate is evaluated in terms of;

(i) The temperature of the liquid in the tank in degrees Fahrenheit;

(ii) The number of degrees Fahrenheit that this temperature is below the boiling point of the liquid in degrees Fahrenheit;

(iii) The relative evaporation of the liquid in still air at room temperature in an arbitrary scale—fast, medium, slow, or nil; and

(iv) The extent that the tank gases or produces mist in an arbitrary scale—high, medium, low, and nil. (See Table 17, Note 2.) Gassing depends upon electrochemical or mechanical processes, the effects of which have to be individually evaluated for each installation (see Table 17, Note 3).

(g) Rate of evolution shall be determined from Table 17. When evaporation and gassing yield different rates, the lowest numerical value shall be used.

TABLE 17
DETERMINATION OF RATE OF GAS, VAPOR, OR MIST EVOLUTION¹

Rate	Liquid temperature, °F	Degrees below boiling point	Evaporation ²	Relative Gassing ³
1	Over 200	0-20	Fast	High
2	150-200	21-50	Medium ...	Medium
3	94-149	51-100	Slow	Low
4	Under 94	Over 100	Nil	Nil

Note 1. In certain classes of equipment, specifically vapor degreasers, an internal condenser or vapor level thermostat is used to prevent the vapor from leaving the tank during normal operations. In such cases, rate of vapor evolution from the tank into the workroom is not dependent upon the factors listed in the table, but rather upon abnormalities of operating procedure, such as carry out of vapors from excessively fast action, dragout of liquid by entrainment in parts, contamination of solvent by water and other materials, or improper heat balance. When operating procedure is excellent, effective rate of evolution may be taken as 4. When operating procedures are average, the effective rate of evolution may be taken as 3. When operation is poor, a rate of 2 or 1 is indicated, depending upon observed conditions.

Note 2. Relative evaporation rate is determined according to the methods described by A. K. Doolittle in Industrial and Engineering Chemistry, vol. 27, p. 1169, (3) where time for 100— percent evaporation is as follows: Fast: 0-3 hours; Medium: 3-12 hours; Slow: 12-50 hours; Nil: more than 50 hours.

Note 3. Gassing means the formation by chemical or electrochemical action of minute bubbles of gas under the surface of the liquid in the tank and is generally limited to aqueous solutions.

(3) Ventilation. Where ventilation is used to control potential exposures to workers as defined in (2)(c) of this section, it shall be adequate to reduce the concentration of the air contaminant to the degree that a hazard to the worker does not exist. Methods of ventilation are discussed in American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960.

(4) Control requirements.

(a) Control velocities shall conform to Table 18 in all cases where the flow of air past the breathing or working zone of the operator and into the hoods is undisturbed by local environmental conditions, such as open windows, wall fans, unit heaters, or moving machinery.

(b) All tanks exhausted by means of hoods which;

(i) Project over the entire tank;

(ii) Are fixed in position in such a location that the head of the workman, in all his normal operating positions while working at the tank, is in front of all hood openings; and

(iii) Are completely enclosed on at least two sides, shall be considered to be exhausted through an enclosing hood.

(iv) The quantity of air in cubic feet per minute necessary to be exhausted through an enclosing hood shall be not less than the product of the control velocity times the net area of all openings in the enclosure through which air can flow into the hood.

TABLE 18
CONTROL VELOCITIES IN FEET PER MINUTE (F.P.M.) FOR UNDISTURBED LOCATIONS

Class (See Sub-paragraph (2) and Tables 16 and 17)	Enclosing hood (See Subparagraph (4)(ii))		Lateral exhaust ¹ (See Subparagraph (4)(iii))	Canopy hood ² (See Subparagraph (4)(iv))	
	One open side	Two open sides		Three open sides	Four open sides
A-1 and A-2 ———	100	150	150	Do not use	Do not use
A-3 (Note ²), B-1, B-2, and C-1 ———	75	100	100	125	175
B-3, C-2, and D-1 (Note ³) ———	65	90	75	100	150
A-4 (Note ²), C-3, and D-2 (Note ³) ———	50	75	50	75	125
B-4, C-4, D-3 (Note ³), and D-4 ———	General room ventilation required.				

¹ See Table 19 for computation of ventilation rate.

² Do not use canopy hood for Hazard Potential A processes.

³ Where complete control of hot water is desired, design as next highest class.

(c) All tanks exhausted by means of hoods which do not project over the entire tank, and in which the direction of air movement into the hood or hoods is substantially horizontal, shall be considered to be laterally exhausted. The quantity of air in cubic feet per minute necessary to be laterally exhausted per square foot of tank area in order to maintain the required control velocity shall be determined from Table 19 for all variations in ratio of tank width (W) to tank length (L). The total quantity of air in cubic feet per minute required to be exhausted per tank shall be not less than the product of the area of tank surface times the cubic feet per minute per square foot of tank area, determined from Table 19.

(i) For lateral exhaust hoods over 42 inches wide, or where it is desirable to reduce the amount of air removed from the workroom, air supply slots or orifices shall be provided along the side or the center of the tank opposite from the exhaust slots. The design of such systems shall meet the following criteria:

(A) The supply air volume plus the entrained air shall not exceed 50 percent of the exhaust volume.

(B) The velocity of the supply airstream as it reaches the effective control area of the exhaust slot shall be less than the effective velocity over the exhaust slot area.

(C) The vertical height of the receiving exhaust hood, including any baffle, shall not be less than one-quarter the width of the tank.

(D) The supply airstream shall not be allowed to impinge on obstructions between it and the exhaust slot in such a manner as to significantly interfere with the performance of the exhaust hood.

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TABLE 19
MINIMUM VENTILATION RATE IN CUBIC FEET OF AIR PER MINUTE PER SQUARE FOOT OF TANK AREA FOR LATERAL EXHAUST

Required minimum control velocity, f.p.m. (from Table)	C.f.m. per sq. ft. to maintain required minimum velocities at following ratios (tank width (W)/tank length (L)). ^{1,3}				
	0.0-0.09	0.1-0.24	0.25-0.49	0.5-0.99	1.0-2.0
Hood along one side or two parallel sides of tank when one hood is against a wall or baffle. ²					
Also for a manifold along tank centerline. ³					
50	50	60	75	90	100
75	75	90	110	130	150
100	100	125	150	175	200
150	150	190	225	260	300
Hood along one side or two parallel sides of free standing tank not against wall or baffle.					
50	75	90	100	110	125
75	110	130	150	170	190
100	150	175	200	225	250
150	225	260	300	340	375

¹ It is not practicable to ventilate across the long dimension of a tank whose ratio W/L exceeds 2.0.

It is understandable to do so when W/L exceeds 1.0. For circular tanks with lateral exhaust along up the circumference use W/L= 1.0 for over one-half the circumference use W/L = 0.5.

² Baffle is a vertical plate the same length as the tank, and with the top of the plate as high as the tank is wide. If the exhaust hood is on the side of a tank against a building wall or close to it, it is perfectly baffled.

³ Use W/L as tank width in computing when manifold is along centerline, or when hoods are used on two parallel sides of a tank.

Tank Width (W) means the effective width over which the hood must pull air to operate (for example, where the hood face is not back from the edge of the tank, this set back must be added in measuring tank width). The surface area of tanks can frequently be reduced and better control obtained (particularly on conveyerized systems) by using covers extending from the upper edges of the slots toward the center of the tank.

(E) Since most failure of push-pull systems result from excessive supply air volumes and pressures, methods of measuring and adjusting the supply air shall be provided. When satisfactory control has been achieved, the adjustable features of the hood shall be fixed so that they will not be altered.

(d) All tanks exhausted by means of hoods which project over the entire tank, and which do not conform to the definition of enclosing hoods, shall be considered to be overhead canopy hoods. The quantity of air in cubic feet per minute necessary to be exhausted through a canopy hood shall be not less than the product of the control velocity times the net area of all openings between the bottom edges of the hood and the top edges of the tank.

(e) The rate of vapor evolution (including steam or products of combustion) from the process shall be estimated. If the rate of vapor evolution is equal to or greater than 10 percent of the calculated exhaust volume required, the exhaust volume shall be increased in equal amount.

(5) Spray cleaning and degreasing. Wherever spraying or other mechanical means are used to disperse a liquid above an open-surface tank, control must be provided for the airborne spray. Such operations shall be enclosed as completely as possible. The inward air velocity into the enclosure shall

be sufficient to prevent the discharge of spray into the workroom. Mechanical baffles may be used to help prevent the discharge of spray. Spray painting operations are covered in WAC 296-62-11019.

(6) Control means other than ventilation. Tank covers, foams, beads, chips, or other materials floating on the tank surface so as to confine gases, mists, or vapors to the area under the cover or to the foam, bead, or chip layer; or surface tension depressive agents added to the liquid in the tank to minimize mist formation, or any combination thereof, may all be used as gas, mist, or vapor control means for open-surface tank operations, provided that they effectively reduce the concentrations of hazardous materials in the vicinity of the worker below the limits set in accordance with (2) of this section.

(7) System design.

(a) The equipment for exhausting air shall have sufficient capacity to produce the flow of air required in each of the hoods and openings of the system.

(b) The capacity required in (7)(a) of this section shall be obtained when the airflow producing equipment is operating against the following pressure losses, the sum of which is the static pressure:

(i) Entrance losses into the hood.

(ii) Resistance to airflow in branch pipe including bends and transformations.

(iii) Entrance loss into the main pipe.

(iv) Resistance to airflow in main pipe including bends and transformations.

(v) Resistance of mechanical equipment; that is, filters, washers, condensers, absorbers, etc., plus their entrance and exit losses.

(vi) Resistance in outlet duct and discharge stack.

(c) Two or more operations shall not be connected to the same exhaust system where either one or the combination of the substances removed may constitute a fire, explosion, or chemical reaction hazard in the duct system. Traps or other devices shall be provided to insure that condensate in ducts does not drain back into any tank.

(d) The exhaust system, consisting of hoods, ducts, air mover, and discharge outlet shall be designed in accordance with American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960, or the manual, Industrial Ventilation, published by the American Conference of Governmental Industrial Hygienists. Airflow and pressure loss data provided by the manufacturer of any air cleaning device shall be included in the design calculations.

(8) Operation.

(a) The required airflow shall be maintained at all times during which gas, mist, or vapor is emitted from the tank, and at all times the tank, the draining, or the drying area is in operation or use. When the system is first installed, the airflow from each hood shall be measured by means of a pitot traverse in the exhaust duct and corrective action taken if the flow is less than that required. When the proper flow is obtained, the hood static pressure shall be measured and recorded. At intervals of not more than 3 months operation, or after a prolonged shutdown period, the hoods and duct system shall be inspected for evidence of corrosion or damage.

In any case where the airflow is found to be less than required, it shall be increased to the required value. (Information on airflow and static pressure measurement and calculations may be found in American National Standard Fundamentals Governing the Design and Operation of Local Exhaust Systems, Z9.2-1960, or in the manual, Industrial Ventilation, published by the American Conference of Governmental Industrial Hygienists.)

(b) The exhaust system shall discharge to the outer air in such a manner that the possibility of its effluent entering any building is at a minimum. Recirculation shall only be through a device for contaminant removal which will prevent the creation of a health hazard in the room or area to which the air is recirculated.

(c) A volume of outside air in the range of 90 percent to 110 percent of the exhaust volume shall be provided to each room having exhaust hoods. The outside air supply shall enter the workroom in such a manner as not to be detrimental to any exhaust hood. The airflow of the makeup air system shall be measured on installation. Periodically, thereafter, the airflow should be remeasured, and corrective action shall be taken when the airflow is below that required. The makeup air shall be uncontaminated.

(9) Personal protection.

(a) All employees working in and around open surface tank operations must be instructed as to the hazards of their respective jobs, and in the personal protection and first aid procedures applicable to these hazards.

(b) All persons required to work in such a manner that their feet may become wet shall be provided with rubber or other impervious boots or shoes, rubbers, or wooden-soled shoes sufficient to keep feet dry.

(c) All persons required to handle work wet with a liquid other than water shall be provided with gloves impervious to such a liquid and of a length sufficient to prevent entrance of liquid into the tops of the gloves. The interior of gloves shall be kept free from corrosive or irritating contaminants.

(d) All persons required to work in such a manner that their clothing may become wet shall be provided with such aprons, coats, jackets, sleeves, or other garments made of rubber, or of other materials impervious to liquids other than water, as are required to keep their clothing dry. Aprons shall extend well below the top of boots to prevent liquid splashing into the boots. Provision of dry, clean, cotton clothing along with rubber shoes or short boots and an apron impervious to liquids other than water shall be considered a satisfactory substitute where small parts are cleaned, plated, or acid dipped in open tanks and rapid work is required.

(e) Whenever there is a danger of splashing, for example, when additions are made manually to the tanks, or when acids and chemicals are removed from the tanks, the employees so engaged shall be required to wear either tight-fitting chemical goggles or an effective face shield. (See WAC 296-24-078.)

(f) When, during emergencies as described in (11)(e) of this section, workers must be in areas where concentrations of air contaminants are greater than the limit set by (2)(c) of this section, or oxygen concentrations are less than 19.5%, they shall be required to wear respirators adequate to reduce their exposure to a level below these limits, or to provide ade-

quate oxygen. Such respirators shall also be provided in marked, quickly accessible storage compartments built for the purpose, when there exists the possibility of accidental release of hazardous concentrations of air contaminants. Respirators shall meet the applicable provisions of chapter 296-62 WAC and shall be selected by a competent industrial hygienist or other technically qualified source. Respirators shall be used in accordance with the applicable provisions of chapter 296-62 WAC, and persons who may require them shall be trained in their use.

(g) Near each tank containing a liquid which may burn, irritate, or otherwise be harmful to the skin if splashed upon the worker's body, there shall be a supply of clean cold water. The water pipe (carrying a pressure not exceeding 25 pounds) shall be provided with a quick opening valve and at least 48 inches of hose not smaller than three-fourths inch, so that no time may be lost in washing off liquids from the skin or clothing. Alternatively, deluge showers and eye flushes shall be provided in cases where harmful chemicals may be splashed on parts of the body.

(h) Operators with sores, burns, or other skin lesions requiring medical treatment shall not be allowed to work at their regular operations until so authorized by a physician. Any small skin abrasions, cuts, rash, or open sores which are found or reported shall be treated by a properly designated person so that chance of exposures to the chemicals are removed. Workers exposed to chromic acids shall have a periodic examination made of the nostrils and other parts of the body, to detect incipient ulceration.

(i) Sufficient washing facilities, including soap, individual towels, and hot water, shall be provided for all persons required to use or handle any liquids which may burn, irritate, or otherwise be harmful to the skin, on the basis of at least one basin (or its equivalent) with a hot water faucet for every 10 employees. (See WAC 296-24-12009.)

(j) Locker space or equivalent clothing storage facilities shall be provided to prevent contamination of street clothing.

(k) First aid facilities specific to the hazards of the operations conducted shall be readily available.

(10) Special precautions for cyanide. Dikes or other arrangements shall be provided to prevent the possibility of intermixing of cyanide and acid in the event of tank rupture.

(11) Inspection, maintenance, and installation.

(a) Floors and platforms around tanks shall be prevented from becoming slippery both by original type of construction and by frequent flushing. They shall be firm, sound, and of the design and construction to minimize the possibility of tripping.

(b) Before cleaning the interior of any tank, the contents shall be drained off, and the cleanout doors shall be opened where provided. All pockets in tanks or pits, where it is possible for hazardous vapors to collect, shall be ventilated and cleared of such vapors.

(c) Tanks which have been drained to permit employees to enter for the purposes of cleaning, inspection, or maintenance may contain atmospheres which are hazardous to life or health, through the presence of flammable or toxic air contaminants, or through the absence of sufficient oxygen. Before employees shall be permitted to enter any such tank, appropriate tests of the atmosphere shall be made to deter-

mine if the limits set by (2)(c) of this section are exceeded, or if the oxygen concentration is less than 19.5%.

(d) If the tests made in accordance with (11)(c) of this section indicate that the atmosphere in the tank is unsafe, before any employee is permitted to enter the tank, the tank shall be ventilated until the hazardous atmosphere is removed, and ventilation shall be continued so as to prevent the occurrence of a hazardous atmosphere as long as an employee is in the tank.

(e) If, in emergencies, such as rescue work, it is necessary to enter a tank which may contain a hazardous atmosphere, suitable respirators, such as self-contained breathing apparatus; hose mask with blower, if there is a possibility of oxygen deficiency; or a gas mask, selected and operated in accordance with (9)(f) of this section, shall be used. If a contaminant in the tank can cause dermatitis, or be absorbed through the skin, the employee entering the tank shall also wear protective clothing. At least one trained standby employee, with suitable respirator, shall be present in the nearest uncontaminated area. The standby employee must be able to communicate with the employee in the tank and be well able to haul him out of the tank with a lifeline if necessary.

(f) Maintenance work requiring welding or open flame, where toxic metal fumes such as cadmium, chromium, or lead may be evolved, shall be done only with sufficient local exhaust ventilation to prevent the creation of a health hazard, or be done with respirators selected and used in accordance with (9)(f) of this section. Welding, or the use of open flames near any solvent cleaning equipment shall be permitted only after such equipment has first been thoroughly cleared of solvents and vapors.

(12) Vapor degreasing tanks.

(a) In any vapor degreasing tank equipped with a condenser and vapor level thermostat, the condenser or thermostat shall keep the level of vapors below the top edge of the tank by a distance at least equal to one-half the tank width, or at least 36 inches, whichever is shorter.

(b) Where gas is used as a fuel for heating vapor degreasing tanks, the combustion chamber shall be of tight construction, except for such openings as the exhaust flue, and those that are necessary for supplying air for combustion. Flues shall be of corrosion-resistant construction and shall extend to the outer air. If mechanical exhaust is used on this flue, a draft diverter shall be used. Special precautions must be taken to prevent solvent fumes from entering the combustion air of this or any other heater when chlorinated or fluorinated hydrocarbon solvents (for example, trichloroethylene; Freon) are used.

(c) Heating elements shall be so designed and maintained that their surface temperature will not cause the solvent or mixture to decompose, break down, or be converted into an excessive quantity of vapor.

(d) Tanks or machines of more than 4 square feet of vapor area, used for solvent cleaning or vapor degreasing, shall be equipped with suitable cleanout or sludge doors located near the bottom of each tank or still. These doors shall be so designed and gasketed that there will be no leakage of solvent when they are closed.

(13) Scope.

(a) This paragraph applies to all operations involving the immersion of materials in liquids, or in the vapors of such liquids, for the purpose of cleaning or altering their surfaces, or adding or imparting a finish thereto, or changing the character of the materials, and their subsequent removal from the liquids or vapors, draining, and drying. Such operations include washing, electroplating, anodizing, pickling, quenching, dyeing, dipping, tanning, dressing, bleaching, degreasing, alkaline cleaning, stripping, rinsing, digesting, and other similar operations, but do not include molten materials handling operations, or surface coating operations.

(b) "Molten materials handling operations" means all operations, other than welding, burning, and soldering operations, involving the use, melting, smelting, or pouring of metals, alloys, salts, or other similar substances in the molten state. Such operations also include heat treating baths, descaling baths, die casting stereotyping, galvanizing, tinning, and similar operations.

(c) "Surface coating operations" means all operations involving the application of protective, decorative, adhesive, or strengthening coating or impregnation to one or more surfaces, or into the interstices of any object or material, by means of spraying, spreading, flowing, brushing, roll coating, pouring, cementing, or similar means; and any subsequent draining or drying operations, excluding open-tank operations.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-11021, filed 11/22/91, effective 12/24/91. RCW 49.17.040, 49.17.050, and 49.17.240, 81-16-015 (Order 81-20), § 296-62-11021, filed 7/27/81; 80-11-010 (Order 80-14), § 296-62-11021, filed 8/8/80; Order 73-3, § 296-62-11021, filed 5/7/73.]

WAC 296-62-12000 Environmental tobacco smoke in office work environments—Scope and application. This regulation applies to all indoor office work environments and requires employee exposure to environmental tobacco smoke to be controlled.

[Statutory Authority: Chapter 49.17 RCW. 94-07-086 (Order 93-18), § 296-62-12000, filed 3/16/94, effective 9/1/94.]

WAC 296-62-12003 Definitions. (1) "CFM" means cubic feet per minute.

(2) "Employer" means any person, firm, corporation, partnership, business trust, legal representative, or other business entity which engages in any business, industry, profession, or activity in this state and employs one or more employees or who contracts with one or more persons, the essence of which is the personal labor of such person or persons and includes the state, counties, cities, and all municipal corporations, public corporations, political subdivisions of the state, and charitable organizations: *Provided*, That any persons, partnership, or business entity not having employees, and who is covered by the Industrial Insurance Act shall be considered both an employer and an employee.

(3) "Office work environment" means an indoor or enclosed occupied space where activities such as clerical, administration, or business are transacted. It includes associated spaces controlled by the employer that office workers utilize (e.g., cafeteria or meeting rooms). It does not include production or manufacturing process areas, but does include the office areas of manufacturing and production facilities. It

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includes only the office areas of other firms such as food and beverage establishments, agricultural operations, construction, commercial trade, services, etc.

(4) "Smoking" means igniting, inhaling, exhaling, or carrying a pipe, cigar, or cigarette of any kind which is burning.

[Statutory Authority: Chapter 49.17 RCW. 94-07-086 (Order 93-18), § 296-62-12003, filed 3/16/94, effective 9/1/94.]

WAC 296-62-12005 Controls for environmental tobacco smoke. (1) Employers shall prohibit smoking in their office's entirety, or restrict smoking indoors to designated enclosed smoking rooms that satisfy the minimum requirements below:

(a) Designated smoking rooms shall be clearly posted.

(b) Designated smoking rooms shall be prohibited in common areas such as places where nonsmoking employees are required to work or visit, restrooms, washrooms, hallways, and stairways.

(c) No employee shall be required to enter a designated smoking room while smoking is occurring. Cleaning and maintenance work in a designated smoking room shall be conducted when no smokers are present.

(d) Designated smoking rooms shall be ventilated at rates of at least 60 cfm per smoker (calculated on the basis of the maximum number of smokers expected during the course of a normal working day), which can be supplied by transfer air from adjacent areas.

Note: This ventilation rate is recommended for occupancies of no more than seven people for every 100 square feet of net occupied space in the designated smoking room.

(e) Sufficient negative pressure shall be maintained in designated smoking rooms to prevent smoke migration to surrounding nonsmoking areas at all times.

(f) Designated smoking rooms shall operate with a separate mechanical exhaust system and be exhausted directly outside, without recirculation to nonsmoking areas.

(g) If the mechanical exhaust system for a designated smoking room is not operating properly, the employer shall prohibit the use of the room until repairs are completed.

Note: This regulation is not intended to affect structures provided for smokers such as gazebos or lean-tos external to a building that are intended to provide protection from inclement weather.

(2) The employer shall use engineering or administrative controls to minimize the infiltration of environmental tobacco smoke from sources outside the building, through air intakes, entryways, and other openings (e.g., by ensuring any outside smoking areas utilized by their employees are not in close proximity to entryways, air intakes, and other openings that may allow airflow directly into an office).

(3) This section does not preempt any federal, state, municipal, or other local authority's regulation of indoor smoking that is more protective than this section.

Note: WAC 296-62-12009, the appendix, contains smoking cessation program information sources.

[Statutory Authority: Chapter 49.17 RCW. 94-07-086 (Order 93-18), § 296-62-12005, filed 3/16/94, effective 9/1/94.]

WAC 296-62-12007 Effective date. The effective date of WAC 296-62-12000 through 296-62-12009 shall be September 1, 1994.

[Statutory Authority: Chapter 49.17 RCW, 94-07-086 (Order 93-18), § 296-62-12007, filed 3/16/94, effective 9/1/94.]

WAC 296-62-12009 Appendix—Smoking cessation program information—Nonmandatory. The following organizations* provide smoking cessation information and program material:

(1) The National Cancer Institute operates a toll-free Cancer Information Service (CIS) with trained personnel to help you. Call 1-800-4-CANCER to reach the CIS office serving your area, or write: Office of Cancer Communications, National Cancer Institute, National Institutes of Health, Building 31, Room 10A24, Bethesda, Maryland 20892.

(2) American Cancer Society, 1599 Clifton Road NE, Atlanta, Georgia 30062, (404) 320-3333. The American Cancer Society (ACS) is a voluntary organization composed of 58 divisions and 3,100 local units. Through "The Great American Smokeout" in November, the annual Cancer Crusade in April, and numerous educational material, ACS helps people learn about the health hazards of smoking and become successful ex-smokers.

(3) American Heart Association, 7320 Greenville Avenue, Dallas, Texas 75231, (214) 750-5300. The American Heart Association (AHA) is a voluntary organization with 130,000 members (physicians, scientists, and laypersons) in 55 state and regional groups. AHA produces a variety of publications and audiovisual materials about the effects of smoking on the heart. AHA also has developed a guidebook for incorporating a weight-control component into smoking cessation programs.

(4) American Lung Association, 1740 Broadway, New York, New York 10019, (212) 245-8000. A voluntary organization of 7,500 members (physicians, nurses and laypersons), the American Lung Association (ALA) conducts numerous public information programs about the health effect of smoking. ALA has 59 state and 85 local units. The organization actively supports legislation and information campaigns for nonsmokers' rights and provides help for smokers who want to quit, for example through "Freedom From Smoking," a self-help cessation program.

(5) Office on Smoking and Health, United States Department of Health and Human Services, 5600 Fishers Lane, Park Building, Room 110, Rockville, Maryland 20857. The Office of Smoking and Health (OSH) is the Department of Health and Human Services' lead agency in smoking control. OSH has sponsored distribution of publications on smoking-related topics, such as free flyers on relapse after initial quitting, helping a friend or family member quit smoking, the health hazards of smoking, and the effects of parental smoking on teenagers.

* Consult your local telephone directory for listing of local chapters.

[Statutory Authority: Chapter 49.17 RCW, 94-07-086 (Order 93-18), § 296-62-12009, filed 3/16/94, effective 9/1/94.]

WAC 296-62-130 Emergency washing facilities. (1) Definitions.

(1999 Ed.)

(a) "Emergency washing facilities" means emergency showers, eyewashes, eye/face washes, or other similar units.

(b) "Emergency shower" means a unit that enables a user to have water cascading over the entire body. It shall deliver a minimum of 113.6 liters (30 gallons) per minute of water.

(c) "Eye/face wash" means a device used to irrigate and flush both the face and eyes. It shall deliver not less than 11.4 liters (3 gallons) per minute of water for at least fifteen minutes.

(d) "Eyewash" means a device to irrigate and flush the eyes. It shall deliver not less than 1.5 liters (0.4 gallons) per minute for at least fifteen minutes.

(e) "Personal eyewash" means a portable, supplementary eyewash that supports plumbed units, self-contained units, or both, by delivering immediate flushing for less than fifteen minutes.

(f) "Contact chemical agents" are defined in WAC 296-62-07003.

(2) Facilities required.

(a) Emergency washing facilities shall be readily available in the immediate work area for workers who may be exposed to harmful concentrations of contact chemical agents. To be readily available, emergency washing facilities shall require no more than ten seconds to reach. They should be within a travel distance no greater than 15.25 meters (50 feet).

(b) Personal eyewash equipment may be used to supplement the requirement for emergency washing facilities, however, in no event shall it be used as a substitute. Such units shall deliver potable water or other medically approved eye flushing solution.

(c) All emergency washing facilities, including personal eyewash equipment, shall be periodically inspected to ensure that they function correctly and that the quality and quantity of water is satisfactory for emergency washing purposes.

(3) All emergency washing facilities using nonpotable water shall have signs stating water is nonpotable.

[Statutory Authority: RCW 49.17.040 and 49.17.050, 85-10-004 (Order 85-09), § 296-62-130, filed 4/19/85; Order 73-3, § 296-62-130, filed 5/7/73; Order 70-8, § 296-62-130, filed 7/31/70, effective 9/1/70; Rule 13.010, effective 8/1/63.]

PART M—CONFINED SPACES

WAC 296-62-145 Permit-required confined spaces.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-145, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-145 reference section, filed 5/7/73.]

WAC 296-62-14500 Scope and application. (1) Scope. This part contains minimum requirements for practices and procedures to protect employees in all industries from the hazards of entry and/or work in permit-required confined spaces.

(2) Application. Part M (Permit-required confined spaces) applies to all employers under the jurisdiction of the Washington Industrial Safety and Health Act, chapter 49.17 RCW. Part M may be augmented by more protective requirements for confined spaces or areas in vertical standards. Certain industry specific vertical standards are more protective than chapter 296-62 WAC, Part M. Where there is a conflict

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between an industry specific vertical standard and chapter 296-62 WAC, Part M, the vertical standard shall apply.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14500, filed 1/18/95, effective 3/1/95.]

WAC 296-62-14501 Definitions. Acceptable entry conditions means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

Attendant means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

Authorized entrant means an employee who is authorized by the employer to enter a permit space.

Blanking or blinding means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (For example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Emergency means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

Entry means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

Entry permit (permit) means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in WAC 296-62-14509.

Entry supervisor means the person (such as the employer, crew leader, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this part.

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Note: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of ten percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note: This concentration may be approximated as a condition in which the dust obscures vision at a distance of five feet (1.52 m) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in chapter 296-62 WAC, general occupational health standards, and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Note: For air contaminants for which WISHA has not determined a dose or permissible exposure limit, other sources of information, such as material safety data sheets that comply with the Hazard Communication Standard, chapter 296-62 WAC, Part C, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Hot work permit means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

Immediately dangerous to life or health (IDLH) means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

Note: Some materials - hydrogen fluoride gas and cadmium vapor, for example - may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

Inerting means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Note: This procedure produces an IDLH oxygen-deficient atmosphere.

Isolation means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: Blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lock-out or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

Line breaking means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

Nonpermit confined space means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

Oxygen deficient atmosphere means an atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

- (1) Contains or has a potential to contain a hazardous atmosphere;
- (2) Contains a material that has the potential for engulfing an entrant;
- (3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or
- (4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program (permit space program) means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Permit system means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

Rescue service means the personnel designated to rescue employees from permit spaces.

Retrieval system means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for nonentry rescue of persons from permit spaces.

Testing means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note: Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 95-17-036, § 296-62-14501, filed 8/9/95, effective 9/25/95. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14501, filed 1/18/95, effective 3/1/95; 91-24-017 (Order 91-07), § 296-62-14501, filed 11/22/91, effective

(1999 Ed.)

12/24/91. RCW 49.17.040, 49.17.050, and 49.17.240. 80-11-010 (Order 80-14), § 296-62-14501, filed 8/8/80; Order 73-3, § 296-62-14501, filed 5/7/73.]

WAC 296-62-14503 General requirements. (1) The employer shall evaluate the workplace to determine if any spaces are permit-required confined spaces.

Note: Proper application of the decision flow chart in WAC 296-62-14521, Appendix A, would facilitate compliance with this requirement.

(2) If the workplace contains permit spaces, the employer shall inform exposed employees, by posting danger signs or by any other equally effective means, of the existence and location of and the danger posed by the permit spaces.

Note: A sign reading "DANGER-PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.

(3) If the employer decides that its employees will not enter permit spaces, the employer shall take effective measures to prevent its employees from entering the permit spaces and shall comply with subsections (1), (2), (6), and (8) of this section.

(4) If the employer decides that its employees will enter permit spaces, the employer shall develop and implement a written permit space program that complies with this part. The written program shall be available for inspection by employees and their authorized representatives.

(5) An employer may use the alternate procedures specified in (b) of this subsection for entering a permit space under the conditions set forth in (a) of this subsection.

(a) An employer whose employees enter a permit space need not comply with WAC 296-62-14505 through 296-62-14509 and WAC 296-62-14513 through 296-62-14519, provided that:

(i) The employer can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;

(ii) The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry;

(iii) The employer develops monitoring and inspection data that supports the demonstrations required by (a)(i) and (ii) of this subsection;

(iv) If an initial entry of the permit space is necessary to obtain the data required by (a)(iii) of this subsection, the entry is performed in compliance with WAC 296-62-14505 through 296-62-14519;

(v) The determinations and supporting data required by (a)(i), (ii), and (iii) of this subsection are documented by the employer and are made available to each employee who enters the permit space under the terms of WAC this subsection; and

(vi) Entry into the permit space under the terms of (a) of this subsection is performed in accordance with the requirements of (b) of this subsection.

Note: See subsection (7) of this section for reclassification of a permit space after all hazards within the space have been eliminated.

(b) The following requirements apply to entry into permit spaces that meet the conditions set forth in (a) of this subsection.

(i) Any conditions making it unsafe to remove an entrance cover shall be eliminated before the cover is removed.

(ii) When entrance covers are removed, the opening shall be promptly guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(iii) Before an employee enters the space, the internal atmosphere shall be tested, with a calibrated direct-reading instrument, for the following conditions in the order given:

(A) Oxygen content,

(B) Flammable gases and vapors, and

(C) Potential toxic air contaminants.

(iv) There may be no hazardous atmosphere within the space whenever any employee is inside the space.

(v) Continuous forced air ventilation shall be used, as follows:

(A) An employee may not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;

(B) The forced air ventilation shall be so directed as to ventilate the immediate areas where an employee is or will be present within the space and shall continue until all employees have left the space;

(C) The air supply for the forced air ventilation shall be from a clean source and may not increase the hazards in the space.

(vi) The atmosphere within the space shall be periodically tested as necessary to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere.

(vii) If a hazardous atmosphere is detected during entry:

(A) Each employee shall leave the space immediately;

(B) The space shall be evaluated to determine how the hazardous atmosphere developed; and

(C) Measures shall be implemented to protect employees from the hazardous atmosphere before any subsequent entry takes place.

(viii) The employer shall verify that the space is safe for entry and that the preentry measures required by (b) of this subsection have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification shall be made before entry and shall be made available to each employee entering the space.

(6) When there are changes in the use or configuration of a nonpermit confined space that might increase the hazards to entrants, the employer shall reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

(7) A space classified by the employer as a permit-required confined space may be reclassified as a nonpermit confined space under the following procedures:

(a) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated without entry into the space, the permit space may be

reclassified as a nonpermit confined space for as long as the nonatmospheric hazards remain eliminated.

(b) If it is necessary to enter the permit space to eliminate hazards, such entry shall be performed under WAC 296-62-14505 through 296-62-14519. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated, the permit space may be reclassified as a nonpermit confined space for as long as the hazards remain eliminated.

Note: Control of atmospheric hazards through forced air ventilation does not constitute elimination of the hazards. Subsection (5) of this section covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

(c) The employer shall document the basis for determining that all hazards in a permit space have been eliminated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification shall be made available to each employee entering the space.

(d) If hazards arise within a permit space that has been declassified to a nonpermit space under this subsection, each employee in the space shall exit the space. The employer shall then reevaluate the space and determine whether it must be reclassified as a permit space, in accordance with other applicable provisions of this part.

(8) When an employer (host employer) arranges to have employees of another employer (contractor) perform work that involves permit space entry, the host employer shall:

(a) Inform the contractor that the workplace contains permit spaces and that permit space entry is allowed only through compliance with a permit space program meeting the requirements of this part;

(b) Apprise the contractor of the elements, including the hazards identified and the host employer's experience with the space, that make the space in question a permit space;

(c) Apprise the contractor of any precautions or procedures that the host employer has implemented for the protection of employees in or near permit spaces where contractor personnel will be working;

(d) Coordinate entry operations with the contractor, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by WAC 296-62-14505(11); and

(e) Debrief the contractor at the conclusion of the entry operations regarding the permit space program followed and regarding any hazards confronted or created in permit spaces during entry operations.

(9) In addition to complying with the permit space requirements that apply to all employers, each contractor who is retained to perform permit space entry operations shall:

(a) Obtain any available information regarding permit space hazards and entry operations from the host employer;

(b) Coordinate entry operations with the host employer, when both host employer personnel and contractor personnel will be working in or near permit spaces, as required by WAC 296-62-14505(11); and

(c) Inform the host employer of the permit space program that the contractor will follow and of any hazards con-

fronted or created in permit spaces, either through a debriefing or during the entry operation.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14503, filed 1/18/95, effective 3/1/95; 91-11-070 (Order 91-01), § 296-62-14503, filed 5/20/91, effective 6/20/91; Order 73-3, § 296-62-14503, filed 5/7/73.]

WAC 296-62-14505 Permit-required confined space program (permit space program). Under the permit space program required by WAC 296-62-14503(4), the employer shall:

(1) Implement the measures necessary to prevent unauthorized entry;

(2) Identify and evaluate the hazards of permit spaces before employees enter them;

(3) Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

(a) Specifying acceptable entry conditions;

(b) Isolating the permit space;

(c) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

(d) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards; and

(e) Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry.

(4) Provide the following equipment (specified in (a) through (i) of this subsection) at no cost to employees, maintain that equipment properly, and ensure that employees use that equipment properly:

(a) Testing and monitoring equipment needed to comply with subsection (5) of this section;

(b) Ventilating equipment needed to obtain acceptable entry conditions;

(c) Communications equipment necessary for compliance with WAC 296-62-14513(3) and 296-62-14515(5);

(d) Personal protective equipment insofar as feasible engineering and work practice controls do not adequately protect employees;

(e) Lighting equipment needed to enable employees to see well enough to work safely and to exit the space quickly in an emergency;

(f) Barriers and shields as required by subsection (3)(d) of this section;

(g) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(h) Rescue and emergency equipment needed to comply with subsection (9) of this section, except to the extent that the equipment is provided by rescue services; and

(i) Any other equipment necessary for safe entry into and rescue from permit spaces.

(5) Evaluate permit space conditions as follows when entry operations are conducted:

(a) Test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin, except that, if isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer), preentry testing shall be performed to the extent feasible before entry is authorized and, if entry is

authorized, entry conditions shall be continuously monitored in the areas where authorized entrants are working;

(b) Test or monitor the permit space as necessary to determine if acceptable entry conditions are being maintained during the course of entry operations; and

(c) When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors.

Note: Atmospheric testing conducted in accordance with WAC 296-62-14523, Appendix B, would be considered as satisfying the requirements of this paragraph. For permit space operations in sewers, atmospheric testing conducted in accordance with Appendix B, as supplemented by WAC 296-62-14529, Appendix E, would be considered as satisfying the requirements of this subdivision.

(6) Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations;

Note: Attendants may be assigned to monitor more than one permit space provided the duties described in WAC 296-62-14515 can be effectively performed for each permit space that is monitored. Likewise, attendants may be stationed at any location outside the permit space to be monitored as long as the duties described in WAC 296-62-14515 can be effectively performed for each permit space that is monitored. However, it is important to assess if it is appropriate or possible to have multiple permit spaces monitored by a single attendant or have attendants stationed at a location outside the monitored permit space. Due to the variability of permit space work environments, the appropriateness of how a permit space is monitored must be tailored to the requirements of the permit space and the work being performed.

(7) If multiple spaces are to be monitored by a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of the permit spaces being monitored without distraction from the attendant's responsibilities under WAC 296-62-14515;

(8) Designate the persons who are to have active roles (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by WAC 296-62-14511;

(9) Develop and implement procedures for summoning rescue and emergency services, for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;

(10) Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this part;

(11) Develop and implement procedures to coordinate entry operations when employees of more than one employer are working simultaneously as authorized entrants in a permit space, so that employees of one employer do not endanger the employees of any other employer;

(12) Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;

(13) Review entry operations when the employer has reason to believe that the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

Note: Examples of circumstances requiring the review of the permit space program are: Any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.

(14) Review the permit space program, using the canceled permits retained under WAC 296-62-14507(6) within one year after each entry and revise the program as necessary, to ensure that employees participating in entry operations are protected from permit space hazards.

Note: Employers may perform a single annual review covering all entries performed during a twelve-month period. If no entry is performed during a twelve-month period, no review is necessary.

WAC 296-62-14525, Appendix C, presents examples of permit space programs that are considered to comply with the requirements of WAC 296-62-14505.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14505, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14505, filed 5/7/73.]

WAC 296-62-14507 Permit system. (1) Before entry is authorized, the employer shall document the completion of measures required by WAC 296-62-14505(3) by preparing an entry permit.

Note: WAC 296-62-14527, Appendix D, presents examples of permits whose elements are considered to comply with the requirements of this part.

(2) Before entry begins, the entry supervisor identified on the permit shall sign the entry permit to authorize entry.

(3) The completed permit shall be made available at the time of entry to all authorized entrants, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that preentry preparations have been completed.

(4) The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit in accordance with WAC 296-62-14509(2).

(5) The entry supervisor shall terminate entry and cancel the entry permit when:

(a) The entry operations covered by the entry permit have been completed; or

(b) A condition that is not allowed under the entry permit arises in or near the permit space.

(6) The employer shall retain each canceled entry permit for at least one year to facilitate the review of the permit-required confined space program required by WAC 296-62-14505(14). Any problems encountered during an entry operation shall be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14507, filed 1/18/95, effective 3/1/95. Statutory Authority: RCW 49.17.040, 49.17.050, and 49.17.240. 81-16-015 (Order 81-20), § 296-62-14507, filed 7/27/81; 80-

11-010 (Order 80-14), § 296-62-14507, filed 8/8/80; Order 73-3, § 296-62-14507, filed 5/7/73.]

WAC 296-62-14509 Entry permit. The entry permit that documents compliance with this part and authorizes entry to a permit space shall identify:

(1) The permit space to be entered;

(2) The purpose of the entry;

(3) The date and the authorized duration of the entry permit;

(4) The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

Note: This requirement may be met by inserting a reference on the entry permit as to the means used, such as a roster or tracking system, to keep track of the authorized entrants within the permit space.

(5) The personnel, by name, currently serving as attendants;

(6) The individual, by name, currently serving as entry supervisor, with a space for the signature or initials of the entry supervisor who originally authorized entry;

(7) The hazards of the permit space to be entered;

(8) The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

Note: Those measures can include the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

(9) The acceptable entry conditions;

(10) The results of initial and periodic tests performed under WAC 296-62-14505(5), accompanied by the names or initials of the testers and by an indication of when the tests were performed;

(11) The rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

(12) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

(13) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this part;

(14) Any other information whose inclusion is necessary, given the circumstances of the particular confined space, in order to ensure employee safety; and

(15) Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14509, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14509, filed 5/7/73.]

WAC 296-62-14511 Training. (1) The employer shall provide training so that all employees whose work is regulated by this section acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this part.

(2) Training shall be provided to each affected employee:

(a) Before the employee is first assigned duties under this section;

(b) Before there is a change in assigned duties;

(c) Whenever there is a change in permit space operations that presents a hazard about which an employee has not previously been trained;

(d) Whenever the employer has reason to believe either that there are deviations from the permit space entry procedures required by WAC 296-62-14505(3) or that there are inadequacies in the employee's knowledge or use of these procedures.

(3) The training shall establish employee proficiency in the duties required by this part and shall introduce new or revised procedures, as necessary, for compliance with this part.

(4) The employer shall certify that the training required by subsections (1) through (3) of this section has been accomplished. The certification shall contain each employee's name, the signatures or initials of the trainers, and the dates of training. The certification shall be available for inspection by employees and their authorized representatives.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14511, filed 1/18/95, effective 3/1/95; 91-24-017 (Order 91-07), § 296-62-14511, filed 11/22/91, effective 12/24/91; Order 73-3, § 296-62-14511, filed 5/7/73.]

WAC 296-62-14513 Duties of authorized entrants.

The employer shall ensure that all authorized entrants:

(1) Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Properly use equipment as required by WAC 296-62-14505(4);

(3) Communicate with the attendant as necessary to enable the attendant to monitor entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by WAC 296-62-14515(6).

(4) Alert the attendant whenever:

(a) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or

(b) The entrant detects a prohibited condition; and

(5) Exit from the permit space as quickly as possible whenever:

(a) An order to evacuate is given by the attendant or the entry supervisor,

(b) The entrant recognizes any warning sign or symptom of exposure to a dangerous situation,

(c) The entrant detects a prohibited condition, or

(d) An evacuation alarm is activated.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14513, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14513, filed 5/7/73.]

WAC 296-62-14515 Duties of attendants. The employer shall ensure that each attendant:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(3) Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means

used to identify authorized entrants under WAC 296-62-14509(4) accurately identifies who is in the permit space;

(4) Remains outside the permit space during entry operations until relieved by another attendant;

Note: When the employer's permit entry program allows attendant entry for rescue, attendants may enter a permit space to attempt a rescue if they have been trained and equipped for rescue operations as required by WAC 296-62-14519(1) and if they have been relieved as required by subsection (4) of this section.

(5) Communicates with authorized entrants as necessary to monitor entrant status and to alert entrants of the need to evacuate the space under subsection (6) of this section;

(6) Monitors activities inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

(a) If the attendant detects a prohibited condition;

(b) If the attendant detects the behavioral effects of hazard exposure in an authorized entrant;

(c) If the attendant detects a situation outside the space that could endanger the authorized entrants; or

(d) If the attendant cannot effectively and safely perform all the duties required under this section;

(7) Summon rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(8) Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(a) Warn the unauthorized persons that they must stay away from the permit space;

(b) Advise the unauthorized persons that they must exit immediately if they have entered the permit space; and

(c) Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(9) Performs nonentry rescues as specified by the employer's rescue procedure; and

(10) Performs no duties that might interfere with the attendant's primary duty to monitor and protect the authorized entrants.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14515, filed 1/18/95, effective 3/1/95; 91-24-017 (Order 91-07), § 296-62-14515, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050, 83-15-017 (Order 83-19), § 296-62-14515, filed 7/13/83, effective 9/12/83; 82-13-045 (Order 82-22), § 296-62-14515, filed 6/11/82; Order 73-3, § 296-62-14515, filed 5/7/73.]

WAC 296-62-14517 Duties of entry supervisors. The employer shall ensure that each entry supervisor:

(1) Knows the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(2) Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(3) Terminates the entry and cancels the permit as required by WAC 296-62-14507(5);

(4) Verifies that rescue services are available and that the means for summoning them are operable;

(5) Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(6) Determines, whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14517, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14517, filed 5/7/73.]

WAC 296-62-14519 Rescue and emergency services.

(1) The following requirements apply to employers who have employees enter permit spaces to perform rescue services.

(a) The employer shall ensure that each member of the rescue service is provided with, and is trained to use properly, the personal protective equipment and rescue equipment necessary for making rescues from permit spaces.

(b) Each member of the rescue service shall be trained to perform the assigned rescue duties. Each member of the rescue service shall also receive the training required of authorized entrants under WAC 296-62-14511.

(c) Each member of the rescue service shall practice making permit space rescues at least once every twelve months, by means of simulated rescue operations in which they remove dummies, mannequins, or actual persons from the actual permit spaces or from representative permit spaces. Representative permit spaces shall, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

(d) Each member of the rescue service shall be trained in basic first-aid and in cardiopulmonary resuscitation (CPR). At least one member of the rescue service holding current certification in first aid and in CPR shall be available.

(2) When an employer (host employer) arranges to have persons other than the host employer's employees perform permit space rescue, the host employer shall:

(a) Inform the rescue service of the hazards they may confront when called on to perform rescue at the host employer's facility, and

(b) Provide the rescue service with access to all permit spaces from which rescue may be necessary so that the rescue service can develop appropriate rescue plans and practice rescue operations.

(3) To facilitate nonentry rescue, retrieval systems or methods shall be used whenever an authorized entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Retrieval systems shall meet the following requirements.

(a) Each authorized entrant shall use a chest or full-body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, or above the entrant's head. Wristlets may be used in lieu of the chest or full-body harness if the employer can demonstrate that the use of a chest or full-body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative.

[Title 296 WAC—p. 1692]

(b) The other end of the retrieval line shall be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device shall be available to retrieve personnel from vertical type permit spaces more than five feet (1.52 m) deep.

(4) If an injured entrant is exposed to a substance for which a material safety data sheet (MSDS) or other similar written information is required to be kept at the worksite, that MSDS or written information shall be made available to the medical facility treating the exposed entrant.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14519, filed 1/18/95, effective 3/1/95; 91-24-017 (Order 91-07), § 296-62-14519, filed 11/22/91, effective 12/24/91; Order 73-3, § 296-62-14519, filed 5/7/73.]

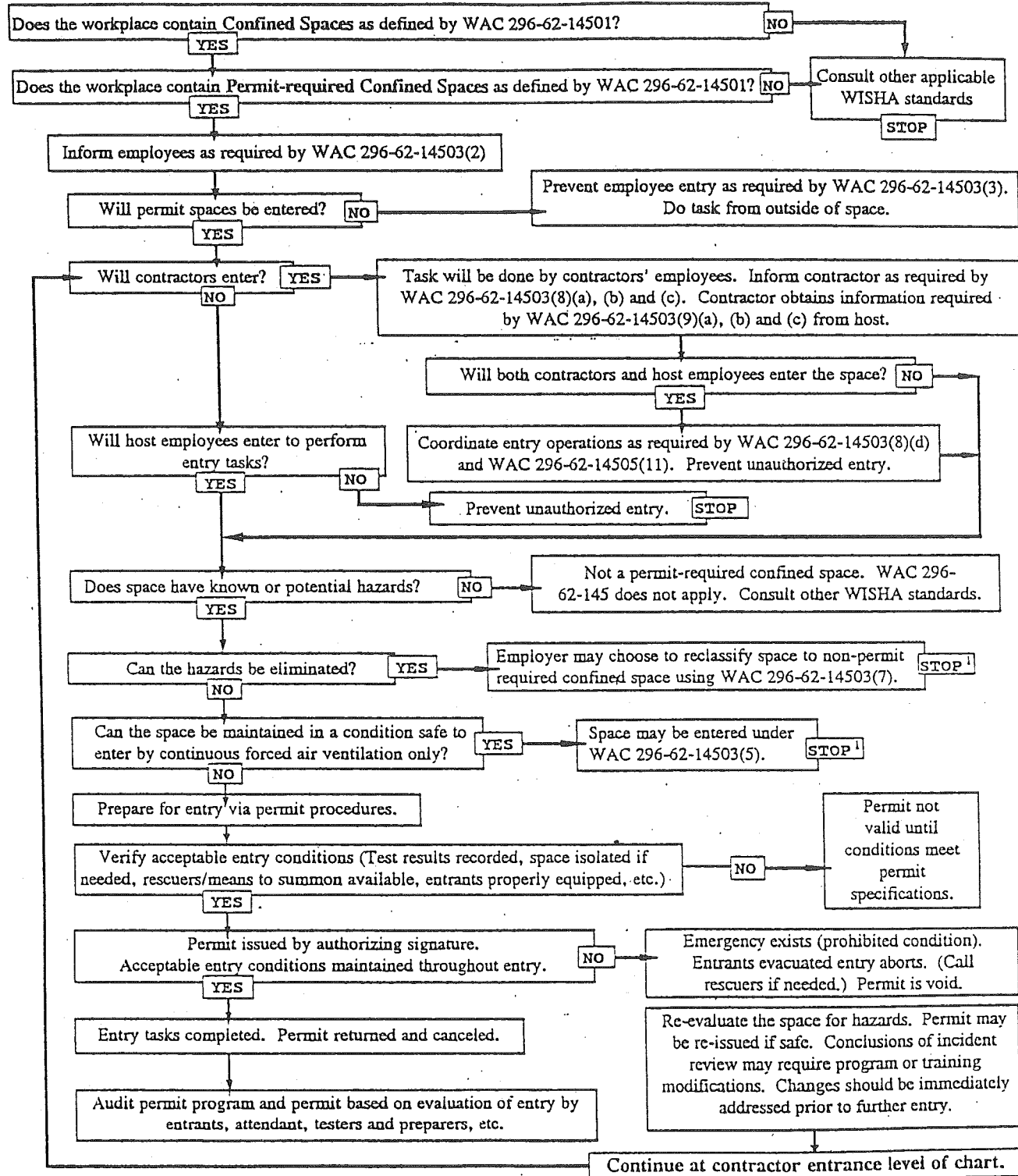
WAC 296-62-14520 Appendices to WAC 296-62-145—Permit-required confined spaces.

Note: Appendices A through E serve to provide information and nonmandatory guidelines to assist employers and employees in complying with the appropriate requirements of this part.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14520, filed 1/18/95, effective 3/1/95.]

WAC 296-62-14521 Appendix A—Permit-required confined space decision flow chart.

WAC 296-62-14521 Appendix A
Permit-required Confined Space Decision Flow Chart



¹ Spaces may have to be evacuated and re-evaluated if hazards arise during entry

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14521, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14521, filed 5/7/73.]

WAC 296-62-14523 Appendix B—Procedures for atmospheric testing. Atmospheric testing is required for two distinct purposes: Evaluation of the hazards of the permit space and verification that acceptable entry conditions for entry into that space exist.

(1) Evaluation testing. The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space. Evaluation and interpretation of these data, and development of the entry procedure, should be done by, or reviewed by, a technically qualified professional (e.g., WISHA consultation service, or certified industrial hygienist, registered safety engineer, certified safety professional, certified marine chemist, etc.) based on evaluation of all serious hazards.

(2) Verification testing. The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions. Results of testing (i.e., actual concentration, etc.) should be recorded on the permit in the space provided adjacent to the stipulated acceptable entry condition.

(3) Duration of testing. Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

(4) Testing stratified atmospheres. When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately four feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

(5) Order of testing. A test for oxygen is performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere. Combustible gases are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gases and vapors. If tests for toxic gases and vapors are necessary, they are performed last.

[Statutory Authority: Chapter 49.17 RCW, 95-04-007, § 296-62-14523, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14523, filed 5/7/73.]

WAC 296-62-14525 Appendix C—Examples of permit-required confined space programs. Example 1. Work-place. Sewer entry.

(1) Potential hazards. The employees could be exposed to the following:

(a) Engulfment.

(b) Presence of toxic gases. Equal to or more than 10 ppm hydrogen sulfide measured as an eight-hour time-weighted average. If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.

space and there is no reason to believe that any is likely to

(c) Presence of explosive/flammable gases. Equal to or greater than ten percent of the lower flammable limit (LFL).

(d) Oxygen deficiency. A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

(2) Entry without permit/attendant:

(a) Certification. Confined spaces may be entered without the need for a written permit or attendant provided that the space can be maintained in a safe condition for entry by mechanical ventilation alone, as provided in WAC 296-62-14503(5). All spaces shall be considered permit-required confined spaces until the preentry procedures demonstrate otherwise. Any employee required or permitted to precheck or enter an enclosed/confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures.

A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The confined space preentry check list must be completed by the LEAD WORKER before entry into a confined space. This list verifies completion of items listed below. This check list shall be kept at the job site for duration of the job. If circumstances dictate an interruption in the work, the permit space must be reevaluated and a new check list must be completed.

(b) Control of atmospheric and engulfment hazards.

(i) Pumps and lines. All pumps and lines which may reasonably cause contaminants to flow into the space shall be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals shall be blocked. If blocking and/or isolation requires entry into the space the provisions for entry into a permit-required confined space must be implemented.

(ii) Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

(iii) Testing. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. Detector tubes, alarm only gas monitors and explosion meters are examples of monitoring equipment that may be used to test permit space atmospheres. Testing shall be performed by the LEAD WORKER who has successfully completed the gas detector training for the monitor to be used. The minimum parameters to be monitored are oxygen deficiency, LFL, and hydrogen sulfide concentration. A written record of the preentry test results shall be made and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the preentry testing, that all hazards have been eliminated. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connecting spaces.

(c) Entry procedures. If there are no nonatmospheric hazards present and if the preentry tests show there is no dangerous air contamination and/or oxygen deficiency within the develop, entry into and work within may proceed.

Continuous testing of the atmosphere in the immediate vicinity of the workers within the space shall be accomplished. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until a SUPERVISOR who has completed the gas detector training has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

(d) Rescue. Arrangements for rescue services are not required where there is no attendant. See the rescue portion of subsection (3), below, for instructions regarding rescue planning where an entry permit is required.

(3) Entry permit required.

(a) Permits. Confined space entry permit. All spaces shall be considered permit-required confined spaces until the preentry procedures demonstrate otherwise. Any employee required or permitted to precheck or enter a permit-required confined space shall have successfully completed, as a minimum, the training as required by the following sections of these procedures.

A written copy of operating and rescue procedures as required by these procedures shall be at the work site for the duration of the job. The confined space entry permit must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of items listed below. This permit shall be kept at the job site for the duration of the job. If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, a new confined space entry permit must be completed.

(b) Control of atmospheric and engulfment hazards.

(i) Surveillance. The surrounding area shall be surveyed to avoid hazards such as drifting vapors from tanks, piping or sewers.

(ii) Testing. The confined space atmosphere shall be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor shall be used. Testing shall be performed by the SUPERVISOR who has successfully completed the gas detector training for the monitor he/she will use.

The minimum parameters to be monitored are oxygen deficiency, LFL and hydrogen sulfide concentration. A written record of the preentry test results shall be made and kept at the work site for the duration of the job. Affected employees shall be able to review the testing results. The most hazardous conditions shall govern when work is being performed in two adjoining, connected spaces.

(iii) Space ventilation. Mechanical ventilation systems, where applicable, shall be set at one hundred percent outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

(c) Entry procedures. The following procedure shall be observed under any of the following conditions:

(i) Testing demonstrates the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels;

(ii) The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop;

(iii) It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or

(iv) An emergency exists and it is not feasible to wait for preentry procedures to take effect.

(d) All personnel must be trained. A self-contained breathing apparatus shall be worn by any person entering the space. At least one worker shall stand by the outside of the space ready to give assistance in case of emergency. The standby worker shall have a self-contained breathing apparatus available for immediate use. There shall be at least one additional worker within sight or call of the standby worker. Continuous powered communications shall be maintained between the worker within the confined space and standby personnel.

(e) If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately.

Exception:

If the worker is disabled due to falling or impact, he/she shall not be removed from the confined space unless there is immediate danger to his/her life. Local fire department rescue personnel shall be notified immediately. The standby worker may only enter the confined space in case of an emergency (wearing the self-contained breathing apparatus) and only after being relieved by another worker. Safety belt or harness with attached lifeline shall be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker shall attempt to remove a disabled worker via his/her lifeline before entering the space.

(f) When practical, these spaces shall be entered through side openings - those within three and one-half feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt shall be of the harness type that suspends a person upright and a hoisting device or similar apparatus shall be available for lifting workers out of the space.

(g) In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued.

(h) When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment shall be Class 1, Division 1 rated per National Electrical Code and no ignition sources shall be introduced into the area.

(i) Continuous gas monitoring shall be performed during all confined space operations. If alarm conditions change adversely, entry personnel shall exit the confined space and a new confined space permit issued.

(j) Rescue. Call the fire department services for rescue. Where immediate hazards to injured personnel are present, workers at the site shall implement emergency procedures to fit the situation.

Example 2. Workplace. Meat and poultry rendering plants.

Cookers and dryers are either batch or continuous in their operation. Multiple batch cookers are operated in parallel. When one unit of a multiple set is shut down for repairs, means are available to isolate that unit from the others which remain in operation.

Cookers and dryers are horizontal, cylindrical vessels equipped with a center, rotating shaft and agitator paddles or discs. If the inner shell is jacketed, it is usually heated with steam at pressures up to 150 psig (1034.25 kPa). The rotating shaft assembly of the continuous cooker or dryer is also steam heated.

(1) Potential hazards. The recognized hazards associated with cookers and dryers are the risk that employees could be:

- (a) Struck or caught by rotating agitator;
- (b) Engulfed in raw material or hot, recycled fat;
- (c) Burned by steam from leaks into the cooker/dryer steam jacket or the condenser duct system if steam valves are not properly closed and locked out;
- (d) Burned by contact with hot metal surfaces, such as the agitator shaft assembly, or inner shell of the cooker/dryer;
- (e) Heat stress caused by warm atmosphere inside cooker/dryer;
- (f) Slipping and falling on grease in the cooker/dryer;
- (g) Electrically shocked by faulty equipment taken into the cooker/dryer;
- (h) Burned or overcome by fire or products of combustion; or
- (i) Overcome by fumes generated by welding or cutting done on grease covered surfaces.

(2) Permits. The supervisor in this case is always present at the cooker/dryer or other permit entry confined space when entry is made. The supervisor must follow the preentry isolation procedures described in the entry permit in preparing for entry, and ensure that the protective clothing, ventilating equipment and any other equipment required by the permit are at the entry site.

(3) Control of hazards. Mechanical. Lock out main power switch to agitator motor at main power panel. Affix tag to the lock to inform others that a permit entry confined space entry is in progress.

(4) Engulfment. Close all valves in the raw material blow line. Secure each valve in its closed position using chain and lock. Attach a tag to the valve and chain warning that a permit entry confined space entry is in progress. The same procedure shall be used for securing the fat recycle valve.

(5) Burns and heat stress. Close steam supply valves to jacket and secure with chains and tags. Insert solid blank at flange in cooker vent line to condenser manifold duct system. Vent cooker/dryer by opening access door at discharge end and top center door to allow natural ventilation throughout the entry. If faster cooling is needed, use a portable ventilation fan to increase ventilation. Cooling water may be circulated through the jacket to reduce both outer and inner surface temperatures of cooker/dryers faster. Check air and inner surface temperatures in cooker/dryer to assure they are within acceptable limits before entering, or use proper protective clothing.

(6) Fire and fume hazards. Careful site preparation, such as cleaning the area within four inches (10.16 cm) of all welding or torch cutting operations, and proper ventilation are the preferred controls. All welding and cutting operations shall be done in accordance with the requirements of chapter 296-24 WAC, Part I, Welding, cutting, and brazing. Proper ventilation may be achieved by local exhaust ventilation, or the

use of portable ventilation fans, or a combination of the two practices.

(7) Electrical shock. Electrical equipment used in cooker/dryers shall be in serviceable condition.

(8) Slips and falls. Remove residual grease before entering cooker/dryer.

(9) Attendant. The supervisor shall be the attendant for employees entering cooker/dryers.

(10) Permit. The permit shall specify how isolation shall be done and any other preparations needed before making entry. This is especially important in parallel arrangements of cooker/dryers so that the entire operation need not be shut down to allow safe entry into one unit.

(11) Rescue. When necessary, the attendant shall call the employer's trained rescue team or the local fire services as previously arranged.

Example 3. Workplace. Workplaces where tank cars, trucks, and trailers, dry-bulk tanks and trailers, railroad tank cars, and similar portable tanks are fabricated or serviced.

(1) During fabrication. These tanks and dry-bulk carriers are entered repeatedly throughout the fabrication process. These products are not configured identically, but the manufacturing processes by which they are made are very similar.

(a) Sources of hazards. In addition to the mechanical hazards arising from the risks that an entrant would be injured due to contact with components of the tank or the tools being used, there is also the risk that a worker could be injured by breathing fumes from welding materials or mists or vapors from materials used to coat the tank interior. In addition, many of these vapors and mists are flammable, so the failure to properly ventilate a tank could lead to a fire or explosion.

(b) Control of hazards.

(i) Welding. Local exhaust ventilation shall be used to remove welding fumes once the tank or carrier is completed to the point that workers may enter and exit only through a manhole. (Follow the requirements of chapter 296-24 WAC, Part I, Welding, cutting and brazing, at all times.) Welding gas tanks may never be brought into a tank or carrier that is a permit entry confined space.

(ii) Application of interior coatings/linings. Atmospheric hazards shall be controlled by forced air ventilation sufficient to keep the atmospheric concentration of flammable materials below ten percent of the lower flammable limit (LFL) (or lower explosive limit (LEL), whichever term is used locally). The appropriate respirators are provided and shall be used in addition to providing forced ventilation if the forced ventilation does not maintain acceptable respiratory conditions.

(c) Permits. Because of the repetitive nature of the entries in these operations, an "area entry permit" will be issued for a one-month period to cover those production areas where tanks are fabricated to the point that entry and exit are made using manholes.

(d) Authorization. Only the area supervisor may authorize an employee to enter a tank within the permit area. The area supervisor must determine that conditions in the tank trailer, dry-bulk trailer or truck, etc., meet permit requirements before authorizing entry.

(e) Attendant. The area supervisor shall designate an employee to maintain communication by employer specified means with employees working in tanks to ensure their

safety. The attendant may not enter any permit entry confined space to rescue an entrant or for any other reason, unless authorized by the rescue procedure and, and even then, only after calling the rescue team and being relieved by an attendant by another worker.

(f) Communications and observation. Communications between attendant and entrant(s) shall be maintained throughout entry. Methods of communication that may be specified by the permit include voice, voice-powered radio, tapping or rapping codes on tank walls, signaling tugs on a rope, and the attendant's observation that work activities such as chipping, grinding, welding, spraying, etc., which require deliberate operator control continue normally. These activities often generate so much noise that the necessary hearing protection makes communication by voice difficult.

(g) Rescue procedures. Acceptable rescue procedures include entry by a team of employee-rescuers, use of public emergency services, and procedures for breaching the tank. The area permit specifies which procedures are available, but the area supervisor makes the final decision based on circumstances. (Certain injuries may make it necessary to breach the tank to remove a person rather than risk additional injury by removal through an existing manhole. However, the supervisor must ensure that no breaching procedure used for rescue would violate terms of the entry permit. For instance, if the tank must be breached by cutting with a torch, the tank surfaces to be cut must be free of volatile or combustible coatings within four inches (10.16 cm) of the cutting line and the atmosphere within the tank must be below the LFL.)

(h) Retrieval line and harnesses. The retrieval lines and harnesses generally required under this standard are usually impractical for use in tanks because the internal configuration of the tanks and their interior baffles and other structures would prevent rescuers from hauling out injured entrants. However, unless the rescue procedure calls for breaching the tank for rescue, the rescue team shall be trained in the use of retrieval lines and harnesses for removing injured employees through manholes.

(2) Repair or service of "used" tanks and bulk trailers.

(a) Sources of hazards. In addition to facing the potential hazards encountered in fabrication or manufacturing, tanks or trailers which have been in service may contain residues of dangerous materials, whether left over from the transportation of hazardous cargoes or generated by chemical or bacterial action on residues of nonhazardous cargoes.

(b) Control of atmospheric hazards. A "used" tank shall be brought into areas where tank entry is authorized only after the tank has been emptied, cleansed (without employee entry) of any residues, and purged of any potential atmospheric hazards.

(c) Welding. In addition to tank cleaning for control of atmospheric hazards, coating and surface materials shall be removed four inches (10.16 cm) or more from any surface area where welding or other torch work will be done and care taken that the atmosphere within the tank remains well below the LFL. (Follow the requirements of chapter 296-24 WAC, Part I, Welding, cutting and brazing, at all times.)

(d) Permits. An entry permit valid for up to one year shall be issued prior to authorization of entry into used tank trailers, dry-bulk trailers or trucks. In addition to the preentry

cleaning requirement, this permit shall require the employee safeguards specified for new tank fabrication or construction permit areas.

(e) Authorization. Only the area supervisor may authorize an employee to enter a tank trailer, dry-bulk trailer or truck within the permit area. The area supervisor must determine that the entry permit requirements have been met before authorizing entry.

[Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14525, filed 1/18/95, effective 3/1/95; 91-24-017 (Order 91-07), § 296-62-14525, filed 11/22/91, effective 12/24/91. Statutory Authority: RCW 49.17.040 and 49.17.050. 82-03-023 (Order 82-1), § 296-62-14525, filed 1/15/82; Order 73-3, § 296-62-14525, filed 5/7/73.]

WAC 296-62-14527, Appendix D, Sample A
Confined Space Entry Permit

Date & Time Issued: _____
Job site/Space I.D.: _____
Equipment to be worked on: _____

Date & Time Expires: _____
Job Supervisor: _____
Work to be performed: _____

Stand-by personnel _____

- 1. Atmospheric Checks: Time _____
Oxygen _____ %
Explosive _____ % L.F.L.
Toxic _____ PPM
- 2. Tester's signature _____
- 3. Source isolation (No Entry): N/A YES NO
Pumps or lines blinded, () () ()
disconnected, or blocked () () ()
- 4. Ventilation Modification: N/A YES NO
Mechanical () () ()
Natural Ventilation only () () ()
- 5. Atmospheric check after isolation and Ventilation:
Oxygen _____ % > 19.5%
Explosive _____ % L.F.L. < 10 %
Toxic _____ PPM < 10 PPM H₂S
Time _____
Testers signature _____
- 6. Communication procedures: _____

- 7. Rescue procedures: _____

- 8. Entry, standby, and back up persons: Yes No
Successfully completed required training? () ()
Is it current? () ()
- 9. Equipment: N/A Yes No
Direct reading gas monitor - tested () () ()
Safety harnesses and lifelines for entry and standby persons () () ()
Hoisting equipment () () ()
Powered communications () () ()
SCBA's for entry and standby persons () () ()
Protective Clothing () () ()
All electric equipment listed Class I, Division I, Group D and Non-sparking tools () () ()
- 10. Periodic atmospheric tests:
Oxygen _____ % Time _____ Oxygen _____ % Time _____
Oxygen _____ % Time _____ Oxygen _____ % Time _____
Explosive _____ % Time _____ Explosive _____ % Time _____
Explosive _____ % Time _____ Explosive _____ % Time _____
Toxic _____ % Time _____ Toxic _____ % Time _____
Toxic _____ % Time _____ Toxic _____ % Time _____

We have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "No" column. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) _____
Approved By: (Unit Supervisor) _____
Reviewed By: (Cs Operations Personnel) _____
(printed name) (signature)

This permit to be kept at job site. Return job site copy to Safety Office following job completion.

WAC 296-62-14527, Appendix D, Sample B ENTRY PERMIT
PERMIT VALID FOR 8 HOURS ONLY. ALL PERMIT COPIES REMAIN AT SITE UNTIL JOB COMPLETED.

DATE: - - SITE LOCATION/DESCRIPTION _____
PURPOSE OF ENTRY _____
SUPERVISOR(S) in charge of crews. Type of Crew Phone # _____

COMMUNICATION PROCEDURES _____
RESCUE PROCEDURES (PHONE NUMBERS AT BOTTOM) _____

BOLD DENOTES MINIMUM REQUIREMENTS TO BE COMPLETED AND REVIEWED PRIOR TO ENTRY

REQUIREMENTS COMPLETED	DATE	TIME	REQUIREMENTS COMPLETED	DATE	TIME
LockOut/De-energize/Try-out	_____	_____	Full Body Harness w/"D" ring	_____	_____
Line(s) Broken-Capped-Blank	_____	_____	Emergency Escape Retrieval Eq	_____	_____
Purge-Flush and Vent	_____	_____	Lifelines	_____	_____
Ventilation	_____	_____	Fire Extinguishers	_____	_____
Secure Area (Post and Flag)	_____	_____	Lighting (Explosive Proof)	_____	_____
Breathing Apparatus	_____	_____	Protective Clothing	_____	_____
Resuscitator - Inhalator	_____	_____	Respirator(s) (Air Purifying)	_____	_____
Standby Safety Personnel	_____	_____	Burning and Welding Permit	_____	_____

Note: Items that do not apply enter N/A in the blank.

** RECORD CONTINUOUS MONITORING RESULTS EVERY 2 HOURS **

CONTINUOUS MONITORING**

TEST(S) TO BE TAKEN	Permissible	Entry Level	_____	_____	_____	_____	_____	_____
PERCENT OF OXYGEN	19.5% to 23.5%	_____	_____	_____	_____	_____	_____	_____
LOWER FLAMMABLE LIMIT	Under 10%	_____	_____	_____	_____	_____	_____	_____
CARBON MONOXIDE	+35 PPM	_____	_____	_____	_____	_____	_____	_____
Aromatic Hydrocarbon	+ 1 PPM * 5 PPM	_____	_____	_____	_____	_____	_____	_____
Hydrogen Cyanide	(Skin) * 4 PPM	_____	_____	_____	_____	_____	_____	_____
Hydrogen Sulfide	+10 PPM * 15 PPM	_____	_____	_____	_____	_____	_____	_____
Sulfur Dioxide	+ 2 PPM * 5 PPM	_____	_____	_____	_____	_____	_____	_____
Ammonia	* 35 PPM	_____	_____	_____	_____	_____	_____	_____

* Short-term exposure limit: Employee can work in the area up to 15 minutes.
+ 8 hr. Time Weighted Avg.: Employee can work in area 8 hrs (longer with appropriate respiratory protection).

REMARKS:

GAS TESTER NAME & CHECK #	INSTRUMENT(S) USED	MODEL &/OR TYPE	SERIAL &/OR UNIT #
_____	_____	_____	_____

SAFETY STANDBY PERSON IS REQUIRED FOR ALL CONFINED SPACE WORK

SAFETY STANDBY PERSON(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #	CONFINED SPACE ENTRANT(S)	CHECK #
_____	_____	_____	_____	_____	_____

SUPERVISOR AUTHORIZATION - ALL CONDITIONS SATISFIED _____ DEPARTMENT/PHONE # _____
ABULANCE # _____ FIRE # _____ Safety # _____ Gas Coordinator # _____

WAC 296-62-14529 Appendix E—Sewer system entry. Sewer entry differs in three vital respects from other permit entries:

- There rarely exists any way to completely isolate the space (a section of a continuous system) to be entered;
- Because isolation is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer; and
- Experienced sewer workers are especially knowledgeable in entry and work in their permit spaces because of their frequent entries. Unlike other employments where permit space entry is a rare and exceptional event, sewer workers' usual work environment is a permit space.

(1) Adherence to procedure. The employer should designate as entrants only employees who are thoroughly trained in the employer's sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

(2) Atmospheric monitoring. Entrants should be trained in the use of, and be equipped with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout, whenever one of the following conditions is encountered: Oxygen concentration less than 19.5 percent; flammable gas or vapor at ten percent or more of the lower flammable limit (LFL); or hydrogen sulfide or carbon monoxide at or above 10 ppm or 35 ppm, respectively, measured as an eight-hour time-weighted average.

Atmospheric monitoring equipment needs to be calibrated according to the manufacturer's instructions. The oxygen sensor/broad range sensor is best suited for initial use in situations where the actual or potential contaminants have not been identified, because broad range sensors, unlike substance-specific sensors, enable employers to obtain an overall reading of the hydrocarbons (flammables) present in the space.

However, such sensors only indicate that a hazardous threshold of a class of chemicals has been exceeded. They do not measure the levels of contamination of specific substances. Therefore, substance-specific devices, which measure the actual levels of specific substances, are best suited for use where actual and potential contaminants have been identified.

The measurements obtained with substance-specific devices are of vital importance to the employer when decisions are made concerning the measures necessary to protect entrants (such as ventilation or personal protective equipment) and the setting and attainment of appropriate entry conditions. However, the sewer environment may suddenly and unpredictably change, and the substance-specific devices may not detect the potentially lethal atmospheric hazards which may enter the sewer environment.

(a) Although WISHA considers the information and guidance provided above to be appropriate and useful in most sewer entry situations, the department emphasizes that each employer must consider the unique circumstances, including the predictability of the atmosphere, of the sewer permit spaces in the employer's workplace in preparing for entry. Only the employer can decide, based upon his or her knowledge of, and experience with permit spaces in sewer systems,

what the best type of testing instrument may be for any specific entry operation.

(b) The selected testing instrument should be carried and used by the entrant in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrant's direction of movement, to warn the entrant of any deterioration in atmospheric condition. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

(3) Surge flow and flooding. Sewer crews should develop and maintain liaison, to the extent possible, with the local weather bureau and fire and emergency services in their area so that sewer work may be delayed or interrupted and entrants withdrawn whenever sewer lines might be suddenly flooded by rain or fire suppression activities, or whenever flammable or other hazardous materials are released into sewers during emergencies by industrial or transportation accidents.

(4) Special equipment. Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as atmosphere monitoring devices with automatic audible alarms, escape self-contained breathing apparatus (ESCBAs) with at least ten minute air supply (or other NIOSH approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

[Statutory Authority: RCW 49.17.040, [49.17].050 and [49.17].060. 95-17-036, § 296-62-14529, filed 8/9/95, effective 9/25/95. Statutory Authority: Chapter 49.17 RCW. 95-04-007, § 296-62-14529, filed 1/18/95, effective 3/1/95; Order 73-3, § 296-62-14529, filed 5/7/73.]

PART N—COTTON DUST

WAC 296-62-14533 Cotton dust. (1) Scope and application.

(a) This section, in its entirety, applies to the control of employee exposure to cotton dust in all workplaces where employees engage in yarn manufacturing, engage in slashing and weaving operations, or work in waste houses for textile operations.

(b) This section does not apply to the handling or processing of woven or knitted materials; to maritime operations covered by chapters 296-56 and 296-304 WAC; to harvesting or ginning of cotton; or to the construction industry.

(c) Only subsection (8) Medical surveillance, subsection (11) (b) Medical surveillance, subsection (11)(c) Availability, subsection (11)(d) Transfer of records, and Appendices B, C, and D of this section apply in all work places where employees exposed to cotton dust engage in cottonseed processing or waste processing operations.

(d) This section applies to yarn manufacturing and slashing and weaving operations exclusively using washed cotton (as defined by subsection (14) of this section) only to the extent specified by subsection (14) of this section.

(e) This section, in its entirety, applies to the control of all employees exposure to the cotton dust generated in the preparation of washed cotton from opening until the cotton is thoroughly wetted.

(f) This section does not apply to knitting, classing or warehousing operations except that employers with these operations, if requested by WISHA, shall grant WISHA

access to their employees and workplaces for exposure monitoring and medical examinations for purposes of a health study to be performed by WISHA on a sampling basis.

(2) Definitions applicable to this section:

(a) "Blow down" - the cleaning of equipment and surfaces with compressed air.

(b) "Blow off" - the use of compressed air for cleaning of short duration and usually for a specific machine or any portion of a machine.

(c) "Cotton dust" - dust present in the air during the handling or processing of cotton, which may contain a mixture of many substances including ground-up plant matter, fiber, bacteria, fungi, soil, pesticides, noncotton plant matter and other contaminants which may have accumulated with the cotton during the growing, harvesting and subsequent processing or storage periods. Any dust present during the handling and processing of cotton through the weaving or knitting of fabrics, and dust present in other operations or manufacturing processes using raw or waste cotton fibers or cotton fiber byproducts from textile mills are considered cotton dust within this definition. Lubricating oil mist associated with weaving operations is not considered cotton dust.

(d) "Director" - the director of labor and industries or his authorized representative.

(e) "Equivalent instrument" - a cotton dust sampling device that meets the vertical elutriator equivalency requirements as described in subsection (4)(a)(iii) of this section.

(f) "Lint-free respirable cotton dust" - particles of cotton dust of approximately 15 microns or less aerodynamic equivalent diameter.

(g) "Vertical elutriator cotton dust sampler" or "vertical elutriator" - a dust sampler which has a particle size cut-off at approximately 15 microns aerodynamic equivalent diameter when operating at the flow rate of 7.4 ± 0.2 liters per minute.

(h) "Waste processing" - waste recycling (sorting, blending, cleaning and willowing) and garnetting.

(i) "Yarn manufacturing" - all textile mill operations from opening to, but not including, slashing and weaving.

(3) Permissible exposure limits and action levels.

(a) Permissible exposure limits (PEL).

(i) The employer shall assure that no employee who is exposed to cotton dust in yarn manufacturing and cotton washing operations is exposed to airborne concentrations of lint-free respirable cotton dust greater than $200 \mu\text{g}/\text{m}^3$ mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(ii) The employer shall assure that no employee who is exposed to cotton dust in textile mill waste house operations or is exposed in yarn manufacturing to dust from "lower grade washed cotton" as defined in subsection (14)(e) of this section is exposed to airborne concentrations of lint-free respirable cotton dust greater than $500 \mu\text{g}/\text{m}^3$ mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(iii) The employer shall assure that no employee who is exposed to cotton dust in the textile processes known as slashing and weaving is exposed to airborne concentrations of lint-free respirable cotton dust greater than $750 \mu\text{g}/\text{m}^3$

mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(b) Action levels.

(i) The action level for yarn manufacturing and cotton washing operations is an airborne concentration of lint-free respirable cotton dust of $100 \mu\text{g}/\text{m}^3$ mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(ii) The action level for waste houses for textile operations is an airborne concentration of lint-free respirable cotton dust of $250 \mu\text{g}/\text{m}^3$ mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(iii) The action level for the textile processes known as slashing and weaving is an airborne concentration of lint-free respirable cotton dust of $375 \mu\text{g}/\text{m}^3$ mean concentration, averaged over an eight-hour period, as measured by a vertical elutriator or an equivalent instrument.

(4) Exposure monitoring and measurement.

(a) General.

(i) For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.

(ii) The sampling device to be used shall be either the vertical elutriator cotton dust sampler or an equivalent instrument.

(iii) If an alternative to the vertical elutriator cotton dust sampler is used, the employer shall establish equivalency by demonstrating that the alternative sampling devices:

(A) It collects respirable particulates in the same range as the vertical elutriator (approximately 15 microns);

(B) Replicate exposure data used to establish equivalency are collected in side-by-side field and laboratory comparisons; and

(C) A minimum of 100 samples over the range of 0.5 to 2 times the permissible exposure limit are collected, and ninety percent of these samples have an accuracy range of plus or minus twenty-five percent of the vertical elutriator reading with a ninety-five percent confidence level as demonstrated by a statistically valid protocol. (An acceptable protocol for demonstrating equivalency is described in Appendix E of this section.)

(iv) WISHA will issue a written opinion stating that an instrument is equivalent to a vertical elutriator cotton dust sampler if:

(A) A manufacturer or employer requests an opinion in writing and supplies the following information:

(I) Sufficient test data to demonstrate that the instrument meets the requirements specified in this paragraph and the protocol specified in Appendix E of this section;

(II) Any other relevant information about the instrument and its testing requested by WISHA; and

(III) A certification by the manufacturer or employer that the information supplied is accurate, and

(B) If WISHA finds, based on information submitted about the instrument, that the instrument meets the requirements for equivalency specified by this subsection.

(b) Initial monitoring. Each employer who has a place of employment within the scope of subsections (1)(a), (d) or (e) of this section shall conduct monitoring by obtaining mea-

surements which are representative of the exposure of all employees to airborne concentrations of lint-free respirable cotton dust over an eight-hour period. The sampling program shall include at least one determination during each shift for each work area.

(c) Periodic monitoring.

(i) If the initial monitoring required by (4)(b) of this section or any subsequent monitoring reveals employee exposure to be at or below the permissible exposure limit, the employer shall repeat the monitoring for those employees at least annually.

(ii) If the initial monitoring required by (4)(b) of this section or any subsequent monitoring reveals employee exposure to be above the PEL, the employer shall repeat the monitoring for those employees at least every six months.

(iii) Whenever there has been a production, process, or control change which may result in new or additional exposure to cotton dust, or whenever the employer has any other reason to suspect an increase in employee exposure, the employer shall repeat the monitoring and measurements for those employees affected by the change or increase.

(d) Employee notification.

(i) Within twenty working days after the receipt of monitoring results, the employer shall notify each employee in writing of the exposure measurements which represent that employee's exposure.

(ii) Whenever the results indicate that the employee's exposure exceeds the applicable permissible exposure limit specified in subsection (3) of this section, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action taken to reduce exposure below the permissible exposure limit.

(5) Methods of compliance.

(a) Engineering and work practice controls. The employer shall institute engineering and work practice controls to reduce and maintain employee exposure to cotton dust at or below the permissible exposure limit specified in subsection (3) of this section, except to the extent that the employer can establish that such controls are not feasible.

(b) Whenever feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the permissible exposure limit, the employer shall nonetheless institute these controls to immediately reduce exposure to the lowest feasible level, and shall supplement these controls with the use of respirators which shall comply with the provisions of subsection (6) of this section.

(c) Compliance program.

(i) Where the most recent exposure monitoring data indicates that any employee is exposed to cotton dust levels greater than the permissible exposure limit, the employer shall establish and implement a written program sufficient to reduce exposures to or below the permissible exposure limit solely by means of engineering controls and work practices as required by (a) of this subsection.

(ii) The written program shall include at least the following:

(A) A description of each operation or process resulting in employee exposure to cotton dust;

(B) Engineering plans and other studies used to determine the controls for each process;

(C) A report of the technology considered in meeting the permissible exposure limit;

(D) Monitoring data obtained in accordance with subsection (4) of this section;

(E) A detailed schedule for development and implementation of engineering and work practice controls, including exposure levels projected to be achieved by such controls;

(F) Work practice program; and

(G) Other relevant information.

(iii) The employer's schedule as set forth in the compliance program, shall project completion of the implementation of the compliance program no later than March 27, 1984 or as soon as possible if monitoring after March 27, 1984 reveals exposures over the PEL, except as provided in (13)(b)(ii)(B) of this section.

(iv) The employer shall complete the steps set forth in his program by the dates in the schedule.

(v) Written programs shall be submitted, upon request, to the director, and shall be available at the worksite for examination and copying by the director, and any affected employee or their designated representatives.

(vi) The written programs required under subsection (5)(c) of this section shall be revised and updated at least every six months to reflect the current status of the program and current exposure levels.

(d) Mechanical ventilation. When mechanical ventilation is used to control exposure, measurements which demonstrate the effectiveness of the system to control exposure, such as capture velocity, duct velocity, or static pressure shall be made at reasonable intervals.

(6) Use of respirators.

(a) General. Where the use of respirators is required under this section, the employer shall provide, at no cost to the employee, and assure the use of respirators which comply with the requirements of this subsection (6). Respirators shall be used in the following circumstances:

(i) During the time periods necessary to install or implement feasible engineering controls and work practice controls;

(ii) During maintenance and repair activities in which engineering and work practice controls are not feasible;

(iii) In work situations where feasible engineering and work practice controls are not yet sufficient to reduce exposure to or below the permissible exposure limits;

(iv) In operations specified under subsection (7)(a) of this section; and

(v) Whenever an employee requests a respirator.

(b) Respirator selection.

(i) Where respirators are required under this section, the employer shall select the appropriate respirator from Table I and shall assure that the employee uses the respirator provided.

TABLE - I

Cotton dust concentration	Required respirator
Not greater than—	
(a) 5 x the applicable permissible exposure limit (PEL).	A disposable respirator with a particulate filter.
(b) 10 x the applicable PEL.	A quarter or half-mask respirator, other than a disposable respirator, equipped with particulate filters.
(c) 100 x the applicable PEL.	A full facepiece respirator equipped with high-efficiency particulate filters.
(d) Greater than 100 x the applicable PEL.	A powered air-purifying respirator equipped with high-efficiency particulate filters.

- Notes
1. A disposable respirator means the filter element is an inseparable part of the respirator.
 2. Any respirators permitted at higher environmental concentrations can be used at lower concentrations.
 3. Self-contained breathing apparatus are not required respirators but are permitted respirators.
 4. Supplied air respirators are not required but are permitted under the following conditions: Cotton dust concentration not greater than 10X the PEL—Any supplied air respirator; not greater than 100X the PEL—Any supplied air respirator with full facepiece, helmet or hood; greater than 100X the PEL—A supplied air respirator operated in positive pressure mode.

(ii) The employer shall select respirators from those tested and approved for protection against dust by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 30 CFR Part 11.

(iii) Whenever respirators are required by this section for concentrations not greater than 100 x the applicable permissible exposure limit, the employer shall, upon the request of the employee, provide a powered air purifying respirator with a high efficiency particulate filter in lieu of the respirator specified in paragraphs (a), (b), or (c) of Table I.

(iv) Whenever a physician determines that an employee who works in an area in which the dust level exceeds the PEL is unable to wear any form of respirator, including a powered air purifying respirator, the employee shall be given the opportunity to transfer to another position which is available or which later becomes available having a dust level at or below the PEL. The employer shall assure that an employee who is transferred from an area in which the dust level exceeds the PEL due to an inability to wear a respirator suffers no reduction in current wage rate or other benefits as a result of the transfer.

(c) Respirator program. The employer shall institute a respirator program in accordance with WAC 296-62-071.

(d) Respirator usage.

(i) The employer shall assure that the respirator used by each employee exhibits minimum face piece leakage and that the respirator is fitted properly.

(ii) The employer shall allow each employee who uses a filter respirator, to change the filter elements whenever an increase in breathing resistance is detected by the employee. The employer shall maintain an adequate supply of filter elements for this purpose.

(iii) The employer shall allow employees who wear respirators to wash their faces and respirator face pieces to prevent skin irritation associated with respirator use.

(7) Work practices. Each employer shall, regardless of the level of employee exposure, immediately establish and implement a written program of work practices which shall minimize cotton dust exposure. The following shall be included where applicable:

(a) Compressed air "blow down" cleaning shall be prohibited, where alternative means are feasible. Where compressed air is used for cleaning, the employees performing the "blow down" or "blow off" shall wear suitable respirators. Employees whose presence is not required to perform "blow down" or "blow off" shall be required to leave the area affected by the "blow down" or "blow off" during this cleaning operation.

(b) Cleaning of clothing or floors with compressed air shall be prohibited.

(c) Floor sweeping shall be performed with a vacuum or with methods designed to minimize dispersal of dust.

(d) In areas where employees are exposed to concentrations of cotton dust greater than the permissible exposure limit, cotton and cotton waste shall be stacked, sorted, baled, dumped, removed or otherwise handled by mechanical means, except where the employer can show that it is infeasible to do so. Where infeasible, the method used for handling cotton and cotton waste shall be the method which reduces exposure to the lowest level feasible.

(8) Medical surveillance.

(a) General.

(i) Each employer covered by the standard shall institute a program of medical surveillance for all employees exposed to cotton dust.

(ii) The employer shall assure that all medical examinations and procedures are performed by or under the supervision of a licensed physician and are provided without cost to the employee.

(iii) Persons other than licensed physicians, who administer the pulmonary function testing required by this section shall have completed a NIOSH approved training course in spirometry.

(b) Initial examinations. The employer shall provide medical surveillance to each employee who is or may be exposed to cotton dust. For new employees' this examination shall be provided prior to initial assignment. The medical surveillance shall include at least the following:

(i) A medical history;

(ii) The standardized questionnaire contained in WAC 296-62-14537; and

(iii) A pulmonary function measurement, including a determination of forced vital capacity (FVC) and forced expiratory volume in one second (FEV₁), the FEV₁/FVC ratio, and the percentage that the measured values of FEV₁ and FVC differ from the predicted values, using the standard tables in WAC 296-62-14539. These determinations shall be made for each employee before the employee enters the workplace on the first day of the work week, preceded by at least thirty-five hours of no exposure to cotton dust. The tests shall be repeated during the shift, no less than four hours and no more than ten hours after the beginning of the work shift; and, in any event, no more than one hour after cessation of exposure. Such exposure shall be typical of the employee's usual workplace exposure. The predicted FEV₁ and FVC for

blacks shall be multiplied by 0.85 to adjust for ethnic differences.

(iv) Based upon the questionnaire results, each employee shall be graded according to Schilling's byssinosis classification system.

(c) Periodic examinations.

(i) The employer shall provide at least annual medical surveillance for all employees exposed to cotton dust above the action level in yarn manufacturing, slashing and weaving, cotton washing and waste house operations. The employer shall provide medical surveillance at least every two years for all employees exposed to cotton dust at or below the action level, for all employees exposed to cotton dust from washed cotton (except from washed cotton defined in subsection (9)(c) of this section), and for all employees exposed to cotton dust in cottonseed processing and waste processing operations. Periodic medical surveillance shall include at least an update of the medical history, standardized questionnaire (Appendix B-111), Schilling byssinosis grade, and the pulmonary function measurements in (b)(iii) of this subsection.

(ii) Medical surveillance as required in (c)(i) of this subsection shall be provided every six months for all employees in the following categories:

(A) An FEV₁ of greater than eighty percent of the predicted value, but with an FEV₁ decrement of five percent or 200 ml. on a first working day;

(B) An FEV₁ of less than eighty percent of the predicted value; or

(C) Where, in the opinion of the physician, any significant change in questionnaire findings, pulmonary function results, or other diagnostic tests have occurred.

(iii) An employee whose FEV₁ is less than sixty percent of the predicted value shall be referred to a physician for a detailed pulmonary examination.

(iv) A comparison shall be made between the current examination results and those of previous examinations and a determination made by the physician as to whether there has been a significant change.

(d) Information provided to the physician. The employer shall provide the following information to the examining physician:

(i) A copy of this regulation and its appendices;

(ii) A description of the affected employee's duties as they relate to the employee's exposure;

(iii) The employee's exposure level or anticipated exposure level;

(iv) A description of any personal protective equipment used or to be used; and

(v) Information from previous medical examinations of the affected employee which is not readily available to the examining physician.

(e) Physician's written opinion.

(i) The employer shall obtain and furnish the employee with a copy of a written opinion from the examining physician containing the following:

(A) The results of the medical examination and tests including the FEV₁, FVC, and FEV₁/FVC ratio;

(B) The physician's opinion as to whether the employee has any detected medical conditions which would place the

employee at increased risk of material impairment of the employee's health from exposure to cotton dust;

(C) The physician's recommended limitations upon the employee's exposure to cotton dust or upon the employee's use of respirators including a determination of whether an employee can wear a negative pressure respirator, and where the employee cannot, a determination of the employee's ability to wear a powered air purifying respirator; and

(D) A statement that the employee has been informed by the physician of the results of the medical examination and any medical conditions which require further examination or treatment.

(ii) The written opinion obtained by the employer shall not reveal specific findings or diagnoses unrelated to occupational exposure.

(9) Employee education and training.

(a) Training program.

(i) The employer shall provide a training program for all employees exposed to cotton dust and shall assure that each employee is informed of the following:

(A) The acute and long term health hazards associated with exposure to cotton dust;

(B) The names and descriptions of jobs and processes which could result in exposure to cotton dust at or above the PEL.

(C) The measures, including work practices required by subsection (7) of this section, necessary to protect the employee from exposures in excess of the permissible exposure limit;

(D) The purpose, proper use and limitations of respirators required by subsection (6) of this section;

(E) The purpose for and a description of the medical surveillance program required by subsection (8) of this section and other information which will aid exposed employees in understanding the hazards of cotton dust exposure; and

(F) The contents of this standard and its appendices.

(ii) The training program shall be provided prior to initial assignment and shall be repeated annually for each employee exposed to cotton dust, when job assignments or work processes change and when employee performance indicates a need for retraining.

(b) Access to training materials.

(i) Each employer shall post a copy of this section with its appendices in a public location at the workplace, and shall, upon request, make copies available to employees.

(ii) The employer shall provide all materials relating to the employee training and information program to the director upon request.

(10) Signs. The employer shall post the following warning sign in each work area where the permissible exposure limit for cotton dust is exceeded:

WARNING
COTTON DUST WORK AREA
MAY CAUSE ACUTE OR DELAYED LUNG INJURY
(BYSSINOSIS)
RESPIRATORS REQUIRED IN THIS AREA

(11) Recordkeeping.

(a) Exposure measurements.

(i) The employer shall establish and maintain an accurate record of all measurements required by subsection (4) of this section.

(ii) The record shall include:

(A) A log containing the items listed in WAC 296-62-14535 (4)(a), and the dates, number, duration, and results of each of the samples taken, including a description of the procedure used to determine representative employee exposures;

(B) The type of protective devices worn, if any, and length of time worn; and

(C) The names, social security number, job classifications, and exposure levels of employees whose exposure the measurement is intended to represent.

(iii) The employer shall maintain this record for at least twenty years.

(b) Medical surveillance.

(i) The employer shall establish and maintain an accurate medical record for each employee subject to medical surveillance required by subsection (8) of this section.

(ii) The record shall include:

(A) The name and social security number and description of the duties of the employee;

(B) A copy of the medical examination results including the medical history, questionnaire response, results of all tests, and the physician's recommendation;

(C) A copy of the physician's written opinion;

(D) Any employee medical complaints related to exposure to cotton dust;

(E) A copy of this standard and its appendices, except that the employer may keep one copy of the standard and the appendices for all employees, provided that he references the standard and appendices in the medical surveillance record of each employee; and

(F) A copy of the information provided to the physician as required by subsection (8)(d) of this section.

(iii) The employer shall maintain this record for at least twenty years.

(c) Availability.

(i) The employer shall make all records required to be maintained by subsection (11) of this section available to the director for examination and copying.

(ii) Employee exposure measurement records and employee medical records required by this subsection shall be provided upon request to employees, designated representatives, and the assistant director in accordance with WAC 296-62-05201 through 296-62-05209 and 296-62-05213 through 296-62-05217.

(d) Transfer of records.

(i) Whenever the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by subsection (11) of this section.

(ii) Whenever the employer ceases to do business, and there is no successor employer to receive and retain the records for the prescribed period, these records shall be transmitted to the director.

(iii) At the expiration of the retention period for the records required to be maintained by this section, the employer shall notify the director at least three months prior to the disposal of such records and shall transmit those records to the director if he requests them within that period.

(iv) The employer shall also comply with any additional requirements involving transfer of records set forth in WAC 296-62-05215.

(12) Observation of monitoring.

(a) The employer shall provide affected employees or their designated representatives an opportunity to observe any measuring or monitoring of employee exposure to cotton dust conducted pursuant to subsection (4) of this section.

(b) Whenever observation of the measuring or monitoring of employee exposure to cotton dust requires entry into an area where the use of personal protective equipment is required, the employer shall provide the observer with and assure the use of such equipment and shall require the observer to comply with all other applicable safety and health procedures.

(c) Without interfering with the measurement, observers shall be entitled to:

(i) An explanation of the measurement procedures;

(ii) An opportunity to observe all steps related to the measurement of airborne concentrations of cotton dust performed at the place of exposure; and

(iii) An opportunity to record the results obtained.

(13) Effective date.

(a) General. This emergency rule is effective upon filing with the code reviser, except as otherwise provided below.

(b) Startup dates.

(i) Initial monitoring. The initial monitoring required by subsection (4)(b) of this section shall be completed as soon as possible but no later than September 27, 1980.

(ii) Methods of compliance;

(A) The engineering and work practice controls required by subsection (5) of this section shall be implemented no later than March 27, 1984 except as set forth in (13)(b)(ii)(B) of this section.

(B) The engineering and work practice controls required by subsection (5) of this section shall be implemented no later than March 27, 1986, for ring spinning operations (including only ring spinning and winding, twisting, spooling, beaming and warping following ring spinning) where the operations meet the following criteria:

(I) The weight of the yarn being run is one hundred percent cotton and the average yarn count by weight is eighteen or below;

(II) The average weight of the yarn run is eighty percent or more cotton and the average yarn count by weight is sixteen or below; or

(III) The average weight of the yarn being run is fifty percent or more cotton and the average yarn count by weight is fourteen or below:

(C) When the provisions of (b)(ii)(B) of this subsection are being relied upon, the following definitions shall apply:

(I) The average cotton content shall be determined by dividing the total weight of cotton in the yarns being run by the total weight of all the yarns being run in the relevant work area.

(II) The average yarn count shall be determined by multiplying the yarn count times the pounds of each particular yarn being run to get the "total hank" for each of the yarns being run in the relevant area. The "total hank" values for all of the yarns being run should then be summed and divided by

the total pounds of yarn being run, to produce the average yarn count number for all the yarns being run in the relevant work area.

(D) Where the provisions of (b)(ii)(B) of this subsection are being relied upon, the employer shall update the employer's compliance plan no later than February 13, 1986, to indicate the steps being taken to reduce cotton dust levels to 200 µg/m³ through the use of engineering and work practice controls by March 27, 1986.

(E) Where the provisions of (b)(ii)(B) of this subsection are being relied upon, the employer shall maintain airborne concentrations of cotton dust below 1000 µg/m³ mean concentration averaged over an eight-hour period measured by a vertical elutriator or an equivalent instrument with engineering and work practice controls and shall maintain the permissible exposure limit specified by subsection (3)(a)(i) of this section with any combination of engineering controls, work practice controls and respirators.

(iii) Compliance program. The compliance program required by subsection (5)(c) of this section shall be established no later than March 27, 1981.

(iv) Respirators. The respirators required by subsection (6) of this section shall be provided no later than April 27, 1980.

(v) Work practices. The work practices required by subsection (7) of this section shall be implemented no later than June 27, 1980.

(vi) Medical surveillance. The medical surveillance required by subsection (8) of this section shall be completed no later than March 27, 1981 for the textile industry and no later than June 13, 1986 for the cotton seed processing and waste processing industry.

(vii) Employee education and training. The initial education and training required by subsection (9) of this section shall be completed as soon as possible but no later than June 27, 1980.

(14) Washed cotton.

(a) Exemptions. Cotton, after it has been washed by the processes described in this section is exempt from all or parts of this section as specified if the requirements of this section are met.

(b) Initial requirements.

(i) In order for an employer to qualify as exempt or partially exempt from this standard for operations using washed cotton, the employer must demonstrate that the cotton was washed in a facility which is open to inspection by the director and the employer must provide sufficient accurate documentary evidence to demonstrate that the washing methods utilized meet the requirements of this section.

(ii) An employer who handles or processes cotton which has been washed in a facility not under the employer's control and claims an exemption or partial exemption under this paragraph, must obtain from the cotton washer and make available at the worksite, to the director, or his designated representative, to any affected employee, or to their designated representative the following:

(A) A certification by the washer of the cotton of the grade of cotton, the type of washing process, and that the batch meets the requirements of this section:

(B) Sufficient accurate documentation by the washer of the cotton grades and washing process; and

(C) An authorization by the washer that the director may inspect the washer's washing facilities and documentation of the process.

(c) Medical and dyed cotton. Medical grade (USP) cotton, cotton that has been scoured, bleached and dyed, and mercerized yarn shall be exempt from all provisions of this standard.

(d) Higher grade washed cotton. The handling or processing of cotton classed as "low middling light spotted or better" which has been washed:

(i) On a continuous batt system or a rayon rinse system.

(ii) With water,

(iii) At a temperature of no less than 60°C,

(iv) With a water-to-fiber ratio of no less than 40:1, and

(v) With bacterial levels in the wash water controlled to limit bacterial contamination of the cotton, shall be exempt from all provisions of the standard except the requirements of subsection (8) Medical surveillance, subsection (11)(b) Medical surveillance, subsection (11)(c) Availability, subsection (11)(d) Transfer of records, and Appendices B, C, and D of this section.

(e) Lower grade washed cotton. The handling and processing of cotton of grades lower than "low middling light spotted," that has been washed as specified in (d) of this subsection and has also been bleached, shall be exempt from all provisions of the standard except the requirements of subsection (3)(a) Permissible exposure limits, subsection (4) Exposure monitoring and measurement, subsection (8) Medical surveillance, subsection (11) Recordkeeping, and Appendices B, C and D of this section.

(f) Mixed grades of washed cotton. If more than one grade of washed cotton is being handled or processed together, the requirements of the grade with the most stringent exposure limit, medical and monitoring requirements shall be followed.

(15) Appendices.

(a) Appendix B (B-I, B-II and B-III), WAC 296-62-14537, Appendix C, WAC 296-62-14539 and Appendix D, WAC 296-62-14541 are incorporated as part of this chapter and the contents of these appendices are mandatory.

(b) Appendix A of this chapter, WAC 296-62-14535 contains information which is not intended to create any additional obligations not otherwise imposed or to detract from any existing obligations.

(c) Appendix E of this chapter is a protocol which may be followed in the validation of alternative measuring devices as equivalent to the vertical elutriator cotton dust sampler. Other protocols may be used if it is demonstrated that they are statistically valid, meet the requirements in subsection (4)(a)(iii) of this section, and are appropriate for demonstrating equivalency.

[Statutory Authority: Chapter 49.17 RCW. 87-24-051 (Order 87-24), § 296-62-14533, filed 11/30/87. Statutory Authority: RCW 49.17.040 and 49.17.050. 86-16-009 (Order 86-28), § 296-62-14533, filed 7/25/86; 82-03-023 (Order 82-1), § 296-62-14533, filed 1/15/82. Statutory Authority: 49.17.040, 49.17.050, and 49.17.240. 81-16-015 (Order 81-20), § 296-62-14533, filed 7/27/81. Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-14533, filed 11/13/80.]

WAC 296-62-14535 Appendix A—Air sampling and analytical procedures for determining concentrations of cotton dust. (1) Sampling locations. The sampling procedures must be designed so that samples of the actual dust concentrations are collected accurately and consistently and reflect the concentrations of dust at the place and time of sampling. Sufficient number of six-hour area samples in each distinct work area of the plant should be collected at locations which provide representative samples of air to which the worker is exposed. In order to avoid filter overloading, sampling time may be shortened when sampling in dusty areas. Samples in each work area should be gathered simultaneously or sequentially during a normal operating period. The daily time-weighted average (TWA) exposure of each worker can then be determined by using the following formula:

$$\frac{\text{Summation of hours spent in each location and the dust concentration in that location.}}{\text{Total hours exposed}}$$

A time-weighted average concentration should be computed for each worker and properly logged and maintained on file for review.

(2) Sampling equipment.

(a) Sampler. The instrument selected for monitoring is the Lumsden-Lynch vertical elutriator. It should operate at a flow rate of 7.4 ± 0.2 liters/minute. The samplers should be cleaned prior to sampling. The pumps should be monitored during sampling.

(b) Filter holder. A three-piece cassette constructed of polystyrene designed to hold a 37-mm diameter filter should be used. Care must be exercised to insure that an adequate seal exists between elements of the cassette.

(c) Filters and support pads. The membrane filters used should be polyvinyl chloride with a 5- μ m pore size and 37-mm diameter. A support pad, commonly called a backup pad, should be used under the filter membrane in the field monitor cassette.

(d) Balance. A balance sensitive to 10 micrograms should be used.

(3) Instrument calibration procedure. Samplers shall be calibrated when first received from the factory, after repair, and after receiving any abuse. The samplers should be calibrated in the laboratory both before they are used in the field and after they have been used to collect a large number of field samples. The primary standard, such as a spirometer or other standard calibrating instruments such as a wet test meter or a large bubble meter or dry gas meter, should be used. Instructions for calibration with the wet test meter follow. If another calibration device is selected, equivalent procedures should be used:

(a) Level wet test meter. Check the water level which should just touch the calibration point at the left side of the meter. If water level is low, add water 1-2°F. warmer than room temperature of till point. Run the meter for thirty minutes before calibration;

(b) Place the polyvinyl chloride membrane filter in the filter cassette;

(c) Assemble the calibration sampling train;

(d) Connect the wet test meter to the train.

The pointer on the meter should run clockwise and a pressure drop of not more than 1.0 inch of water indicated. If the pressure drop is greater than 1.0, disconnect and check the system;

(e) Operate the system for ten minutes before starting the calibration;

(f) Check the vacuum gauge on the pump to insure that the pressure drop across the orifice exceeds seventeen inches of mercury;

(g) Record the following on calibration data sheets:

(i) Wet test meter reading, start and finish;

(ii) Elapsed time, start and finish (at least two minutes);

(iii) Pressure drop at manometer;

(iv) Air temperature;

(v) Barometric pressure; and

(vi) Limiting orifice number.

(h) Calculate the flow rate and compare against the flow of 7.4 ± 0.2 liters/minute. If flow is between these limits, perform calibration again, average results, and record orifice number and flow rate. If flow is not within these limits, discard or modify orifice and repeat procedure;

(i) Record the name of the person performing the calibration, the date, serial number of the wet test meter, and the number of the critical orifices being calibrated.

(4) Sampling procedure.

(a) Sampling data sheets should include a log of:

(i) The date of the sample collection;

(ii) The time of sampling;

(iii) The location of the sampler;

(iv) The sampler serial number;

(v) The cassette number;

(vi) The time of starting and stopping the sampling and the duration of sampling;

(vii) The weight of the filter before and after sampling;

(viii) The weight of dust collected (corrected for controls);

(ix) The dust concentration measured;

(x) Other pertinent information; and

(xi) Name of person taking sample.

(b) Assembly of filter cassette should be as follows:

(i) Loosely assemble three-piece cassette;

(ii) Number cassette;

(iii) Place absorbent pad in cassette;

(iv) Weigh filter to an accuracy of 10 μ g;

(v) Place filter in cassette;

(vi) Record weight of filter in log, using cassette number for identification;

(vii) Fully assemble cassette, using pressure to force parts tightly together;

(viii) Install plugs top and bottom;

(ix) Put shrink band on cassette, covering joint between center and bottom parts of cassette; and

(x) Set cassette aside until shrink band dries thoroughly.

(c) Sampling collection should be performed as follows:

(i) Clean lint out of the motor and elutriator;

(ii) Install vertical elutriator in sampling locations specified above with inlet 4-1/2 to 5-1/2 feet from floor (breathing zone height);

(iii) Remove top section of cassette;

(iv) Install cassette in ferrule of elutriator;

(v) Tape cassette to ferrule with masking tape or similar material for air-tight seal;

(vi) Remove bottom plug of cassette and attach hose containing critical orifice;

(vii) Start elutriator pump and check to see if gauge reads above 17 in. of Hg vacuum;

(viii) Record starting time, cassette number, and sampler number;

(ix) At end of sampling period stop pump and record time; and

(x) Controls with each batch of samples collected, two additional filter cassettes should be subjected to exactly the same handling as the samples, except that they are not opened. These control filters should be weighed in the same manner as the sample filters.

Any difference in weight in the control filters would indicate that the procedure for handling sample filters may not be adequate and should be evaluated to ascertain the cause of the difference, whether and what necessary corrections must be made, and whether additional samples must be collected.

(d) Shipping. The cassette with samples should be collected, along with the appropriate number of blanks, and shipped to the analytical laboratory in a suitable container to prevent damage in transit.

(e) Weighing of the sample should be achieved as follows:

(i) Remove shrink band;

(ii) Remove top and middle sections of cassette and bottom plug;

(iii) Remove filter from cassette and weigh to an accuracy of 10 μg ; and

(iv) Record weight in log against original weight.

(f) Calculation of volume of air sampled should be determined as follows:

(i) From starting and stopping times of sampling period, determine length of time in minutes of sampling period; and

(ii) Multiply sampling time in minutes by flow rate of critical orifice in liters per minute and divide by 1000 to find air quantity in cubic meters.

(g) Calculation of dust concentrations should be made as follows:

(i) Subtract weight of clean filter from dirty filter and apply control correction to find actual weight of sample. Record this weight (in μg) in log; and

(ii) Divide mass of sample in μg by air volume in cubic meters to find dust concentration in $\mu\text{g}/\text{m}$. Record in log.

[Statutory Authority: RCW 49.17.040, 49.17.050, 49.17.240, chapters 42.30 and 43.22 RCW. 80-17-014 (Order 80-20), § 296-62-14535, filed 11/13/80.]