WSR 16-20-024
EXPEDITED RULES
OFFICE OF INSURANCE COMMISSIONER

[Insurance Commissioner Matter No. R 2016-25—Filed September 27, 2016, 12:04 p.m.]

Title of Rule and Other Identifying Information: Candidate handbook name change to candidate information bulletin.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Stacy Middleton, Office of Insurance Commissioner (OIC), P.O. [Box] 40260, Olympia, WA 98504-0260, e-mail rulescoordinator@oic.wa.gov, AND RECEIVED BY December 6, 2016.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: Changing name in WAC 284-17-551 WAC, from "candidate handbook," to "candidate information bulletin" to align with phrasing used by PSI Services and the NAIC State Licensing Handbook.

Reasons Supporting Proposal: PSI Services and the NAIC State Licensing Handbook use the term candidate information bulletin rather than candidate handbook. As a result of a recent concern with a candidate, OIC determined it should update WAC 284-17-551.

Statutory Authority for Adoption: RCW 48.02.060 and 48.17.005.

Statute Being Implemented: RCW 48.17.005.

Rule is not necessitated by federal law, federal or state court decision.

Name of Proponent: Mike Kreidler, insurance commissioner, governmental.

Name of Agency Personnel Responsible for Drafting: Joe Mendoza, 5000 Capitol Boulevard, Tumwater, WA 98504, (360) 725-7146; Implementation: Jeff Baughman, 5000 Capitol Boulevard, Tumwater, WA 98504, (360) 725-7156; and Enforcement: AnnaLisa Gellermann, 5000 Capitol Boulevard, Tumwater, WA 98504, (360) 725-7050.

September 27, 2016
Mike Kreidler
Insurance Commissioner

AMENDATORY SECTION (Amending WSR 09-02-073, filed 1/6/09, effective 7/1/09)

WAC 284-17-551 Prelicensing insurance education—Candidate ((~~handbook~~)) information bulletin. The prelicensing insurance education curriculum is described in the candidate ((~~handbook~~)) information bulletin. The candidate ((~~handbook~~)) information bulletin is incorporated by reference and its entire contents will be enforced by the commissioner. A copy of the current candidate ((~~handbook~~)) information bulletin is available through the commissioner's web site at www.insurance.wa.gov.

(1) Information in the current version of the candidate ((~~handbook~~)) information bulletin must be provided to each license candidate at the time of enrollment.

(2) If changes are implemented in the prescribed prelicensing education curriculum, the prelicensing insurance education provider must submit a revised course outline at least fifteen calendar days before the implementation date.

WSR 16-20-079
EXPEDITED RULES
DEPARTMENT OF LABOR AND INDUSTRIES

[Filed October 4, 2016, 10:51 a.m.]

Title of Rule and Other Identifying Information: Hazard communication/globally harmonized system (GHS) of classification and labeling chemicals—Final stage.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Chris Miller, Department of Labor and Industries, P.O. Box 44610, Olympia, WA 98504, AND RECEIVED BY December 5, 2016.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: The primary purpose of this proposal is to repeal chapter 296-62 WAC Part B1; chapter 296-307 WAC Part Y-1 and Y-2; WAC 296-800-170 through 296-800-17055; chapter 296-816 WAC, and chapter 296-839 WAC, which have been rendered obsolete as a result of the adoption of WAC 296-901-140 Globally harmonized system for hazard communication, which became fully effective June 1, 2016.

This proposal also includes several minor corrections within various WAC chapters and sections such as replacing antiquated terminology like "material safety data sheet (MSDS)" with the globally harmonized term "safety data sheet (SDS)," and replacing the obsolete "combustible liquid" classifications with the now preferred and globally recognized "flammable liquid" categories that were not updated in previous GHS rule-making packages.

Repealed Chapters/Sections: Notes have been added to the following directing readers to pertinent sections of WAC 296-901-140 Globally harmonized system for hazard communication: Chapter 296-62 WAC, General occupational health standards, Part B-1 (WAC 296-62-05301 - 296-62-05325); chapter 296-307 WAC, Safety standards for agricul-

ture, Part Y-1 and Y-2 (WAC 296-307-550 - 296-307-56050); chapter 296-800 WAC, Safety and health core rules, WAC 296-800-170 - 296-800-17055; chapter 296-816 WAC, Protecting trade secrets; and chapter 296-839 WAC, Content and distribution of material safety data sheets (MSDS) and label information.

Amended Sections:

WAC 296-24-33001:

- Removed definition for obsolete term "combustible liquid."
- Replaced reference to obsolete combustible classifications with corresponding flammable categories within definition of "viscous."

WAC 296-24-33009 (2)(d)(ii):

- Replaced the word "class" with the word "category" referring to GHS flammable categories.

WAC 296-24-33009 (5)(d)(ii), Table H-14, Table H-15, Table H-16, and Table H-17, WAC 296-24-33013 (4)(e), and WAC 296-24-47505 (6)(g):

- Replaced reference to obsolete combustible classifications with corresponding flammable categories.

WAC 296-62-07753:

- Changed obsolete term "material safety data sheet (MSDS)" to "safety data sheet (SDS)."

WAC 296-305-01005:

- Replaced reference to WAC 296-800-170 with reference to WAC 296-901-140.
- Corrected alphabetical placement of incident command system (ICS).

WAC 296-305-01509:

- Replaced reference to WAC 296-800-170 with reference to WAC 296-901-14010.

WAC 296-305-05502:

- Replaced reference to WAC 296-800-170 with reference to WAC 296-901-14016.

WAC 296-800-180 - 296-800-18020:

- Changed obsolete term "material safety data sheet (MSDS)" to "safety data sheet (SDS)" throughout.
- Replaced reference to chapter 296-816 WAC with reference to WAC 296-901-14018.
- Removed obsolete reference to WAC 296-800-17010.

WAC 296-828-099:

- Corrected definition of "health hazard" to match WAC 296-901-140 (an error during GHS Phase 1 resulted in the wrong/unrelated definition being added in this section). It now correctly reads:
  Health hazard. A chemical which is classified as posing one of the following hazardous effects: Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in WAC 296-901-14022, Appendix A—Health hazard criteria.

WAC 296-835-11030:

- Changed obsolete term "material safety data sheet (MSDS)" to "safety data sheet (SDS)."
- Replaced reference to WAC 296-800-170 with reference to chapter 296-901 WAC.

Reasons Supporting Proposal: Updating these housekeeping errors will help keep employers and workers safe by being current.

Statutory Authority for Adoption: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.

Statute Being Implemented: Chapter 49.17 RCW.

Rule is necessary because of federal law, [no further information supplied by agency].

Name of Proponent: Department of labor and industries, governmental.

Name of Agency Personnel Responsible for Drafting: Chris Miller, Tumwater, (360) 902-5516; Implementation and Enforcement: Anne Soiza, Tumwater, (360) 902-5090.

October 4, 2016
Joel Sacks
Director

AMENDATORY SECTION (Amending WSR 15-24-100, filed 12/1/15, effective 1/5/16)

WAC 296-24-33001 Definitions. The following definitions are applicable to all sections of this chapter which include WAC 296-24-330 in the section number.

Aerosol. A material which is dispensed from its container as a mist, spray, or foam by a propellant under pressure.

Approved. Unless otherwise indicated, approved, or listed by a nationally recognized testing laboratory. Refer to federal regulation 29 C.F.R. 1910.7 for definition of nationally recognized testing laboratory.

Atmospheric tank. A storage tank which has been designed to operate at pressures from atmospheric through 0.5 p.s.i.g.

Automotive service station. That portion of property where flammable liquids used as motor fuels are stored and dispensed from fixed equipment into the fuel tanks of motor vehicles and shall include any facilities available for the sale and service of tires, batteries, and accessories, and for minor automotive maintenance work. Major automotive repairs, painting, body and fender work are excluded.

Barrel. A volume of forty-two United States gallons.

Basement. A story of a building or structure having one-half or more of its height below ground level and to which access for firefighting purposes is unduly restricted.

Boiling point. The boiling point of a liquid at a pressure of 14.7 pounds per square inch absolute (p.s.i.a.) (760 mm.). Where an accurate boiling point is unavailable for the mate-

rial in question, or for mixtures which do not have a constant boiling point, for purposes of this section the 10% point of a distillation performed in accordance with the Standard Method of Test for Distillation of Petroleum Products, ASTM D-86-62, may be used as the boiling point of the liquid.

Boilover. The expulsion of crude oil (or certain other liquids) from a burning tank. The light fractions of the crude oil burnoff producing a heat wave in the residue, which on reaching a water strata may result in the expulsion of a portion of the contents of the tank in the form of froth.

Bulk plant. That portion of a property where flammable liquids are received by tank vessel, pipelines, tank car, or tank vehicle, and are stored or blended in bulk for the purpose of distributing such liquids by tank vessel, pipeline, tank car, tank vehicle, or container.

Chemical plant. A large integrated plant or that portion of such a plant other than a refinery or distillery where flammable liquids are produced by chemical reactions or used in chemical reactions.

Closed container. A container as herein defined, so sealed by means of a lid or other device that neither liquid nor vapor will escape from it at ordinary temperatures.

((~~**Combustible liquid.** Any liquid having a flashpoint at or above 100°F (37.8°C). Combustible liquids must be divided into two classes as follows:~~

~~(a) **Class II liquids.** Include those with flashpoints at or above 100°F (37.8°C) and below 140°F (60°C), except any mixture having components with flashpoints of 200°F (93.3°C) or higher, the volume of which make up 99% or more of the total volume of the mixture.~~

~~(b) **Class III liquids.** Include those with flashpoints at or above 140°F (60°C). Class III liquids are subdivided into two subclasses:~~

~~(i) **Class IIIA liquids.** Include those with flashpoints at or above 140°F (60°C) and 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.~~

~~(ii) **Class IIIB liquids.** Include those with flashpoints at or above 200°F (93.3°C). This section does not cover Class IIIB liquids. Where the term "Class III liquids" is used in this section, it means only Class IIIA liquids.~~

~~(c) When a combustible liquid is heated for use to within 30°F (16.7°C) of its flashpoint, it must be handled in accordance with the requirements for the next lower class of liquids.~~))

Container. Any can, barrel, or drum.

Crude petroleum. Hydrocarbon mixtures that have a flash point below 150°F and which have not been processed in a refinery.

Distillery. A plant or that portion of a plant where flammable liquids produced by fermentation are concentrated, and where the concentrated products may also be mixed, stored, or packaged.

Fire area. An area of a building separated from the remainder of the building by construction having a fire resistance of at least one hour and having all communicating openings properly protected by an assembly having a fire resistance rating of at least one hour.

Fire resistance or fire resistive construction. Construction to resist the spread of fire.

Flammable aerosol. A flammable aerosol as defined under WAC 296-901-14024, Appendix B—Physical hazard criteria. For the purposes of WAC 296-24-33009, such aerosols are considered Category 1 flammable liquids.

Flammable liquid. Any liquid having a flashpoint at or below 199.4°F (93°C). Flammable liquids are divided into four categories as follows:

(a) **Category 1** includes liquids having flashpoints below 73.4°F (23°C) and having a boiling point at or below 95°F (35°C).

(b) **Category 2** includes liquids having flashpoints below 73.4°F (23°C) and having a boiling point above 95°F (35°C).

(c) **Category 3** includes liquids having flashpoints at or above 73.4°F (23°C) and at or below 140°F (60°C). When a Category 3 liquid with a flashpoint at or above 100°F (37.8°C) is heated for use to within 30°F (16.7°C) of its flashpoint, it must be handled in accordance with the requirements for a Category 3 liquid with a flashpoint below 100°F (37.8°C).

(d) **Category 4** must include liquids having flashpoints above 140°F (60°C) and at or below 199.4°F (93°C). When a Category 4 flammable liquid is heated for use to within 30°F (16.7°C) of its flashpoint, it must be handled in accordance with the requirements for a Category 3 liquid with a flashpoint at or above 100°F (37.8°C).

(e) When liquid with a flashpoint greater than 199.4°F (93°C) is heated for use to within 30°F (16.7°C) of its flashpoint, it must be handled in accordance with the requirements for a Category 4 flammable liquid.

Flashpoint. The minimum temperature at which a liquid gives off vapor within a test vessel in sufficient concentration to form an ignitable mixture with air near the surface of the liquid, and shall be determined as follows:

(a) For a liquid which has a viscosity of less than 45 SUS at 100°F (37.8°C), does not contain suspended solids, and does not have a tendency to form a surface film while under test, the procedure specified in the Standard Method of Test for Flashpoint by Tag Closed Tester (ASTM D-56-70), WAC 296-901-14024, Appendix B—Physical hazard criteria, shall be used.

(b) For a liquid which has a viscosity of 45 SUS or more at 100°F (37.8°C), or contains suspended solids, or has a tendency to form a surface film while under test, the Standard Method of Test for Flashpoint by Pensky-Martens Closed Tester (ASTM D-93-71) or an equivalent method as defined by WAC 296-901-14024, Appendix B—Physical hazard criteria, shall be used, except that the methods specified in Note 1 to section 1.1 of ASTM D-93-71 may be used for the respective materials specified in the note.

(c) For a liquid that is a mixture of compounds that have different volatilities and flashpoints, its flashpoint shall be determined by using the procedure specified in (a) or (b) of this subsection on the liquid in the form it is shipped.

(d) Organic peroxides, which undergo autoaccelerating thermal decomposition, are excluded from any of the flashpoint determination methods specified in this section.

Hotel. Buildings or groups of buildings under the same management in which there are sleeping accommodations for hire primarily used by transients who are lodged with or without meals including but not limited to inns, clubs, motels, and apartment hotels.

Institutional occupancy. The occupancy or use of a building or structure or any portion thereof by persons harbored or detained to receive medical, charitable or other care or treatment, or by persons involuntarily detained.

Liquid. For the purpose of these standards, any material which has a fluidity greater than that of 300 penetration asphalt when tested in accordance with ASTM Test for Penetration for Bituminous Materials, D-5-65. When not otherwise identified, the term liquid shall include both flammable liquids.

Listed. See "Approved."

Low-pressure tank. A storage tank which has been designed to operate at pressures above 0.5 p.s.i.g. but not more than 15 p.s.i.g.

Marine service station. That portion of a property where flammable liquids used as fuels are stored and dispensed from fixed equipment on shore, piers, wharves, or floating docks into the fuel tanks or self-propelled craft, and shall include all facilities used in connection therewith.

Mercantile occupancy. The occupancy or use of a building or structure or any portion thereof for the displaying, selling, or buying of goods, wares, or merchandise.

Office occupancy. The occupancy or use of a building or structure or any portion thereof for the transaction of business, or the rendering or receiving of professional services.

Portable tank. A closed container having a liquid capacity over sixty United States gallons and not intended for fixed installation.

Pressure vessel. A storage tank or vessel which has been designed to operate at pressures above 15 p.s.i.g.

Protection for exposure. Adequate fire protection for structures on property adjacent to tanks, where there are employees of the establishment.

Refinery. A plant in which flammable liquids are produced on a commercial scale from crude petroleum, natural gasoline, or other hydrocarbon sources.

Safety can. An approved container, of not more than five gallons capacity, having a spring-closing lid and spout cover and so designed that it will safely relieve internal pressure when subjected to fire exposure.

Storage. Flammable liquids must be stored in a tank or in a container that complies with WAC 296-24-33009(2).

SUS. Saybolt Universal Seconds as determined by the Standard Method of Test for Saybolt Viscosity (ASTM D-88-56), and may be determined by use of the SUS conversion tables specified in ASTM Method D2161-66 following determination of viscosity in accordance with the procedures specified in the Standard Method of Test for Viscosity of Transparent and Opaque Liquids (ASTM D445-65).

Unstable (reactive) liquid. A liquid which in the pure state or as commercially produced or transported will vigorously polymerize, decompose, condense, or will become self-reactive under conditions of shocks, pressure, or temperature.

Vapor pressure. The pressure, measured in pounds per square inch (absolute) exerted by a volatile liquid as determined by the "Standard Method of Test for Vapor Pressure of Petroleum Products (Reid Method)," American Society for Testing and Materials ASTM D323-68.

Ventilation. As specified in these standards is for the prevention of fire and explosion. It is considered adequate if it is sufficient to prevent accumulation of significant quantities of vapor-air mixtures in concentration over one-fourth of the lower flammable limit.

Viscous. A viscosity of 45 SUS or more.

Note: The volatility of liquids is increased when artificially heated to temperatures equal to or higher than their flashpoints. When so heated ((~~Class II and III~~)) Category 3 and 4 liquids ((~~shall~~)) must be subject to the applicable requirements for ((~~Class I or II~~)) Category 1 and 2 liquids. These standards may also be applied to high flashpoint liquids when so heated even though these same liquids when not heated are outside of its scope.

AMENDATORY SECTION (Amending WSR 15-24-100, filed 12/1/15, effective 1/5/16)

WAC 296-24-33009 Container and portable tank storage. (1) **Scope.**

(a) **General.** This section must apply only to the storage of flammable liquids in drums or other containers (including flammable aerosols) not exceeding 60 gallons individual capacity and those portable tanks not exceeding 660 gallons individual capacity.

(b) **Exceptions.** This section must not apply to the following:

(i) Storage of containers in bulk plants, service stations, refineries, chemical plants, and distilleries;

(ii) Category 1, 2, or 3 flammable liquids in the fuel tanks of a motor vehicle, aircraft, boat, or portable or stationary engine;

(iii) Flammable or combustible paints, oils, varnishes, and similar mixtures used for painting or maintenance when not kept for a period in excess of thirty days;

(iv) Beverages when packaged in individual containers not exceeding 1 gallon in size.

(2) **Design, construction, and capacity of containers.**

(a) **General.** You must use only approved containers and portable tanks. Metal containers and portable tanks meeting the requirements of and containing products authorized by Chapter I, Title 49 of the Code of Federal Regulations - October 1, 1972, (regulations issued by the hazardous materials regulations board, department of transportation), must be deemed to be acceptable.

(b) **Emergency venting.** You must provide each portable tank with one or more devices installed in the top with sufficient emergency venting capacity to limit internal pressure under fire exposure conditions to 10 p.s.i.g., or 30% of the bursting pressure of the tank, whichever is greater. The total venting capacity must be not less than that specified in WAC 296-24-33005 (2)(e)(iii) or (v). You must use at least one pressure-actuated vent having a minimum capacity of six thousand cubic feet of free air (14.7 p.s.i.a. and 60°F). You must set it to open at not less than 5 p.s.i.g. If fusible vents are

used, they must be actuated by elements that operate at a temperature not exceeding 300°F.

TABLE H-12
MAXIMUM ALLOWABLE SIZE OF
CONTAINERS AND PORTABLE TANKS FOR FLAMMABLE LIQUIDS

Container type	Category 1	Category 2	Category 3 and 4
Glass or approved plastic	1 pt	1 qt	1 gal
Metal (other than DOT drums)	1 gal	5 gal	5 gal
Safety cans	2 gal		
Metal drums (DOT specifications)	60 gal	60 gal	60 gal
Approved portable tanks	660 gal	660 gal	660 gal

Container exemptions:

(c) Medicines, beverages, foodstuffs, cosmetics and other common consumer items, when packaged according to commonly accepted practices, must be exempt from the requirements of subsection (4)(a) and (b) of this section.

(d) **Size.** Flammable liquid containers must be in accordance with Table H-12, except that glass or plastic containers of no more than 1-gallon capacity may be used for a Category 1 or 2 flammable liquid if:

(i) Such liquid either would be rendered unfit for its intended use by contact with metal or would excessively corrode a metal container so as to create a leakage hazard; and

(ii) The user's process either would require more than 1 pint of Category 1 flammable liquid or more than 1 quart of a Category 2 flammable liquid of a single assay lot to be used at one time, or would require the maintenance of an analytical standard liquid of a quality which is not met by the specified standards of liquids available, and the quantity of the analytical standard liquid required to be used in any one control process exceeds one-sixteenth the capacity of the container allowed under Table H-12 for the ((~~class~~)) category of liquid; or

(iii) The containers are intended for direct export outside the United States.

(3) **Design, construction, and capacity of storage cabinets.**

(a) **Maximum capacity.** Not more than 60 gallons of Category 1, 2, or 3 flammable liquids, nor more than 120 gallons of Category 4 flammable liquids may be stored in a storage cabinet.

(b) **Fire resistance.** Storage cabinets must be designed and constructed to limit the internal temperature to not more than 325°F when subjected to a ten-minute fire test using the standard time-temperature curve as set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969. All joints and seams must remain tight and the door must remain securely closed during the fire test. You must label cabinets "Flammable—Keep fire away."

(i) Metal cabinets constructed in the following manner must be deemed to be in compliance. The bottom, top, door, and sides of cabinet must be at least No. 18 gage sheet iron and double walled with 1 1/2 inch air space. Joints must be riveted, welded or made tight by some equally effective means. The door must be provided with a three-point lock, and the door sill must be raised at least two inches above the bottom of the cabinet.

(ii) Wooden cabinets constructed in the following manner must be deemed in compliance. The bottom, sides, and top must be constructed of an approved grade of plywood at least one inch in thickness, which must not break down or delaminate under fire conditions. All joints must be rabbetted and must be fastened in two directions with flathead woodscrews. When more than one door is used, there must be a rabbetted overlap of not less than one inch. Hinges must be mounted in such a manner as not to lose their holding capacity due to loosening or burning out of the screws when subjected to the fire test.

(4) **Design and construction of inside storage rooms.**

(a) **Construction.** Inside storage rooms must be constructed to meet the required fire-resistive rating for their use. Such construction must comply with the test specifications set forth in Standard Methods of Fire Tests of Building Construction and Materials, NFPA 251-1969. Where an automatic sprinkler system is provided, the system must be designed and installed in an acceptable manner. You must provide openings to other rooms or buildings with noncombustible liquid-tight raised sills or ramps at least 4 inches in height, or the floor in the storage area shall be at least 4 inches below the surrounding floor. You must provide openings with approved self-closing fire doors. The room must be liquid tight where the walls join the floor. A permissible alternate to the sill or ramp is an open-grated trench inside of the room which drains to a safe location. Where other portions of the building or other properties are exposed, you must protect windows as set forth in the Standard for Fire Doors and Windows, NFPA No. 80-1968, for Class E or F openings. Wood at least one inch nominal thickness may be used for shelving, racks, dunnage, scuffboards, floor overlay, and similar installations.

(b) **Rating and capacity.** Storage in inside storage rooms must comply with Table H-13.

TABLE H-13
STORAGE IN INSIDE ROOMS

Fire protection* provided	Fire resistance	Maximum size	Total allowable quantities (gals./sq. Ft./floor area)
Yes	2 hours	500 sq. ft.	10
No	2 hours	500 sq. ft.	4
Yes	1 hour	150 sq. ft.	5
No	1 hour	150 sq. ft.	2

* Fire protection system must be sprinkler, water spray, carbon dioxide, or other system.

(c) **Wiring.** Electrical wiring and equipment located inside storage rooms used for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), must comply with the provisions of chapter 296-24 WAC Part L for Class I, Division 2 Hazardous Locations; for Category 3 flammable liquids with a flash-

point at or above 100°F (37.8°C) and Category 4 flammable liquids, must be approved for general use.

(d) **Ventilation.** You must provide every inside storage room with either a gravity or a mechanical exhaust ventilation system. Such system must be designed to provide for a complete change of air within the room at least six times per hour. If a mechanical exhaust system is used, it must be controlled by a switch located outside of the door. You must operate the ventilating equipment and any lighting fixtures by the same switch. You must install a pilot light adjacent to the switch if Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are dispensed within the room. Where gravity ventilation is provided, the fresh air intake, as well as the exhaust outlet from the room, must be on the exterior of the building in which the room is located.

(e) **Storage in inside storage rooms.** In every inside storage room you must maintain one clear aisle at least 3 feet wide. You must not stack containers over 30 gallons capacity one upon the other. Dispensing must be by approved pump or self-closing faucet only.

(5) **Storage inside building.**

(a) **Egress.** You must not store flammable liquids, including stock for sale, so as to limit use of exits, stairways, or areas normally used for the safe egress of people.

(b) **Containers.** The storage of flammable liquids in containers or portable tanks must comply with subsection (4)(c) through (e) of this section.

(c) **Office occupancies.** You must prohibit storage except that which is required for maintenance and operation of building and operation of equipment. You must keep such storage in closed metal containers stored in a storage cabinet or in safety cans or in an inside storage room not having a door that opens into that portion of the building used by the public.

(d) **Mercantile occupancies and other retail stores.**

(i) In rooms or areas accessible to the public, you must limit storage to quantities needed for display and normal merchandising purposes but must not exceed 2 gallons per square foot of gross floor area. You must consider the gross floor area used for computing the maximum quantity permitted as that portion of the store actually being used for merchandising flammable liquids.

(ii) Where the aggregate quantity of additional stock exceeds 60 gallons of ((~~Class IA~~)) Category 1, or 120 gallons of ((~~Class IB~~)) Category 2, or 180 gallons of ((~~Class IC~~)) Category 3 liquids with a flash point below 100°F (37.8°C), or 240 gallons of ((~~Class II~~)) Category 3 liquids with a flash point at or above 100°F (37.8°C) and below 140°F (60°C), or 500 gallons of ((~~Class III~~)) Category 4 liquids, or any combination of ((~~Class I and Class II~~)) Category 1, 2, and 3 liquids exceeding 240 gallons, you must store it in a room or portion of the building that complies with the construction provisions for an inside storage room as prescribed in subsection (4) of this section. For water miscible liquids, these quantities may be doubled.

(iii) You must not stack containers in a display area more than 3 feet or two containers high, whichever is the greater, unless the stacking is done on fixed shelving or is otherwise satisfactorily secured.

(iv) Shelving must be of stable construction, of sufficient depth and arrangement such that containers displayed thereon must not be easily displaced.

(v) You must remove leaking containers to a storage room or taken to a safe location outside the building and the contents transferred to an undamaged container.

(e) **General purpose public warehouses.** Storage must be in accordance with Table H-14 or H-15 and in buildings or in portions of such buildings cut off by standard firewalls. Material creating no fire exposure hazard to the flammable liquids may be stored in the same area.

TABLE H-14
INDOOR CONTAINER STORAGE

((~~Class~~)) Category liquid	Storage level	Protected storage maximum per pile		Unprotected storage maximum per pile	
		Gal.	Ht.	Gal.	Ht.
((~~IA~~)) 1	Ground and upper floors	2,750 (50)	3 ft. (1)	660 (12)	3 ft. (1)
	Basement	Not permitted		Not permitted	
((~~IB~~)) 2	Ground and upper floors	5,500 (100)	6 ft. (2)	1,375 (25)	3 ft. (1)
	Basement	Not permitted		Not permitted	
((~~IC~~)) 3 (with flashpoint <100°F)	Ground and upper floors	16,500 (300)	6 ft (2)	4,125 (75)	3 ft. (1)
	Basement	Not permitted		Not permitted	
((~~II~~)) 3 (with flashpoint ≥100°F)	Ground and upper floors	16,500 (300)	9 ft. (3)	4,125 (75)	9 ft. (3)
	Basement	5,500 (100)	9 ft. (3)	Not permitted	
((~~III~~)) 4	Ground and upper floors	55,000 (1,000)	15 ft. (5)	13,750 (250)	12 ft. (4)
	Basement	8,250 (450)	9 ft. (3)	Not permitted	

Note 1: When 2 or more ((~~classes~~)) categories of materials are stored in a single pile, the maximum gallonage permitted in that pile must be the smallest of the 2 or more separate maximum gallonages.

Note 2: You must provide aisles so that no container is more than 12 ft. from an aisle. Main aisles shall be at least 8 ft. wide and side aisles at least 4 ft. wide.

(Numbers in parentheses indicate corresponding number of 55-gal. drums.)

Note 3: Each pile must be separated from each other by at least 4 ft.

TABLE H-15
INDOOR PORTABLE TANK STORAGE

((~~Class~~)) Category liquid	Storage level	Protected storage maximum per pile		Unprotected storage maximum per pile	
		Gal.	Ht.	Gal.	Ht.
((~~IA~~)) 1	Ground and upper floors	Not permitted		Not permitted	
	Basement	Not permitted		Not permitted	
((~~IB~~)) 2	Ground and upper floors	20,000	7ft.	2,000	7 ft.
	Basement	Not permitted		Not permitted	
((~~IC~~)) 3 (with flashpoint <100°F)	Ground and upper floors	40,000	14 ft	5,500	7 ft.
	Basement	Not permitted		Not permitted	
((~~II~~)) 3 (with flashpoint ≥100°F)	Ground and upper floors	40,000	14 ft.	5,500	7 ft.
	Basement	20,000	7 ft.	Not permitted	
((~~III~~)) 4	Ground and upper floors	60,000	14 ft.	22,000	7 ft.
	Basement	20,000	7 ft.	Not permitted	

Note 1: When 2 or more ((~~classes~~)) categories of materials are stored in a single pile, the maximum gallonage permitted in that pile must be the smallest of the 2 or more separate maximum gallonages.

Note 2: You must provide aisles so that no portable tank is more than 12 ft. from an aisle. Main aisles shall be at least 8 ft. wide and side aisles at least 4 ft. wide.

Note 3: Each pile must be separated from each other by at least 4 ft.

(f) **Flammable liquid warehouses or storage buildings.**

(i) If the storage building is located 50 feet or less from a building or line of adjoining property that may be built upon, the exposing wall must be a blank wall having a fire-resistance rating of at least 2 hours.

(ii) The total quantity of liquids within a building must not be restricted, but the arrangement of storage must comply with Table H-14 or H-15.

(iii) You must separate containers in piles by pallets or dunnage where necessary to provide stability and to prevent excessive stress on container walls.

(iv) Portable tanks stored over one tier high must be designed to nest securely, without dunnage and adequate materials handling equipment must be available to handle tanks safely at the upper tier level.

(v) No pile must be closer than three feet to the nearest beam, chord, girder, or other obstruction, and must be 3 feet below sprinkler deflectors or discharge orifices of water spray, or other overhead fire protection systems.

(vi) You must provide aisles of at least 3 feet wide where necessary for reasons of access to doors, windows or standpipe connections.

(6) **Storage outside buildings.**

(a) **General.** Storage outside buildings must be in accordance with Table H-16 or H-17, and (b) and (d) of this subsection.

TABLE H-16
OUTDOOR CONTAINER STORAGE

1 ((~~Class~~)) Category	2 Maximum per pile (see note 1)	3 Distance between piles (see note 2)	4 Distance to property line that can be built upon (see notes 3 & 4)	5 Distance to street, alley, public way (see note 4)
	gal.	ft.	ft.	ft.
((~~IA~~)) 1	1,100	5	20	10
((~~IB~~)) 2	2,200	5	20	10
((~~IC~~)) 3 (with flashpoint <100˚F)	4,400	5	20	10
((~~II~~)) 3 (with flashpoint ≥100°F)	8,800	5	10	5
((~~III~~)) 4	22,000	5	10	5

Note 1: When 2 or more ((~~classes~~)) categories of materials are stored in a single pile, the maximum gallonage in that pile must be the smallest of the 2 or more separate gallonages.

Note 2: Within 200 ft. of each container, there must be 12-ft. wide access way to permit approach of fire control apparatus.

Note 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 must be doubled.

Note 4: When total quantity stored does not exceed 50 % of maximum per pile, the distances in columns 4 and 5 may be reduced 50 %, but not less than 3 ft.

(b) **Maximum storage.** A maximum of 1,100 gallons of flammable liquids may be located adjacent to buildings located on the same premises and under the same management provided the provisions of (b)(i) and (ii) of this subsection are complied with.

(i) The building must be a one-story building devoted principally to the handling and storing of flammable liquids or the building must have 2-hour fire-resistive exterior walls having no opening within ten feet of such storage.

(ii) Where quantity stored exceeds 1,100 gallons, or provisions of (b)(i) of this subsection cannot be met, you must maintain a minimum distance of 10 feet between buildings and nearest container of flammable liquid.

TABLE H-17
OUTDOOR PORTABLE TANK STORAGE

1 ((~~Class~~)) Category	2 Maximum per pile	3 Distance between piles	4 Distance to property line that can be built upon	5 Distance to street, alley, public way
	gal.	ft.	ft.	ft.
((~~IA~~)) 1	2,200	5	20	10
((~~IB~~)) 2	4,400	5	20	10
((~~IC~~)) 3 (with flashpoint <100°F	8,800	5	20	10
((~~II~~)) 3 (with flashpoint ≥100°F	17,600	5	10	5
((~~III~~)) 4	44,000	5	10	5

Note 1: When 2 or more ((~~classes~~)) categories of materials are stored in a single pile, the maximum gallonage in that pile must be the smallest of the 2 or more separate gallonages.

Note 2: Within 200 ft. of each portable tank, there must be a 12-ft. wide access way to permit approach of fire control apparatus.

Note 3: The distances listed apply to properties that have protection for exposures as defined. If there are exposures, and such protection for exposures does not exist, the distances in column 4 must be doubled.

Note 4: When total quantity stored does not exceed 50 % of maximum per pile, the distances in columns 4 and 5 may be reduced 50 %, but not less than 3 ft.

(c) **Spill containment.** You must grade the storage area in a manner to divert possible spills away from buildings or other exposures or surround it by a curb at least 6 inches high. When curbs are used, you must make provisions for draining of accumulations of ground or rain water or spills of flammable liquids. Drains must terminate at a safe location and must be accessible to operation under fire conditions.

(d) **Security.** You must protect the storage area against tampering or trespassers where necessary and keep it free of weeds, debris and other combustible material not necessary to the storage.

(7) **Fire control.**

(a) **Extinguishers.** You must make available suitable fire control devices, such as small hose or portable fire extinguishers, at locations where flammable liquids are stored.

(i) At least one portable fire extinguisher having a rating of not less than 12-B units must be located outside of, but not more than 10 feet from, the door opening into any room used for storage.

(ii) At least one portable fire extinguisher having a rating of not less than 12-B units must be located not less than 10 feet, nor more than 25 feet, from any Category 1, 2, or 3 flammable liquid storage area located outside of a storage room but inside a building.

Note: For additional requirements relating to portable fire extinguishers see WAC 296-800-300.

(b) **Sprinklers.** When sprinklers are provided, you must install them in accordance with chapter 296-24 WAC, Part G-3.

(c) **Open flames and smoking.** You must not permit open flames and smoking in flammable liquid storage areas.

(d) **Water reactive materials.** You must not store materials which will react with water in the same room with flammable liquids.

AMENDATORY SECTION (Amending WSR 15-24-100, filed 12/1/15, effective 1/5/16)

WAC 296-24-33013 Bulk plants. (1) **Storage.**

(a) **Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C).** You must store Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), in closed containers, or in storage tanks above ground outside of buildings, or underground in accordance with WAC 296-24-33005.

(b) **Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) and Category 4 flammable liquids.** You must store Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) and Category 4 flammable liquids in containers, or in tanks within buildings or above ground outside of buildings, or underground in accordance with WAC 296-24-33005.

(c) **Piling containers.** You must separate containers of flammable liquids when piled one upon the other by dunnage sufficient to provide stability and to prevent excessive stress on container walls. The height of the pile must be consistent with the stability and strength of containers.

(2) **Buildings.**

(a) **Exits.** Rooms in which flammable liquids are stored or handled by pumps must have exit facilities arranged to prevent occupants from being trapped in the event of fire.

(b) **Heating.** Rooms in which Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are stored or handled must be heated only by means not constituting a source of ignition, such as steam or hot water. Rooms containing heating appliances involving sources of ignition must be located and arranged to prevent entry of flammable vapors.

(c) **Ventilation.**

(i) You must provide ventilation for all rooms, buildings, or enclosures in which Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are pumped or dispensed. Design of ventilation systems must take into account the relatively high specific gravity of the vapors. Ventilation may be provided by adequate openings in outside walls at floor level unobstructed except by louvers or course screens. Where natural ventilation is inadequate, you must provide mechanical ventilation.

(ii) You must not store or handle Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), within a building having a basement or pit into which flammable vapors may travel, unless

such area is provided with ventilation designed to prevent the accumulation of flammable vapors therein.

(iii) You must not draw from or fill containers of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), within buildings unless provision is made to prevent the accumulation of flammable vapors in hazardous concentrations. Where mechanical ventilation is required, you must keep it in operation while flammable liquids with a flashpoint below 100°F (37.8°C) are being handled.

(3) **Loading and unloading facilities.**

(a) **Separation.** You must separate tank vehicle and tank car loading or unloading facilities from aboveground tanks, warehouses, other plant buildings or nearest line of adjoining property that may be built upon by a distance of twenty-five feet for Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), and fifteen feet for Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) and Category 4 flammable liquids measured from the nearest position of any fill spout. Buildings for pumps or shelters for personnel may be a part of the facility.

(b) **Category restriction.** You must not use equipment such as piping, pumps, and meters used for the transfer of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), between storage tanks and the fill stem of the loading rack for the transfer of Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) or Category 4 flammable liquids.

(c) **Valves.** Valves used for the final control for filling tank vehicles must be of the self-closing type and manually held open except where automatic means are provided for shutting off the flow when the vehicle is full or after filling of a preset amount.

(d) **Static protection.**

(i) You must provide bonding facilities for protection against static sparks during the loading of tank vehicles through open domes:

(A) Where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are loaded; or

(B) Where Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) or Category 4 flammable liquids are loaded into vehicles which may contain vapors from previous cargoes of Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C).

(ii) Protection as required in (d)(i) of this subsection must consist of a metallic bond wire permanently electrically connected to the fill stem or to some part of the rack structure in electrical contact with the fill stem. The free end of such wire must be provided with a clamp or equivalent device for convenient attachment to some metallic part in electrical contact with the cargo tank of the tank vehicle.

(iii) Such bonding connection must be made fast to the vehicle or tank before dome covers are raised and must remain in place until filling is completed and all dome covers have been closed and secured.

(iv) Bonding as specified in (d)(i), (ii) and (iii) of this subsection is not required:

(A) Where vehicles are loaded exclusively with products not having a static accumulating tendency, such as asphalt, most crude oils, residual oils, and water soluble liquids;

(B) Where no Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are handled at the loading facility and the tank vehicles loaded are used exclusively for Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) and Category 4 flammable liquids; and

(C) Where vehicles are loaded or unloaded through closed bottom or top connections.

(v) Filling through open domes into the tanks of tank vehicles or tank cars, that contain vapor-air mixtures within the flammable range or where the liquid being filled can form such a mixture, must be by means of a downspout which extends near the bottom of the tank. This precaution is not required when loading liquids which are nonaccumulators of static charges.

(e) **Stray currents.** You must protect tank car loading facilities where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are loaded through open domes against stray currents by bonding the pipe to at least one rail and to the rack structure if of metal. You must electrically bond multiple lines entering the rack area shall be electrically bonded together. In addition, in areas where excessive stray currents are known to exist, you must provide all pipe entering the rack area with insulating sections to electrically isolate the rack piping from the pipelines. No bonding between the tank car and the rack or piping is required during either loading or unloading of Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) or Category 4 flammable liquids.

(f) **Container filling facilities.** Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), must not be dispensed into containers unless the nozzle and container are electrically interconnected. Where the metallic floorplate on which the container stands while filling is electrically connected to the fill stem or where the fill stem is bonded to the container during filling operations by means of a bond wire, the provisions of these standards must be deemed to have been complied with.

(4) **Wharves.**

(a) **Definition, application.** The term wharf must mean any wharf, pier, bulkhead, or other structure over or contiguous to navigable water used in conjunction with a bulk plant, the primary function of which is the transfer of flammable liquid cargo in bulk between the bulk plant and any tank vessel, ship, barge, lighter boat, or other mobile floating craft; and this subparagraph must apply to all such installations except marine service stations as covered in WAC 296-24-33015.

(b) **Package cargo.** Package cargo of flammable liquids, including full and empty drums, bulk fuel, and stores may be handled over a wharf and at such times and places as may be agreed upon by the wharf superintendent and the senior deck officer on duty.

(c) **Location.** Wharves at which flammable liquid cargoes are to be transferred in bulk quantities to or from tank vessels must be at least 100 feet from any bridge over a navigable waterway, or from an entrance to or superstructure of

any vehicular or railroad tunnel under a waterway. The termination of the wharf loading or unloading fixed piping must be at least 200 feet from a bridge or from an entrance to or superstructure of a tunnel.

(d) **Design and construction.** Substructure and deck must be substantially designed for the use intended. Deck may employ any material which will afford the desired combination of flexibility, resistance to shock, durability, strength, and fire resistance. Heavy timber construction is acceptable.

(e) **Tanks.** Tanks used exclusively for ballast water or ((~~Class II or Class III~~)) Category 3 or Category 4 liquids may be installed on suitably designed wharves.

(f) **Pumps.** You must provide loading pumps capable of building up pressures in excess of the safe working pressure of cargo hose or loading arms with bypasses, relief valves, or other arrangement to protect the loading facilities against excessive pressure. You must test relief devices at not more than yearly intervals to determine that they function satisfactorily at the pressure at which they are set.

(g) **Hoses and couplings.** You must inspect all pressure hoses and couplings at intervals appropriate to the service. You must test the hose and couplings with the hose extended and using the "inservice maximum operating pressures." You must withdraw any hose showing material deteriorations, signs of leakage, or weakness in its carcass or at the couplings from service and repair or discard it.

(h) **Piping and fittings.** Piping, valves, and fittings must be in accordance with WAC 296-24-33007 with the following exceptions and additions:

(i) You must ensure flexibility of piping by appropriate layout and arrangement of piping supports so that motion of the wharf structure resulting from wave action, currents, tides, or the mooring of vessels will not subject the pipe to repeated strain beyond the elastic limit.

(ii) You must not use pipe joints depending upon the friction characteristics of combustible materials or grooving of pipe ends for mechanical continuity of piping.

(iii) Swivel joints may be used in piping to which hoses are connected, and for articulated swivel-joint transfer systems, provided that the design is such that the mechanical strength of joint will not be impaired if the packing material should fail, as by exposure to fire.

(iv) Piping systems must contain a sufficient number of valves to operate the system properly and to control the flow of liquid in normal operation and in the event of physical damage.

(v) In addition to the requirements of (4)(h)(iv), you must provide each line conveying Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), leading to a wharf with a readily accessible block valve located on shore near the approach to the wharf and outside of any diked area. Where more than one line is involved, you must group the valves in one location.

(vi) You must provide means of easy access for cargo line valves located below the wharf deck.

(vii) You must adequately bond and ground pipelines on flammable liquids wharves. If excessive stray currents are encountered, you must install insulating points. Bonding and grounding connections on all pipelines must be located on wharfside of hose-riser insulating flanges, if used, and must be accessible for inspection.

(viii) Hose or articulated swivel-joint pipe connections used for cargo transfer must be capable of accommodating the combined effects of change in draft and maximum tidal range, and you must keep mooring lines adjusted to prevent the surge of the vessel from placing stress on the cargo transfer system.

(ix) You must support hose so as to avoid kinking and damage from chafing.

(i) **Fire protection.** Suitable portable fire extinguishers with a rating of not less than 12-BC must be located with 75 feet of those portions of the facility where fires are likely to occur, such as hose connections, pumps, and separator tanks.

(i) Where piped water is available, you must provide ready-connected fire hose in size appropriate for the water supply so that manifolds where connections are made and broken can be reached by at least one hose stream.

(ii) You must not place material on wharves in such a manner as to obstruct access to firefighting equipment, or important pipeline control valves.

(iii) Where the wharf is accessible to vehicle traffic, you must maintain an unobstructed roadway to the shore end of the wharf for access of firefighting apparatus.

(j) **Operations control.** You must not commence loading or discharging until the wharf superintendent and officer in charge of the tank vessel agree that the tank vessel is properly moored and all connections are properly made. You must not perform mechanical work on the wharf during cargo transfer, except under special authorization by a delegated person or the delegated persons authorized representative based on a review of the area involved, methods to be employed, and precaution necessary.

(5) **Electrical equipment.**

(a) **Application.** This subsection applies to areas where Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), are stored or handled. For areas where Category 3 flammable liquids with a flashpoint at or above 100°F (37.8°C) or Category 4 flammable liquids are stored or handled, the electrical equipment may be installed according to chapter 296-24 WAC Part L for ordinary locations.

(b) **Conformance.** All electrical equipment and wiring must be of a type specified by and you must install it according to chapter 296-24 WAC Part L.

(c) **Classification.** So far as it applies Table H-18 must be used to delineate and classify hazardous areas for the purpose of installation of electrical equipment under normal circumstances. In Table H-18 a classified area must not extend beyond an unpierced wall, roof, or other solid partition. The area classifications listed must be based on the premise that the installation meets the applicable requirements of this section in all respects.

TABLE H-18
ELECTRICAL EQUIPMENT HAZARDOUS AREAS—BULK PLANTS

Location	Class I Group D division	Extent of classified area
Tank vehicle and tank car:[1] Loading through open dome		
	1	Within 3 feet of edge of dome, extending in all directions.
	2	Area between 3 feet and 5 feet from edge of dome, extending in all directions.
Loading through bottom connections with atmospheric venting		
	1	Within 3 feet of point of venting to atmosphere, extending in all directions.
	2	Area between 3 feet and 5 feet from point of venting to atmosphere, extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of loading connection.
Loading through closed dome with atmospheric venting		
	1	Within 3 feet of open end of vent, extending in all directions.
	2	Area between 3 feet and 5 feet from open end of vent, extending in all directions. Also within 3 feet of edge of dome, extending in all directions.
Loading through closed dome with vapor recovery		
	2	Within 3 feet of point of connection of both fill and vapor lines, extending in all directions.
Bottom loading with vapor recovery or any bottom unloading		
	2	Within 3 feet of point of connections extending in all directions. Also up to 18 inches above grade within a horizontal radius of 10 feet from point of connection.
Drum and container filling: Outdoors, or indoors with adequate ventilation		
	1	Within 3 feet of vent and fill opening, extending in all directions.
	2	Area between 3 feet and 5 feet from vent or fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.
Outdoors, or indoors with adequate ventilation		
	1	Within 3 feet of vent and fill opening, extending in all directions.
	2	Area between 3 feet and 5 feet from vent or fill opening, extending in all directions. Also up to 18 inches above floor or grade level within a horizontal radius of 10 feet from vent or fill opening.
Tank—Aboveground: Shell, ends, or roof and dike area		
	2	Within 10 feet from shell, ends, or roof of tank, area inside dikes to level of top of dike.
Vent	1	Within 5 feet of open end of vent, extending in all directions.
	2	Area between 5 feet and 10 feet from open end of vent, extending in all directions.
Floating roof	1	Area above the roof and within the shell.

Location	Class I Group D division	Extent of classified area
Pits:		
Without mechanical ventilation		
	1	Entire area within pit if any part is within a Division 1 or 2 classified area.
With mechanical ventilation		
	2	Entire area within pit if any part is within a Division 1 or 2 classified area.
Containing valves, fittings or piping, and not within a Division 1 or 2 classified area		
	2	Entire pit.
Pumps, bleeders, withdrawal fittings, meters and similar devices:		
Indoors		
	2	Within 5 feet of any edge of such devices, extending in all directions. Also up to 3 feet above floor or grade level within 25 feet horizontally from any edge of such devices.
Outdoors	2	Within 3 feet of any edge of such devices, extending in all directions. Also up to 18 inches above grade level within 10 feet horizontally from any edge of such devices.
Storage and repair garage for tank vehicles		
	1	All pits or spaces below floor level.
	2	Area up to 18 inches above floor or grade level for entire storage or repair garage.
Drainage ditches, separators, impounding basins		
	2	Area up to 18 inches above ditch, separator or basin. Also up to 18 inches above grade within 15 feet horizontally from any edge.
Garages for other than tank vehicles		
	Ordinary	If there is any opening to these rooms within the extent of an outdoor classified area, the entire room must be classified the same as the area classification at the point of the opening.
Outdoor drum storage	Ordinary	
Indoor warehousing where there is no flammable liquid transfer		
	Ordinary	If there is any opening to these rooms within the extent of an indoor classified area, the room must be classified the same as if the wall, curb or partition did not exist.
Office and rest rooms	Ordinary	

[1] When classifying the extent of the area, you must give consideration to the fact that tank cars or tank vehicles may be spotted at varying points. Therefore, you must use the extremities of the loading or unloading positions.

(6) **Sources of ignition.** You must not handle, draw, or dispense Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), where flammable vapors may reach a source of ignition. You must prohibit smoking except in designated localities. You must conspicuously post "No smoking" signs where hazard from flammable liquid vapors is normally present.

(7) **Drainage and waste disposal.** You must make provisions to prevent flammable liquids which may be spilled at loading or unloading points from entering public sewers and drainage systems, or natural waterways. You must provide connection to such sewers, drains, or waterways by which flammable liquids might enter with separator boxes or other approved means whereby such entry is precluded. You must not dump crankcase drainings and flammable liquids into sewers, but you must store them in tanks or tight drums outside of any building until removed from the premises.

(8) **Fire control.** Suitable fire-control devices, such as small hose or portable fire extinguishers, must be available to locations where fires are likely to occur. Additional fire-control equipment may be required where a tank of more than 50,000 gallons individual capacity contains Category 1 or 2 flammable liquids, or Category 3 flammable liquids with a flashpoint below 100°F (37.8°C), and where an unusual exposure hazard exists from surrounding property. Such additional fire-control equipment shall be sufficient to extinguish a fire in the largest tank. The design and amount of such

equipment must be in accordance with approved engineering standards.

AMENDATORY SECTION (Amending WSR 15-24-100, filed 12/1/15, effective 1/5/16)

WAC 296-24-47505 Basic rules. (1) **Odorizing gases.**

(a) You must effectively odorize all liquefied petroleum gases by an approved agent of such character as to indicate positively, by distinct odor, the presence of gas down to concentration in air of not over one-fifth the lower limit of flammability. Odorization, however, is not required if harmful in the use of further processing of the liquefied petroleum gas, or if odorization will serve no useful purpose as a warning agent in such use or further processing.

(b) The odorization requirement of (a) of this subsection will be considered to be met by the use of 1.0 pounds of ethyl mercaptan, 1.0 pounds of thiophane or 1.4 pounds of amyl mercaptan per 10,000 gallons of LP-gas. However, this listing of odorants and quantities must not exclude the use of other odorants that meet the odorization requirements of (a) of this subsection.

(2) **Approval of equipment and systems.**

(a) Each system utilizing DOT containers in accordance with 49 C.F.R. Part 178 must have its container valves, connectors, manifold valve assemblies, and regulators approved.

(b) Each system for domestic or commercial use utilizing containers of two thousand gallons or less water capacity, other than those constructed in accordance with 49 C.F.R. Part 178, must consist of a container assembly and one or more regulators, and may include other parts. You must individually list the system as a unit or the container assembly as a unit, and the regulator or regulators.

(c) In systems utilizing containers of over two thousand gallons water capacity, each regulator, container, valve, excess flow valve, gaging device, and relief valve installed on or at the container, must have its correctness as to design, construction, and performance determined by listing by a nationally recognized testing laboratory. Refer to federal regulation 29 C.F.R. 1910.7 for definition of nationally recognized testing laboratory.

(d) You must not construe the provisions of subsection (3)(a) of this section as prohibiting the continued use or reinstallation of containers constructed and maintained in accordance with the standard for the Storage and Handling of Liquefied Petroleum Gases NFPA No. 58 in effect at the time of fabrication.

(e) Containers used with systems embodied in this section and WAC 296-24-47509 (3)(c) and 296-24-47513, must be constructed, tested, and stamped in accordance with DOT specifications effective at the date of their manufacture.

(3) **Requirements for construction and original test of containers.**

(a) You must design, construct, and test containers used with systems embodied in WAC 296-24-47509, 296-24-47513 through 296-24-47517, except as provided in WAC 296-24-47511 (3)(c), in accordance with the Rules for Construction of Unfired Pressure Vessels, section VIII, Division 1, American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code, 1968 edition.

(b) Containers constructed according to the 1949 and earlier editions of the ASME Code do not have to comply with U-2 through U-10 and U-19 thereof. Containers constructed according to U-70 in the 1949 and earlier editions do not meet the requirements of this section.

(c) Containers designed, constructed, and tested prior to July 1, 1961, according to the Code for Unfired Pressure Vessels for Petroleum Liquids and Gases, 1951 edition with 1954 Addenda, of the American Petroleum Institute and the American Society of Mechanical Engineers will be considered in conformance. Containers constructed according to API-ASME Code do not have to comply with section I or with appendix to section I. W-601 to W-606 inclusive in the 1943 and earlier editions do not apply.

(4) **Welding of containers.**

(a) You must perform welding to the shell, head, or any other part of the container subject to internal pressure, in compliance with the code under which the tank was fabricated. Other welding is permitted only on saddle plates, lugs, or brackets attached to the container by the tank manufacturer.

(b) Where repair or modification involving welding of DOT containers is required, you must return the container to a qualified manufacturer making containers of the same type, and the repair or modification made in compliance with DOT regulations.

(5) **Markings on container.**

(a) You must mark each container covered in subsection (3)(a) of this section except as provided in subsection (2)(d) of this section as specified in the following:

(i) With a marking identifying compliance with, and other markings required by, the rules of the reference under which the container is constructed; or with the stamp and other markings required by the laws, rules or regulations as administered by the state of Washington, department of labor and industries pertaining to such containers.

(ii) With notation as to whether the container is designed for underground or aboveground installation or both. If intended for both and different style hoods are provided, the marking must indicate the proper hood for each type of installation.

(iii) With the name and address of the supplier of the container, or with the trade name of the container.

(iv) With the water capacity of the container in pounds or gallons, United States standard.

(v) With the pressure in p.s.i.g., for which the container is designed.

(vi) With the wording "This container must not contain a product having a vapor pressure in excess of—p.s.i.g. at 100°F," see WAC 296-24-47509, Table H-31.

(vii) With the tare weight in pounds or other identified unit of weight for containers with a water capacity of three hundred pounds or less.

(viii) With marking indicating the maximum level to which the container may be filled with liquid at temperatures between 20°F and 130°F, except on containers provided with fixed maximum level indicators or which are filled by weighing. Markings must be increments of not more than 20°F. This marking may be located on the liquid level gaging device.

(ix) With the outside surface area in square feet.

(b) Markings specified must be on a metal nameplate attached to the container and located in such a manner as to remain visible after the container is installed.

(c) When LP-gas and one or more other gases are stored or used in the same area, you must mark the containers to identify their content. Marking must be in compliance with American National Standard Z48.1-1954, "Method of Marking Portable Compressed Gas Containers to Identify the Material Contained."

(6) **Location of containers and regulating equipment.**

(a) You must locate containers, and first stage regulating equipment if used, outside of buildings, except under one or more of the following:

(i) In buildings used exclusively for container charging, vaporization pressure reduction, gas mixing, gas manufacturing, or distribution.

(ii) When portable use is necessary and in accordance with WAC 296-24-47507(5).

(iii) LP-gas fueled stationary or portable engines in accordance with WAC 296-24-47511 (11) or (12).

(iv) LP-gas fueled industrial trucks used in accordance with WAC 296-24-47511(13).

(v) LP-gas fueled vehicles garaged in accordance with WAC 296-24-47511(14).

(vi) Containers awaiting use or resale when stored in accordance with WAC 296-24-47513.

(b) You must locate each individual container with respect to the nearest important building or group of buildings or line of adjoining property which may be built on in accordance with Table H-23.

TABLE H-23

Water capacity per container	Minimum distances		
	Containers		Between above-ground containers
	Underground	Above-ground	
Less than 125 gals[1]	10 feet	None	None
125 to 250 gallons	10 feet	10 feet	None.
251 to 500 gallons	10 feet	10 feet	3 feet.
501 to 2,000 gallons	25 feet[2]	25 feet[2]	3 feet.
2,001 to 30,000 gallons	50 feet	50 feet	5 feet.
30,001 to 70,000 gallons	50 feet	75 feet	1/4 of sum diameters of adjacent containers.
70,001 to 90,000 gallons	50 feet	100 feet	

[1] If the aggregate water capacity of a multicontainer installation at a consumer site is five hundred one gallons or greater, the minimum distance must comply with the appropriate portion of this table, applying the aggregate capacity rather than the capacity per container. If more than one installation is made, each installation must be separated from another installation by at least twenty-five feet. Do not apply the MINIMUM DISTANCES BETWEEN ABOVEGROUND CONTAINERS to such installations.

[2]Note: The above distance requirements may be reduced to not less than ten feet for a single container of one thousand two hundred gallons water capacity or less, providing such a container is at least twenty-five feet from any other LP-gas container of more than one hundred twenty-five gallons water capacity.

(c) You must not stack containers installed for use one above the other.

(d) In industrial installations involving containers of one hundred eighty thousand gallons aggregate water capacity or more, where serious mutual exposures between the container and adjacent properties prevail, firewalls or other means of special protection designed and constructed in accordance with good engineering practices are required.

(e) In the case of buildings devoted exclusively to gas manufacturing and distributing operations, the distances required by Table H-23 may be reduced provided that in no case you locate containers of water capacity exceeding 500 gallons be located closer than 10 feet to such gas manufacturing and distributing buildings.

(f) You must remove readily ignitible material such as weeds and long dry grass within 10 feet of any container.

(g) The minimum separation between liquefied petroleum gas containers and flammable liquid tanks must be 20 feet, and the minimum separation between a container and the centerline of the dike must be 10 feet. The foregoing provision must not apply when LP-gas containers of 125 gallons or less capacity are installed adjacent to ((~~Class III~~)) Category 4 flammable liquid tanks of 275 gallons or less capacity.

(h) You must take suitable means to prevent the accumulation of flammable liquids under adjacent liquefied petroleum gas containers, such as by diking, diversion curbs, or grading.

(i) When dikes are used with flammable liquid tanks, you must not locate any liquefied petroleum gas containers within the diked area.

(7) **Container valves and container accessories.**

(a) Valves, fittings, and accessories connected directly to the container including primary shutoff valves, must have a rated working pressure of at least 250 p.s.i.g. and must be of material and design suitable for LP-gas service. You must not use cast iron for container valves, fittings, and accessories. This does not prohibit the use of container valves made of malleable or nodular iron.

(b) Connections to containers, except safety relief connections, liquid level gaging devices, and plugged openings, must have shutoff valves located as close to the container as practicable.

(c) Excess flow valves, where required must close automatically at the rated flows of vapor or liquid as specified by the manufacturer. The connections or line including valves, fittings, etc., being protected by an excess flow valve must

have a greater capacity than the rated flow of the excess flow valve.

(d) Liquid level gaging devices which are so constructed that outward flow of container contents must not exceed that passed by a No. 54 drill size opening, need not be equipped with excess flow valves.

(e) Openings from container or through fittings attached directly on container to which pressure gage connection is made, need not be equipped with shutoff or excess flow valves if such openings are restricted to not larger than No. 54 drill size opening.

(f) Except as provided in WAC 296-24-47507 (5)(a)(ii), you must locate excess flow and back pressure check valves where required by this section inside of the container or at a point outside where the line enters the container; in the latter case, you must install in such manner that any undue strain beyond the excess flow or back pressure check valve will not cause breakage between the container and such valve.

(g) You must design excess flow valves with a bypass, not to exceed a No. 60 drill size opening to allow equalization of pressures.

(h) You must equip containers of more than 30 gallons water capacity and less than two thousand gallons water capacity, filled on a volumetric basis, and manufactured after December 1, 1963, for filling into the vapor space.

(8) **Piping—Including pipe, tubing, and fittings.**

(a) Pipe, except as provided in WAC 296-24-47511 (6)(a) must be wrought iron or steel (black or galvanized), brass, copper, or aluminum alloy. Aluminum alloy pipe must be at least Schedule 40 in accordance with the specifications for Aluminum Alloy Pipe, American National Standards Institute (ANSI) H38.7-1969 (ASTM, B241-1969), except that the use of alloy 5456 is prohibited and must be suitably marked at each end of each length indicating compliance with American National Standard Institute specifications. You must protect aluminum alloy pipe against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by such liquids as water (except rain water), detergents, sewage, or leaking from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum nominal pipe size for aluminum pipe must be 3/4 inch and must not be used for pressures exceeding 20 p.s.i.g. You must not install aluminum alloy pipe within 6 inches of the ground.

(i) Vapor piping with operating pressures not exceeding 125 p.s.i.g. must be suitable for a working pressure of at least 125 p.s.i.g. Pipe must be at least Schedule 40 ASTM A-53-69, Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal.

(ii) Vapor piping with operating pressures over 125 p.s.i.g. and all liquid piping must be suitable for a working pressure of at least 250 p.s.i.g. Pipe must be at least Schedule 80 if joints are threaded or threaded and back welded. You must use at least Schedule 40 (ASTM A-53-1969 Grade B Electric Resistance Welded and Electric Flash Welded Pipe or equal) if joints are welded, or welded and flanged.

(b) Tubing must be seamless and of copper, brass, steel, or aluminum alloy. Copper tubing must be of Type K or L or equivalent as covered in the Specification for Seamless Copper Water Tube, ANSI H23.1-1970 (ASTM B88-1969). Aluminum alloy tubing must be of Type A or B or equivalent as covered in Specification ASTM B210-1968 and must be suitably marked every eighteen inches indicating compliance with ASTM specifications. The minimum nominal wall thickness of copper tubing and aluminum alloy tubing must be as specified in Table H-24 and Table H-25.

TABLE H-24

WALL THICKNESS OF COPPER TUBING[1]

Note: The standard size by which tube is designated is one-eighth-inch smaller than its nominal outside diameter.

Standard size (inches)	Nominal O.D. (inches)	Nominal wall thickness (inches)	
		Type K	Type L
1/4	0.375	0.035	0.030
3/8	0.500	0.049	0.035
1/2	0.625	0.049	0.040
5/8	0.750	0.049	0.042
3/4	0.875	0.065	0.045
1	1.125	0.065	0.050
1 1/4	1.375	0.065	0.055
1 1/2	1.625	0.072	0.060
2	2.125	0.083	0.070

[1] Based on data in Specification for Seamless Copper Water Tubing, ANSI H23.1-1970 (ASTM B-88-69).

TABLE H-25

WALL THICKNESS OF ALUMINUM ALLOY TUBING[1]

Outside diameter (inches)	Nominal wall thickness (inches)	
	Type A	Type B
3/8	0.035	0.049
1/2	0.035	0.049
5/8	0.042	0.049
3/4	0.049	0.058

[1] Based on data in Standard Specification for Aluminum-Alloy Drawn Seamless Coiled Tubes for Special Purpose Applications, ASTM B210-68.

You must protect aluminum alloy tubing against external corrosion when it is in contact with dissimilar metals other than galvanized steel, or its location is subject to repeated wetting by liquids such as water (except rainwater), detergents, sewage, or leakage from other piping, or it passes through flooring, plaster, masonry, or insulation. Galvanized sheet steel or pipe, galvanized inside and out, may be considered suitable protection. The maximum outside diameter for aluminum alloy tubing must be 3/4 inch and must not be used for pressures exceeding 20 p.s.i.g. You must not install aluminum alloy tubing within six inches of the ground.

(c) In systems where the gas in liquid form without pressure reduction enters the building, you must use only heavy walled seamless brass or copper tubing with an internal diameter not greater than 3/32 inch, and a wall thickness of not less than three sixty-fourths inch. This requirement does not

apply to research and experimental laboratories, buildings, or separate fire divisions of buildings used exclusively for housing internal combustion engines, and to commercial gas plants or bulk stations where containers are charged, nor to industrial vaporizer buildings, nor to buildings, structures, or equipment under construction or undergoing major renovation.

(d) Pipe joints may be screwed, flanged, welded, soldered, or brazed with a material having a melting point exceeding 1,000°F. Joints on seamless copper, brass, steel, or aluminum alloy gas tubing must be made by means of approved gas tubing fittings, or soldered or brazed with a material having a melting point exceeding 1,000°F.

(e) For operating pressures of 125 p.s.i.g. or less, fittings must be designed for a pressure of at least 125 p.s.i.g. For operating pressures above 125 p.s.i.g., fittings must be designed for a minimum of 250 p.s.i.g.

(f) The use of threaded cast iron pipe fittings such as ells, tees, crosses, couplings, and unions is prohibited. You must use aluminum alloy fittings with aluminum alloy pipe and tubing. You must use insulated fittings where aluminum alloy pipe or tubing connects with a dissimilar metal.

(g) Strainers, regulators, meters, compressors, pumps, etc., are not to be considered as pipe fittings. This does not prohibit the use of malleable, nodular, or higher strength gray iron for such equipment.

(h) All materials such as valve seats, packing, gaskets, diaphragms, etc., must be of such quality as to be resistant to the action of liquefied petroleum gas under the service conditions to which they are subjected.

(i) You must test all piping, tubing, or hose after assembly and proved free from leaks at not less than normal operating pressures. After installation, you must test piping and tubing of all domestic and commercial systems and prove it to be free of leaks using a manometer or equivalent device that will indicate a drop in pressure. Test must not be made with a flame.

(j) You must make provisions to compensate for expansion, contraction, jarring, and vibration, and for settling. This may be accomplished by flexible connections.

(k) Piping outside buildings may be buried, above ground, or both, but must be well supported and protected against physical damage. Where soil conditions warrant, you must protect all piping against corrosion. Where condensation may occur, you must pitch the piping back to the container, or provide suitable means for revaporization of the condensate.

(9) **Hose specifications.**

(a) Hose must be fabricated of materials that are resistant to the action of LP-gas in the liquid and vapor phases. If wire braid is used for reinforcing the hose, it must be of corrosion-resistant material such as stainless steel.

(b) You must mark any hose subject to container pressure "LP-gas" or "LPG" at not greater than ten-foot intervals.

(c) Hose subject to container pressure must be designed for a bursting pressure of not less than 1,250 p.s.i.g.

(d) Hose subject to container pressure must have its correctness as to design construction and performance determined by being listed (see WAC 296-24-47501(15)).

(e) Hose connections subject to container pressure must be capable of withstanding, without leakage, a test pressure of not less than 500 p.s.i.g.

(f) Hose and hose connections on the low-pressure side of the regulator or reducing valve must be designed for a bursting pressure of not less than 125 p.s.i.g. or five times the set pressure of the relief devices protecting that portion of the system, whichever is higher.

(g) Hose may be used on the low-pressure side of regulators to connect to other than domestic and commercial gas appliances under the following conditions:

(i) The appliances connected with hose must be portable and need a flexible connection.

(ii) For use inside buildings the hose must be of minimum practical length, but must not exceed 6 feet except as provided in WAC 296-24-47507 (5)(a)(vii) and must not extend from one room to another, nor pass through any walls, partitions, ceilings, or floors. You must not conceal such hose from view or used in a concealed location. For use outside of buildings, the hose may exceed this length but you must keep it as short as practical.

(iii) The hose must be approved and you must not use it where it is likely to be subjected to temperatures above 125°F. You must securely connect the hose to the appliance and you must not permit the use of rubber slip ends.

(iv) The shutoff valve for an appliance connected by hose must be in the metal pipe or tubing and not at the appliance end of the hose. When shutoff valves are installed close to each other, you must take precautions to prevent operation of the wrong valve.

(v) You must protect hose used for connecting to wall outlets from physical damage.

(10) **Safety devices.**

(a) You must provide every container except those constructed in accordance with DOT specifications and every vaporizer (except motor fuel vaporizers and except vaporizers described in subsection (11)(b)(iii) of this section and WAC 296-24-47509 (4)(e)(i)) whether heated by artificial means or not, with one or more safety relief valves of spring-loaded or equivalent type. You must arrange these valves to afford free vent to the outer air with discharge not less than five feet horizontally away from any opening into the building which is below such discharge. The rate of discharge must be in accordance with the requirements of (b) or (d) of this subsection in the case of vaporizers.

(b) Minimum required rate of discharge in cubic feet per minute of air at 120% of the maximum permitted start to discharge pressure for safety relief valves to be used on containers other than those constructed in accordance with DOT specification must be as follows:

Surface area (sq. ft.)	Flow rate CFM air
20 or less	626
25	751
30	872
35	990
40	1,100
45	1,220
50	1,330

Surface area (sq. ft.)	Flow rate CFM air
55	1,430
60	1,540
65	1,640
70	1,750
75	1,850
80	1,950
85	2,050
90	2,150
95	2,240
100	2,340
105	2,440
110	2,530
115	2,630
120	2,720
125	2,810
130	2,900
135	2,990
140	3,080
145	3,170
150	3,260
155	3,350
160	3,440
165	3,530
170	3,620
175	3,700
180	3,790
185	3,880
190	3,960
195	4,050
200	4,130
210	4,300
220	4,470
230	4,630
240	4,800
250	4,960
260	5,130
270	5,290
280	5,450
290	5,610
300	5,760
310	5,920
320	6,080
330	6,230
340	6,390
350	6,540
360	6,690
370	6,840
380	7,000
390	7,150
400	7,300
450	8,040
500	8,760
550	9,470
600	10,170
650	10,860
700	11,550
750	12,220
800	12,880
850	13,540
900	14,190
950	14,830
1,000	15,470
1,050	16,100
1,100	16,720
1,150	17,350
1,200	17,960
1,250	18,570
1,300	19,180
1,350	19,780
1,400	20,380
1,450	20,980
1,500	21,570
1,550	22,160
1,600	22,740
1,650	23,320
1,700	23,900
1,750	24,470
1,800	25,050
1,850	25,620
1,900	26,180
1,950	26,750
2,000	27,310

Surface area = total outside surface area of container in square feet.

(c) When the surface area is not stamped on the nameplate or when the marking is not legible, the area can be calculated by using one of the following formulas:

(i) Cylindrical container with hemispherical heads:

Area = Overall length x outside diameter x 3.1416.

(ii) Cylindrical container with other than hemispherical heads:

Area = (Overall length + 0.3 outside diameter) x outside diameter x 3.1416.

Note: This formula is not exact, but will give results within the limits of practical accuracy for the sole purpose of sizing relief valves.

(iii) Spherical container:

Area = Outside diameter squared x 3.1416.

Flow rate-CFM air = Required flow capacity in cubic feet per minute of air at standard conditions, 60°F and atmospheric pressure (14.7 p.s.i.a.).

The rate of discharge may be interpolated for intermediate values of surface area. For containers with total outside surface area greater than two thousand square feet, the required flow rate can be calculated using the formula, flow rate-CFM air = $53.632\ A^{0.82}$.

A = Total outside surface area of the container in square feet.

Valves not marked "air" have flow rate marking in cubic feet per minute of liquefied petroleum gas. These can be converted to ratings in cubic feet per minute of air by multiplying the liquefied petroleum gas ratings by factors listed below. Air flow ratings can be converted to ratings in cubic feet per minute of liquefied petroleum gas by dividing the air ratings by the factors listed below.

AIR CONVERSION FACTORS

Container type	100	125	150	175	200
Air conversion factor	1.162	1.142	1.113	1.078	1.010

(d) Minimum required rate of discharge for safety relief valves for liquefied petroleum gas vaporizers (steam heated, water heated, and direct fired).

You must determine the minimum required rate of discharge for safety relief valves as follows:

(i) Obtain the total surface area by adding the surface area of vaporizer shell in square feet directly in contact with LP-gas and the heat exchanged surface area in square feet directly in contact with LP-gas.

(ii) Obtain the minimum required rate of discharge in cubic feet of air per minute, at 60°F and 14.7 p.s.i.a. from (b) of this subsection, for this total surface area.

(e) You must set container and vaporizer safety relief valves to start-to-discharge, with relation to the design pressure of the container, in accordance with Table H-26.

TABLE H-26

Containers	Minimum (%)	Minimum (%)
ASME Code; Par. U-68, U-69—1949 and earlier editions	110	[1]125
ASME Code; Par. U-200, U-201—1949 edition	88	[1]100
ASME Code—1950, 1952, 1956, 1959, 1962, 1965 and 1968 (Division I) editions	88	[1]100
API—ASME Code—all editions	88	[1]100
DOT—As prescribed in 49 C.F.R. Chapter I		

[1] Manufacturers of safety relief valves are allowed a plus tolerance not exceeding 10% of the set pressure marked on the valve.

(f) Safety relief devices used with systems employing containers other than those constructed according to DOT specifications must be so constructed as to discharge at not less than the rates shown in (b) of this subsection, before the pressure is in excess of 120% of the maximum (not including the 10% referred to in (e) of this subsection) permitted start to discharge pressure setting of the device.

(g) In certain locations sufficiently sustained high temperatures prevail which require the use of a lower vapor pressure product to be stored or the use of a higher designed pressure vessel in order to prevent the safety valves opening as the result of these temperatures. As an alternative the tanks may be protected by cooling devices such as by spraying, by shading, or other effective means.

(h) You must arrange safety relief valves so that the possibility of tampering will be minimized. If pressure setting or adjustment is external, you must provide the relief valves with approved means for sealing adjustment.

(i) You must not install shutoff valves between the safety relief devices and the container, or the equipment or piping to which the safety relief device is connected except that a shutoff valve may be used where the arrangement of this valve is such that full required capacity flow through the safety relief device is always afforded.

(j) Safety relief valves must have direct communication with the vapor space of the container at all times.

(k) You must plainly and permanently mark each container safety relief valve used with systems covered by WAC 296-24-47509, 296-24-47511, and 296-24-47517, except as provided in WAC 296-24-47511 (3)(c) with the following: "Container type" of the pressure vessel on which the valve is designed to be installed; the pressure in p.s.i.g. at which the valve is set to discharge; the actual rate of discharge of the valve in cubic feet per minute of air at 60°F and 14.7 p.s.i.a.; and the manufacturer's name and catalog number, for example: T200-250-4050 AIR—indicating that the valve is suitable for use on a Type 200 container, that it is set to start to discharge at 250 p.s.i.g.; and that its rate of discharge is four thousand fifty cubic feet per minute of air as determined in (b) of this subsection.

(l) Safety relief valve assemblies, including their connections, must be of sufficient size so as to provide the rate of flow required for the container on which they are installed.

(m) You must install a hydrostatic relief valve between each pair of shutoff valves on liquefied petroleum gas liquid piping so as to relieve into a safe atmosphere. The start-to-discharge pressure setting of such relief valves must not be in excess of 500 p.s.i.g. The minimum setting on relief valves installed in piping connected to other than DOT containers must not be lower than 140% of the container relief valve setting and in piping connected to DOT containers not lower than 400 p.s.i.g. Such a relief valve should not be installed in the pump discharge piping if the same protection can be provided by installing the relief valve in the suction piping. The start-to-discharge pressure setting of such a relief valve, if installed on the discharge side of a pump, must be greater than the maximum pressure permitted by the recirculation device in the system.

(n) The discharge from any safety relief device must not terminate in or beneath any building, except relief devices

covered by subsection (6)(a)(i) through (vi) of this section, or WAC 296-24-47507 (4)(a) or (5).

(o) You must not locate container safety relief devices and regulator relief vents less than 5 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(11) **Vaporizer and housing.**

(a) You must construct and install indirect fired vaporizers utilizing steam, water, or other heating medium as follows:

(i) You must construct vaporizers in accordance with the requirements of subsection (3)(a) through (c) of this section and you must permanently mark them as follows:

(A) With the code marking signifying the specifications to which the vaporizer is constructed.

(B) With the allowable working pressure and temperature for which the vaporizer is designed.

(C) With the sum of the outside surface area and the inside heat exchange surface area expressed in square feet.

(D) With the name or symbol of the manufacturer.

(ii) Vaporizers having an inside diameter of six inches or less exempted by the ASME Unfired Pressure Vessel Code, Section VIII of the ASME Boiler and Pressure Vessel Code—1968 must have a design pressure not less than 250 p.s.i.g. and need not be permanently marked.

(iii) You must not install heating or cooling coils inside a storage container.

(iv) Vaporizers may be installed in buildings, rooms, sheds, or lean-tos used exclusively for gas manufacturing or distribution, or in other structures of light, noncombustible construction or equivalent, well ventilated near the floor line and roof.

When vaporizing and/or mixing equipment is located in a structure or building not used exclusively for gas manufacturing or distribution, either attached to or within such a building, you must separate such structure or room from the remainder of the building by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipe or conduit passing through it. You must provide such structure or room with adequate ventilation and it must have a roof or at least one exterior wall of lightweight construction.

(v) Vaporizers must have, at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with subsection (10)(d) of this section, except as provided in WAC 296-24-47509 (4)(e)(i).

(vi) You must provide the heating medium lines into and leaving the vaporizer with suitable means for preventing the flow of gas into the heat systems in the event of tube rupture in the vaporizer. You must provide vaporizers with suitable automatic means to prevent liquid passing through the vaporizers to the gas discharge piping.

(vii) The device that supplies the necessary heat for producing steam, hot water, or other heating medium may be installed in a building, compartment, room, or lean-to which must be ventilated near the floorline and roof to the outside. You must separate the device location from all compartments or rooms containing liquefied petroleum gas vaporizers, pumps, and central gas mixing devices by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipes or conduit passing through it. This requirement does not apply to the domestic water heaters which may supply heat for a vaporizer in a domestic system.

(viii) You must equip gas-fired heating systems supplying heat exclusively for vaporization purposes with automatic safety devices to shut off the flow of gas to main burners, if the pilot light should fail.

(ix) Vaporizers may be an integral part of a fuel storage container directly connected to the liquid section or gas section or both.

(x) You must not equip vaporizers with fusible plugs.

(xi) Vaporizer houses must not have unprotected drains to sewers or sump pits.

(b) You must install atmospheric vaporizers employing heat from the ground or surrounding air as follows:

(i) Buried underground, or

(ii) Located inside the building close to a point at which pipe enters the building provided the capacity of the unit does not exceed one quart.

(iii) Vaporizers of less than one quart capacity heated by the ground or surrounding air, need not be equipped with safety relief valves provided that adequate tests demonstrate that the assembly is safe without safety relief valves.

(c) You must construct, mark, and install direct gas-fired vaporizers as follows:

(i) In accordance with the requirements of the American Society of Mechanical Engineers Boiler and Pressure Vessel Code—1968 that are applicable to the maximum working conditions for which the vaporizer is designed.

(ii) With the name of the manufacturer; rated BTU input to the burner; the area of the heat exchange surface in square feet; the outside surface of the vaporizer in square feet; and the maximum vaporizing capacity in gallons per hour.

(iii) Vaporizers may be connected to the liquid section or the gas section of the storage container, or both; but in any case there must be at the container a manually operated valve in each connection to permit completely shutting off when desired, of all flow of gas or liquid from container to vaporizer.

(iv) You must locate vaporizers with capacity not exceeding 35 gallons per hour at least 5 feet from container shutoff valves. You must locate vaporizers having capacity of more than 35 gallons but not exceeding 100 gallons per hour at least 10 feet from the container shutoff valves. You must locate vaporizers having a capacity greater than 100 gallons per hour at least 15 feet from container shutoff valves.

(v) Vaporizers may be installed in buildings, rooms, housings, sheds, or lean-tos used exclusively for vaporizing or mixing of liquefied petroleum gas. Vaporizing housing structures must be of noncombustible construction, well ventilated near the floorline and the highest point of the roof. When vaporizer and/or mixing equipment is located in a structure or room attached to or within a building, you must separate such structure or room from the remainder of the building by a wall designed to withstand a static pressure of at least one hundred pounds per square foot. This wall must have no openings or pipes or conduit passing through it. You must provide such structure or room with adequate ventila-

tion, and it must have a roof or at least one exterior wall of lightweight construction.

(vi) Vaporizers must have at or near the discharge, a safety relief valve providing an effective rate of discharge in accordance with subsection (10)(d) of this section. You must locate the relief valve so as not to be subjected to temperatures in excess of 140°F.

(vii) You must provide vaporizers with suitable automatic means to prevent liquid passing from the vaporizer to the gas discharge piping of the vaporizer.

(viii) You must provide vaporizers with means for manually turning off the gas to the main burner and pilot.

(ix) You must equip vaporizers with automatic safety devices to shut off the flow of gas to main burners if the pilot light should fail. When the flow through the pilot exceeds 2,000 B.T.U. per hour, you must also equip the pilot with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(x) You must separate pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired vaporizer from the open flame by a substantially airtight noncombustible partition or partitions.

(xi) Except as provided in (c)(v) of this subsection, you must maintain the following minimum distances between direct fired vaporizers and the nearest important building or group of buildings or line of adjoining property which may be built upon:

(A) 10 feet for vaporizers having a capacity of 15 gallons per hour or less vaporizing capacity.

(B) 25 feet for vaporizers having a vaporizing capacity of 16 to 100 gallons per hour.

(C) 50 feet for vaporizers having a vaporizing capacity exceeding 100 gallons per hour.

(xii) Direct fired vaporizers must not raise the product pressure above the design pressure of the vaporizer equipment nor must they raise the product pressure within the storage container above the pressure shown in the second column of Table H-31. (See WAC 296-24-47509.)

(xiii) You must not provide vaporizers with fusible plugs.

(xiv) Vaporizers must not have unprotected drains to sewers or sump pits.

(d) You must construct and install direct gas-fired tank heaters, as follows:

(i) You must only install direct gas-fired tank heaters, and tanks to which they are applied, above ground.

(ii) You must permanently mark tank heaters with the name of the manufacturer, the rated B.T.U. input to the burner, and the maximum vaporizing capacity in gallons per hour.

Note: Tank heaters may be an integral part of a fuel storage container directly connected to the container liquid section, or vapor section, or both.

(iii) You must provide tank heaters with a means for manually turning off the gas to the main burner and pilot.

(iv) You must equip tank heaters with an automatic safety device to shut off the flow of gas to main burners, if the pilot light should fail. When flow through pilot exceeds 2,000 B.T.U. per hour, you must also equip the pilot with an automatic safety device to shut off the flow of gas to the pilot should the pilot flame be extinguished.

(v) You must separate pressure regulating and pressure reducing equipment if located within 10 feet of a direct fired tank heater from the open flame by a substantially airtight noncombustible partition.

(vi) You must maintain the following minimum distances between a storage tank heated by a direct fired tank heater and the nearest important building or group of buildings or line of adjoining property which may be built upon:

(A) 10 feet for storage containers of less than 500 gallons water capacity.

(B) 25 feet for storage containers of 500 to 1,200 gallons water capacity.

(C) 50 feet for storage containers of over 1,200 gallons water capacity.

(vii) No direct fired tank heater must raise the product pressure within the storage container over 75% of the pressure set out in the second column of Table H-31. (See WAC 296-24-47509.)

(e) You must locate the vaporizer section of vaporizer-burners used for dehydrators or dryers outside of buildings; they must be constructed and installed as follows:

(i) Vaporizer-burners must have a minimum design pressure of 250 p.s.i.g. with a factor of safety of 5.

(ii) Manually operated positive shutoff valves must be located at the containers to shut off all flow to the vaporizer-burners.

(iii) Minimum distances between storage containers and vaporizer-burners must be as follows:

Water capacity per container (gallons)	Minimum distances (feet)
Less than 501	10
501 to 2,000	25
Over 2,000	50

(iv) You must protect the vaporizer section of vaporizer-burners by a hydrostatic relief valve. The relief valve must be located so as not to be subjected to temperatures in excess of 140°F. The start-to-discharge pressure setting must be such as to protect the components involved, but not less than 250 p.s.i.g. You must direct the discharge upward and away from component parts of the equipment and away from operating personnel.

(v) You must provide vaporizer-burners with means for manually turning off the gas to the main burner and pilot.

(vi) You must equip vaporizer-burners with automatic safety devices to shut off the flow of gas to the main burner and pilot in the event the pilot is extinguished.

(vii) You must locate or protect pressure regulating and control equipment so that the temperatures surrounding this equipment do not exceed 140°F except that equipment components may be used at higher temperatures if designed to withstand such temperatures.

(viii) Pressure regulating and control equipment when located downstream of the vaporizer must be designed to withstand the maximum discharge temperature of the vapor.

(ix) You must not provide the vaporizer section of vaporizer-burners with fusible plugs.

(x) Vaporizer coils or jackets must be made of ferrous metal or high temperature alloys.

(xi) You must equip equipment utilizing vaporizer-burners with automatic shutoff devices upstream and downstream of the vaporizer section connected so as to operate in the event of excessive temperature, flame failure, and, if applicable, insufficient airflow.

(12) **Filling densities.**

(a) The "filling density" is defined as the percent ratio of the weight of the gas in a container to the weight of water the container will hold at 60°F. You must fill all containers according to the filling densities shown in Table H-27.

TABLE H-27
MAXIMUM PERMITTED FILLING DENSITY

Specific gravity at 60°F (15.6°C)	Above ground containers		Under-ground containers, all capacities
	0 to 1,200 U.S. gals. (1,000 imp. gal. 4,550 liters) total water cap.	Over 1,200 U.S. gals. (1,000 imp. gals. 4,550 liters) total water cap.	
	%	%	%
0.496-0.503	41	44	45
.504-.510	42	45	46
.511-.519	43	46	47
.520-.527	44	47	48
.528-.536	45	48	49
.537-.544	46	49	50
.545-.552	47	50	51
.553-.560	48	51	52
.561-.568	49	52	53
.569-.576	50	53	54
.577-.584	51	54	55
.585-.592	52	55	56
.593-.600	53	56	57

(b) Except as provided in (c) of this subsection, you must charge any container including mobile cargo tanks and portable tank containers regardless of size or construction, shipped under DOT jurisdiction or constructed in accordance with 49 C.F.R. Chapter I specifications according to 49 C.F.R. Chapter I requirements.

(c) Portable containers not subject to DOT jurisdiction (such as, but not limited to, motor fuel containers on industrial and lift trucks, and farm tractors covered in subsection (5) of this section, or containers recharged at the installation) may be filled either by weight, or by volume using a fixed length dip tube gaging device.

(13) **LP-gas in buildings.**

(a) You must pipe vapor into buildings at pressures in excess of 20 p.s.i.g. only if the buildings or separate areas thereof,

(i) Are constructed in accordance with this section;

(ii) Are used exclusively to house equipment for vaporization, pressure reduction, gas mixing, gas manufacturing, or distribution, or to house internal combustion engines, industrial processes, research and experimental laboratories, or equipment and processes using such gas and having similar hazard;

(iii) Buildings, structures, or equipment under construction or undergoing major renovation.

(b) Liquid may be permitted in buildings as follows:

(i) Buildings, or separate areas of buildings, used exclusively to house equipment for vaporization, pressure reduction, gas mixing, gas manufacturing, or distribution, or to house internal combustion engines, industrial processes, research and experimental laboratories, or equipment and processes using such gas and having similar hazard; and when such buildings, or separate areas thereof are constructed in accordance with this section.

(ii) Buildings, structures, or equipment under construction or undergoing major renovation provided the temporary piping meets the following conditions:

(A) Liquid piping inside the building must conform to the requirements of subsection (8) of this section, and must not exceed 3/4 iron pipe size. Copper tubing with an outside diameter of 3/4 inch or less may be used provided it conforms to Type K of Specifications for Seamless Water Tube, ANSI H23.1-1970 (ASTM B88-1969) (see WAC 296-24-47505 Table H-24). You must protect all such piping against construction hazards. You must keep liquid piping inside buildings to a minimum. You must securely fasten such piping to walls or other surfaces so as to provide adequate protection from breakage and so located as to subject the liquid line to lowest ambient temperatures.

(B) You must install a shutoff valve in each intermediate branch line where it takes off the main line and it must be readily accessible. You must also place a shutoff valve at the appliance end of the intermediate branch line. Such shutoff valve must be upstream of any flexible connector used with the appliance.

(C) You must install suitable excess flow valves in the container outlet line supplying liquid LP-gas to the building. You must install a suitable excess flow valve immediately downstream of each shutoff valve. You must install suitable excess flow valves where piping size is reduced and it must be sized for the reduced size piping.

(D) You must install hydrostatic relief valves in accordance with subsection (10)(m) of this section.

(E) You must prohibit the use of hose to carry liquid between the container and the building or at any point in the liquid line, except at the appliance connector.

(F) Where flexible connectors are necessary for appliance installation, such connectors must be as short as practicable and must comply with subsection (8)(b) or (9) of this section.

(G) You must minimize release of fuel when any section of piping or appliances is disconnected by either of the following methods:

(I) Using an approved automatic quick-closing coupling (a type closing in both directions when coupled in the fuel line), or

(II) Closing the valve nearest to the appliance and allowing the appliance to operate until the fuel in the line is consumed.

(III) You must not take portable containers into buildings except as provided in subsection (6)(a) of this section.

(14) **Transfer of liquids.** You must ensure that:

(a) At least one attendant must remain close to the transfer connection from the time the connections are first made until they are finally disconnected, during the transfer of the product.

(b) You must fill or use containers only upon authorization of the owner.

(c) You must not refill or reuse containers manufactured in accordance with specifications of 49 C.F.R. Part 178 and authorized by 49 C.F.R. Chapter 1 as a "single trip" or "nonrefillable container" in LP-gas service.

(d) Gas or liquid must not be vented to the atmosphere to assist in transferring contents of one container to another, except as provided in WAC 296-24-47511 (5)(d) and except that this must not preclude the use of listed pump utilizing LP-gas in the vapor phase as a source of energy and venting such gas to the atmosphere at a rate not to exceed that from a No. 31 drill size opening and provided that such venting and liquid transfer must be located not less than 50 feet from the nearest important building.

(e) Filling of fuel containers for industrial trucks or motor vehicles from industrial bulk storage containers must be performed not less than 10 feet from the nearest important masonry-walled building or not less than 25 feet from the nearest important building or other construction and, in any event, not less than 25 feet from any building opening.

(f) You must perform filling of portable containers, containers mounted on skids, fuel containers on farm tractors, or similar applications, from storage containers used in domestic or commercial service, not less than 50 feet from the nearest important building.

(g) The filling connection and the vent from the liquid level gages in containers, filled at point of installation, must not be less than 10 feet in any direction from air openings into sealed combustion system appliances or mechanical ventilation air intakes.

(h) You must gauge and charge fuel supply containers only in the open air or in buildings especially provided for that purpose.

(i) The maximum vapor pressure of the product at 100°F which may be transferred into a container must be in accordance with WAC 296-24-47509(2) and 296-24-47511(3). (For DOT containers use DOT requirements.)

(j) Marketers and users must exercise precaution to assure that only those gases for which the system is designed, examined, and listed, are employed in its operation, particularly with regard to pressures.

(k) Pumps or compressors must be designed for use with LP-gas. When compressors are used they must normally take suction from the vapor space of the container being filled and discharge to the vapor space of the container being emptied.

(l) Pumping systems, when equipped with a positive displacement pump, must include a recirculating device which must limit the differential pressure on the pump under normal operating conditions to the maximum differential pressure rating of the pump. You must protect the discharge of the pumping system so that pressure does not exceed 350 p.s.i.g. If a recirculation system discharges into the supply tank and contains a manual shutoff valve, you must incorporate an adequate secondary safety recirculation system which has no means of rendering it inoperative. You must keep manual shutoff valves in recirculation systems open except during an emergency or when repairs are being made to the system.

(m) When necessary, you must provide unloading piping or hoses with suitable bleeder valves for relieving pressure before disconnection.

(n) You must shut down agricultural air moving equipment, including crop dryers, when supply containers are being filled unless the air intakes and sources of ignition on the equipment are located fifty feet or more from the container.

(o) You must shut down agricultural equipment employing open flames or equipment with integral containers, such as flame cultivators, weed burners, and, in addition, tractors, during refueling.

(15) **Tank car or transport truck loading or unloading points and operations.**

(a) The track of tank car siding must be relatively level.

(b) You must install a "tank car connected" sign, as covered by DOT rules, at the active end or ends of the siding while the tank car is connected.

(c) While cars are on side track for loading or unloading, you must block the wheels at both ends on the rails.

(d) You must ensure that an employee is in attendance at all times while the tank car, cars, or trucks are being loaded or unloaded.

(e) You must install a backflow check valve, excess-flow valve, or a shutoff valve with means of remote closing, to protect against uncontrolled discharge of LP-gas from storage tank piping close to the point where the liquid piping and hose or swing joint pipe is connected.

(f) Where practical, the distance of the unloading or loading point must conform to the distances in subsection (6)(b) of this section.

(16) **Instructions.** You must properly train personnel performing installation, removal, operation, and maintenance work in such function.

(17) **Electrical equipment and other sources of ignition.**

(a) Electrical equipment and wiring must be of a type specified by and you must install it according to chapter 296-24 WAC Part L, for ordinary locations except that fixed electrical equipment in classified areas must comply with subsection (18) of this section.

(b) You must not permit open flames or other sources of ignition in vaporizer rooms (except those housing direct-fired vaporizers), pumphouses, container charging rooms or other similar locations. Direct-fired vaporizers shall not be permitted in pumphouses or container charging rooms.

Note: Liquefied petroleum gas storage containers do not require lightning protection. Since liquefied petroleum gas is contained in a closed system of piping and equipment, the system need not be electrically conductive or electrically bonded for protection against static electricity (see NFPA No. 77-1972-1973, Recommended Practice for Static Electricity).

(c) You must not open flames (except as provided for in (b) of this subsection), cutting or welding, portable electric tools, and extension lights capable of igniting LP-gas, within classified areas specified in Table H-28 of this section unless the LP-gas facilities have been freed of all liquid and vapor,

or special precautions observed under carefully controlled conditions.

(18) **Fixed electrical equipment in classified areas.** Fixed electrical equipment and wiring installed within classified areas must comply with Table H-28 of this section and must be installed according to chapter 296-24 WAC Part L. This provision does not apply to fixed electrical equipment at residential or commercial installations of LP-gas systems or to systems covered by WAC 296-24-47511.

(19) **Liquid-level gaging device.**

(a) You must equip each container manufactured after December 31, 1965, and filled on a volumetric basis with a fixed liquid-level gage to indicate the maximum permitted filling level as provided in (e) of this subsection. Each container manufactured after December 31, 1969, must have permanently attached to the container adjacent to the fixed level gage a marking showing the percentage full that will be shown by that gage. When a variable liquid-level gage is also provided, the fixed liquid-level gage will also serve as a means for checking the variable gage. You must use these gages in charging containers as required in subsection (12) of this section.

(b) You must arrange all variable gauging devices so that the maximum liquid level for butane, for a 50/50 mixture of butane and propane, and for propane, to which the container may be charged is readily determinable. The markings indicating the various liquid levels from empty to full must be on the system nameplate or gauging device or part may be on the system nameplate and part on the gauging device. Dials of magnetic or rotary gauges must show whether they are for cylindrical or spherical containers and whether for aboveground or underground service. You must mark the dials of gauges intended for use only on aboveground containers of over 1,200 gallons water capacity.

(c) Gauging devices that require bleeding of the product to the atmosphere, such as the rotary tube, fixed tube, and slip tube, must be designed so that the bleed valve maximum opening is not larger than a No. 54 drill size, unless provided with excess flow valve.

(d) Gauging devices must have a design working pressure of at least 250 p.s.i.g.

(e) Length of tube or position of fixed liquid-level gauge must be designed to indicate the maximum level to which the container may be filled for the product contained. You must base this level on the volume of the product at 40°F at its maximum permitted filling density for aboveground containers and at 50°F for underground containers. You must calculate the filling point for which the fixed liquid level gage is designed according to the method in this subsection.

TABLE H-28

Part	Location	Extent of classified area[1]	Equipment must be suitable for Class I, Group D[2]
A	Storage containers other than DOT cylinders.	Within 15 feet in all directions from connections, except connections otherwise covered in Table H-28.	Division 2.
B	Tank vehicle and tank car loading and unloading.[3]	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade. (See Figure H-1.)	Division 2.
C	Gage vent openings other than those on DOT cylinders.	Within 5 feet in all directions from point of discharge.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from point of discharge.	Division 2.
D	Relief valve discharge other than those on DOT cylinders.	Within direct path of discharge.	Division 1. NOTE—Fixed electrical equipment should preferably not be installed.
		Within 5 feet in all directions from point of discharge.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from point of discharge except within the direct path of discharge.	Division 2.
E	Pumps, compressors, gas-air mixers and vaporizers other than direct fired.		
	Indoors without ventilation	Entire room and any adjacent room not separated by a gas-tight partition.	Division 1.
		Within 15 feet of the exterior side of any exterior wall or roof that is not vaportight or within 15 feet of any exterior opening.	Division 2.
	Indoors with adequate ventilation.[4]	Entire room and any adjacent room not separated by a gas-tight partition.	Division 2.

Part	Location	Extent of classified area[1]	Equipment must be suitable for Class I, Group D[2]
	Outdoors in open air at or abovegrade.	Within 15 feet in all directions from this equipment and within the cylindrical volume between the horizontal equator of the sphere and grade. See Figure H-1.	Division 2.
F	Service station dispensing units.	Entire space within dispenser enclosure, and 18 inches horizontally from enclosure exterior up to an elevation 4 ft. above dispenser base. Entire pit or open space beneath dispenser.	Division 1.
		Up to 18 inches abovegrade within 20 ft. horizontally from any edge of enclosure.	Division 2.
		NOTE: For pits within this area, see Part F of this table.	
G	Pits or trenches containing or located beneath LP-gas valves, pumps, compressors, regulators, and similar equipment.		
	Without mechanical ventilation.	Entire pit or trench	Division 1.
		Entire room and any adjacent room not separated by a gastight partition.	Division 2.
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2.
	With adequate mechanical ventilation.	Entire pit or trench	Division 2
		Entire room and any adjacent room not separated by a gastight partition.	Division 2.
		Within 15 feet in all directions from pit or trench when located outdoors.	Division 2.
H	Special buildings or rooms for storage of portable containers.	Entire room	Division 2.
I	Pipelines and connections containing operational bleeds, drips, vents or drains.	Within 5 ft. in all directions from point of discharge.	Division 1.
		Beyond 5 ft. from point of discharge, same as Part E of this table.	
J	Container filling: Indoors without ventilation.	Entire room	Division 1.
	Indoors with adequate ventilation.[4]	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet and entire room	Division 2.
	Outdoors in open air	Within 5 feet in all directions from connections regularly made or disconnected for product transfer.	Division 1.
		Beyond 5 feet but within 15 feet in all directions from a point where connections are regularly made or disconnected and within the cylindrical volume between the horizontal equator of the sphere and grade (See Fig. H-1.)	Division 2.

[1] The classified area must not extend beyond an unpierced wall, roof, or solid vaportight partition.

[2] See chapter 296-46 WAC, and chapter 296-24 WAC Part L.

[3] When classifying extent of hazardous area, you must give consideration to possible variations in the spotting of tank cars and tank vehicles at the unloading points and the effect these variations of actual spotting point may have on the point of connection.

[4] Ventilation, either natural or mechanical, is considered adequate when the concentration of the gas in a gas-air mixture does not exceed 25% of the lower flammable limit under normal operating conditions.

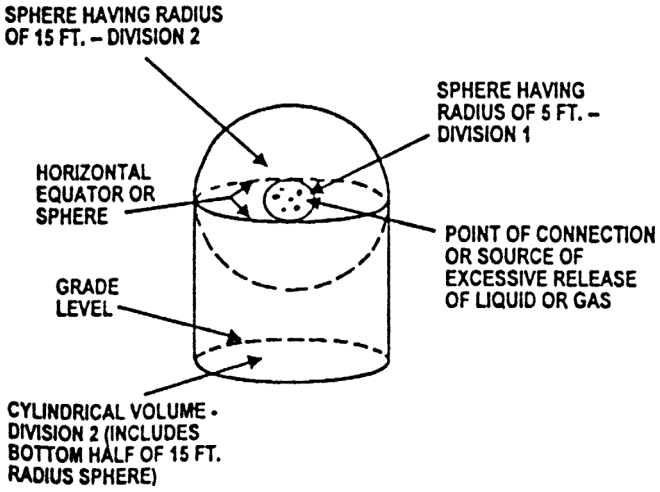


Figure H-1

Note: It is impossible to set out in a table the length of a fixed dip tube for various capacity tanks because of the varying tank diameters and lengths and because the tank may be installed either in a vertical or horizontal position. Knowing the maximum permitted filling volume in gallons, however, the length of the fixed tube can be determined by the use of a strapping table obtained from the container manufacturer. The length of the fixed tube should be such that when its lower end touches the surface of the liquid in the container, the contents of the container will be the maximum permitted volume as determined by the following formula:

$$\frac{\text{Water capacity (gals.) of container* x filling density**}}{\text{Specific gravity of LP-gas* x volume correction factor*** x 100}} = \text{Maximum volume of LP-gas}$$

* Measure at 60°F.

** From subsection (12)(a) of this section "filling densities."

*** For aboveground containers the liquid temperature is assumed to be 40°F and for underground containers the liquid temperature is assumed to be 50°F. To correct the liquid volumes at these temperatures to 60°F you must use the following factors.

(i) Formula for determining maximum volume of liquefied petroleum gas for which a fixed length of dip tube must be set:

TABLE H-29
VOLUME CORRECTION FACTORS

Specific gravity	Aboveground	Underground
0.500	1.033	1.017
.510	1.031	1.016
.520	1.029	1.015
.530	1.028	1.014
.540	1.026	1.013
.550	1.025	1.013
.560	1.024	1.012
.570	1.023	1.011
.580	1.021	1.011
.590	1.020	1.010

(ii) The maximum volume of LP-gas which can be placed in a container when determining the length of the dip tube expressed as a percentage of total water content of the container is calculated by the following formula.

(iii) The maximum weight of LP-gas which may be placed in a container for determining the length of a fixed dip tube is determined by multiplying the maximum volume of liquefied petroleum gas obtained by the formula in (e)(i) of this subsection by the pounds of liquefied petroleum gas in a gallon at 40°F for aboveground and at 50°F for underground containers. For example, typical pounds per gallon are specified below:

Example: Assume a one hundred-gallon total water capacity tank for aboveground storage of propane having a specific gravity of 0.510 of 60°F.

$$\frac{\text{100 (gals.) x 42 (filling density from (12)(a) of this subsection)}}{\text{0.510 x 1.031 (correction factor from Table H-29) x 100}} = \frac{4200}{52.6}$$

$$\frac{4200}{52.6} = \text{79.8 gallons propane, the maximum amount permitted to be placed in a 100-gallon total water capacity aboveground container equipped with a fixed dip tube.}$$

$$\frac{\text{Maximum volume of LP-gas (from formula in (e)(i) of this subsection) x 100}}{\text{Total water content of container in gallons.}} = \text{Maximum \% of LP-gas}$$

	Aboveground, pounds per gallon	Underground, pounds per gallon
Propane.	4.37	4.31
N Butane.	4.97	4.92

(f) You must stamp fixed liquid-level gages used on containers other than DOT containers on the exterior of the gage with the letters "DT" followed by the vertical distance (expressed in inches and carried out to one decimal place) from the top of container to the end of the dip tube or to the centerline of the gage when it is located at the maximum permitted filling level. For portable containers that may be filled in the horizontal and/or vertical position the letters "DT" must be followed by "V" with the vertical distance from the top of the container to the end of the dip tube for vertical filling and with "H" followed by the proper distance for horizontal filling. For DOT containers you must place the stamping both on the exterior of the gage and on the container. On aboveground or cargo containers where the gages are positioned at specific levels, the marking may be specified in percent of total tank contents and you must stamp the marking on the container.

(g) You must restrict gauge glasses of the columnar type to charging plants where the fuel is withdrawn in the liquid phase only. You must equip them with valves having metallic handwheels, with excess flow valves, and with extra-heavy glass adequately protected with a metal housing applied by the gage manufacturer. They shall be shielded against the direct rays of the sun. Gage glasses of the columnar type are prohibited on tank trucks, and on motor fuel tanks, and on containers used in domestic, commercial, and industrial installations.

(h) Gauging devices of the float, or equivalent type which do not require flow for their operation and having connections extending to a point outside the container do not have to be equipped with excess flow valves provided the piping and fittings are adequately designed to withstand the container pressure and are properly protected against physical damage and breakage.

(20) **Requirements for appliances.**

(a) Except as provided in (b) of this subsection, new commercial and industrial gas consuming appliances must be approved.

(b) Any appliance that was originally manufactured for operation with a gaseous fuel other than LP-gas and is in good condition may be used with LP-gas only after it is properly converted, adapted, and tested for performance with LP-gas before the appliance is placed in use.

(c) You must equip unattended heaters used inside buildings for the purpose of animal or poultry production or care with an approved automatic device designed to shut off the flow of gas to the main burners, and pilot if used, in the event of flame extinguishment.

(d) You must install all commercial, industrial, and agricultural appliances or equipment in accordance with the requirements of these standards and in accordance with the following:

(i) Domestic and commercial appliances—NFPA 54-1969, Standard for the Installation of Gas Appliances and Gas Piping.

(ii) Industrial appliances—NFPA 54A-1969, Standard for the Installation of Gas Piping and Gas Equipment on Industrial Premises and Certain Other Premises.

(iii) Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines—NFPA 37-1970.

(iv) Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment, NFPA 96-1970.

AMENDATORY SECTION (Amending WSR 13-05-070, filed 2/19/13, effective 1/1/14)

WAC 296-305-01005 Definitions. Unless the context indicates otherwise, words used in this chapter shall have the meaning given in this section.

Accident: An unexpected event that interrupts or interferes with the orderly progress of the fire department operations and may or may not include personal injury or property damage.

Accountability (tracking) system: A system of firefighter accountability that provides for the tracking and inventory of all members.

ACGIH: American Conference of Governmental Industrial Hygienists.

ACM: Asbestos-containing material; any material containing more than 1 percent asbestos.

Aerial devices: Fire apparatus-mounted aerial ladders, elevated platforms, and water towers.

ANSI: American National Standards Institute.

Apparatus: A mobile piece of fire equipment such as a pumper, aerial, tender, automobile, etc.

Approved:

(1) A method, equipment, procedure, practice, tool, etc., which is sanctioned, consented to, confirmed or accepted as good or satisfactory for a particular purpose or use by a person, or organization authorized to make such a judgment.

(2) 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 Bureau of Mines, the provisions of chapter 296-800 WAC shall apply.

Asbestos: Includes chrysotile, amosite, crocidolite, tremolite, anthophyllite asbestos, actinolite asbestos, and any of these minerals that have been chemically treated or altered.

Belt: See ladder belt and escape belt.

Bloodborne pathogens: 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).

Blowup (wildfire): Sudden increase in fire intensity or rate of spread sufficient to preclude direct control or to upset existing control plans. Often accompanied by violent convection and may have other characteristics of a fire storm.

CBRN: Chemical, biological, radiological, and nuclear.

Chief: The employer representative highest in rank who is responsible for the fire department's operation.

Cold zone: The control zone of an incident that contains the command post and such other support functions as are deemed necessary to control the incident.

Combat scene: The site where the suppression of a fire or emergency exists.

Confined space: A space that is all of the following:

(1) Is large enough and arranged so 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.

Containment: The actions taken to keep a material in its container (e.g., stop the release of the material or reduce the amount being released.)

Contaminated: The presence or the reasonably anticipated presence of nuisance materials foreign to the normal atmospheres, blood, hazardous waste, or other potentially infectious materials on an item or surface.

Contaminated laundry: Laundry which has been soiled with blood or other potentially infectious materials or may contain contaminated sharps.

Contamination: The process of transferring a hazardous material from its source to people, animals, the environment, or equipment, which may act as a carrier.

dBA: A measure of noise level expressed as decibels measured on the "A" scale.

Decontamination:

(1) The physical or chemical process of reducing and preventing the spread of contamination from persons or equipment used at a hazardous materials incident.

(2) 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.

Direct attack: Any treatment applied directly to burning fuel such as wetting, smothering, or chemically quenching the fire or by physically separating the burning from unburned fuel.

Director: The director of the department of labor and industries, or his/her designated representative.

Disinfection: A procedure which inactivates virtually all recognized pathogenic microorganisms, but not necessarily all microbial forms (example: bacterial endospores) on inanimate objects.

Disturb/disturbance: Refers to activities that disrupt the matrix of, crumble or pulverize, or generate visible debris from ACM or PACM.

Dive rescue (public safety diving): The act of searching for or rescuing a viable or presumably viable person(s), while working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure.

Double-layer woven clothing: Clothing worn in two layers allowing air to reach the skin. For example, coveralls worn on top of regular work clothes.

Drill tower: A structure which may or may not be attached to the station and which is principally used for training firefighters in fire service techniques.

Drinking water: Potable water that is suitable to drink. Drinking water packaged as a consumer product and electrolyte-replenishing beverages (i.e., sports drinks) that do not contain caffeine are acceptable.

Driver/operator: A person having satisfactorily completed the fire department's "requirements of driver/operator" of a specific piece of fire apparatus.

Emergency: A sudden and unexpected event calling for immediate action.

Emergency incident: A specific emergency operation.

Emergency medical care: The provision of treatment to, and/or transportation of, patients which may include first aid, cardiopulmonary resuscitation, basic life support, advanced life support, and other medical procedures that occur prior to arrival at a hospital or other health care facility.

Emergency operations: Activities of the fire department relating to rescue, fire suppression, emergency medical care, and special operations, including response to the scene of an incident and all functions performed at the scene.

Employee: An employee of an employer who is employed in the business of his/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 their personal labor for an employer under this chapter whether by way of manual labor or otherwise. Also see "Member."

Employer: 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.

Employer representative: A fire department officer authorized by the chief or director of the fire department to act in his/her behalf.

Engine (pumper): A piece of apparatus equipped with hose and a pump for the purpose of supplying water under pressure through hose lines.

Escape belt: A device that fastens around the waist only and is intended to be used by the wearer only as an emergency self-rescue device.

Escape rope: A single-purpose emergency self-escape (self-rescue) rope, not classified as a life safety rope.

Exclusion zone: The control zone designated to exclude all unauthorized personnel, responders, and equipment.

Note: Examples of exclusion zones could be holes in floors, explosive devices, or collapse hazards.

Extended attack: Suppression activity for a wildfire that has not been contained or controlled by initial attack or contingency forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander.

Extended attack incident: A wildland fire that has not been contained or controlled by initial attack forces and for which more firefighting resources are arriving, en route, or being ordered by the initial attack incident commander. Extended attack implies that the complexity level of the incident will increase beyond the capabilities of initial attack incident command.

Fire apparatus: A fire department emergency vehicle used for rescue, fire suppression, or other specialized functions.

Fire boat: A fire department watercraft having a permanent, affixed firefighting capability.

Fire department: An organization or consortium of organizations providing any or all of the following: Rescue, fire suppression, and other related activities. For the purposes of this standard the term "Fire Department" shall include any public, private, or military organization engaging in this type of activity.

Fire department facility: Any building or area owned, operated, occupied, or used by a fire department on a routine basis. This does not include locations where a fire department may be summoned to perform emergency operations or other duties, unless such premises are normally under the control of the fire department.

Firefighter: A member of a fire department whose duties require the performance of essential firefighting functions or substantially similar functions.

Fire retardant: Any material used to reduce, stop or prevent the flame spread.

Fire suppression training: Training received by firefighters on the drill ground, drill tower, or industrial site to maintain the firefighter's proficiency.

Fly: Extendible sections of ground or aerial ladders.

Full body harness: See life safety harness.

Gross decontamination: The initial phase of the decontamination process during which the amount of surface contaminant is significantly reduced.

Ground jack: Heavy jacks attached to frame of chassis of aerial-equipped apparatus to provide stability when the aerial portion of the apparatus is used.

Guideline: An organizational directive that establishes a standard course of action.

Halyard: Rope used on extension ladders for the purpose of raising or lowering fly section(s). A wire cable may be referred to as a halyard when used on the uppermost fly section(s) of three or four section extension ladders.

Harness: See life safety harness.

Hazard communication program: A procedure to address comprehensively the issue of evaluating the potential hazards of chemicals and communicating information concerning hazards and appropriate protective measures to employees. See WAC ((~~296-800-170, Chemical Hazard Communication Program~~)) 296-901-140 Hazard communication.

Hazard control zones:

Cold zone: The control zone of an incident that contains the command post and such other support functions as are deemed necessary to control the incident.

Note: The cold zone established the public exclusion or clean zone. There are minimal risks of human injury or exposure in this zone.

Exclusion zone: The control zone designated to exclude all unauthorized personnel, responders, and equipment.

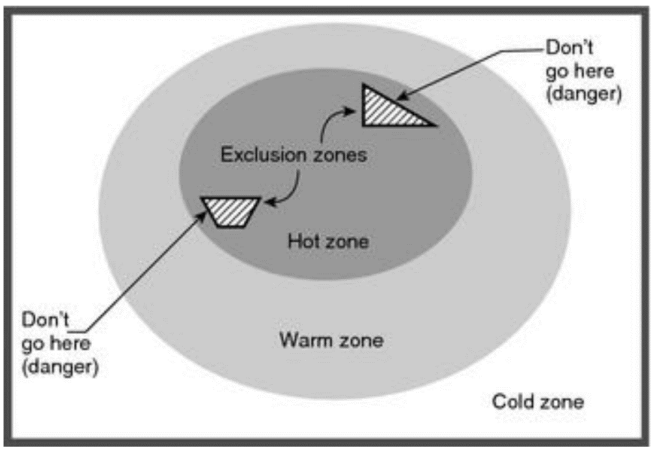
Note: Examples of exclusion zones could be holes in floors, explosive devices, or collapse hazards.

Hot zone: The control zone immediately surrounding the hazard area, which extends far enough to prevent adverse effects to personnel outside the zone. The hot zone is presenting the greatest risk to members and will often be classified as an IDLH atmosphere.

Warm zone: The control zone outside the hot zone where personnel and equipment decontamination and the hot zone support takes place.

Note: The warm zone is a limited access area for members directly aiding or in support of operations in the hot zone. Significant risk of human injury (respiratory, exposures, etc.) can still exist in the warm zone.

Hazard Zones:



Hazards: The characteristics of facilities, equipment, systems, property, hardware or other objects and those areas of structures or buildings posing a hazard greater than normal to the general occupancy or structures.

Hazardous area: The immediate area where members might be exposed to a hazard.

Hazardous atmosphere: An atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (escape unaided from a permit-required confined space), injury or acute illness caused by one or more of the following:

• Flammable gas, vapor, or mist in excess of 10% of its lower flammable limit (LFL);

• Airborne combustible dust at a concentration that meets or exceeds its LFL;

• Atmospheric oxygen concentration below 19.5% or above 23.5%;

• Atmospheric concentration of any substance which may exceed a permissible exposure limit. For additional information about atmospheric concentration, see chapter 296-62 WAC, Parts F, G, and I, General occupational health standards and chapter 296-841 WAC, Airborne contaminants.

Hazardous condition: The physical condition or act which is causally related to accident occurrence. The hazardous condition is related directly to both the accident type and the agency of the accident.

Hazardous material: A substance (solid, liquid, or gas) that when released is capable of creating harm to people, the environment, and property.

Hazardous substances: Substances that present an unusual risk to persons due to properties of toxicity, chemical activity, corrosivity, etiological hazards of similar properties.

Health and safety officer: The member of the fire department assigned and authorized as the administrator of the fire department health and safety program.

Heat-related illness: A medical condition resulting from the body's inability to cope with a particular heat load, and includes, but is not limited to, heat cramps, heat rash, heat exhaustion, fainting, and heat stroke.

Hose bed: Portion of fire apparatus where hose is stored.

Hose tower: A vertical enclosure where hose is hung to dry.

Hot zone: The control zone immediately surrounding the hazard area, which extends far enough to prevent adverse effects to personnel outside the zone. The hot zone is the area presenting the greatest risk to members and will often be classified as an IDLH atmosphere.

Ice rescue: The rescue of a person(s) who is afloat within an opening in the frozen surface or on the frozen surface of a body of water.

Identify: To select or indicate verbally or in writing using recognized standard terms. To establish the identity of; the fact of being the same as the one described.

IDLH: Immediately dangerous to life and health.

Imminent hazard (danger): An act or condition that is judged to present a danger to persons or property and is so immediate and severe that it requires immediate corrective or preventative action.

Incident command system (ICS): A system that includes: Roles, responsibilities, operating requirements, guidelines and procedures for organizing and operating an on-scene management structure.

Incident commander: The person in overall command of an emergency incident. This person is responsible for the direction and coordination of the response effort.

((~~**Incident command system (ICS):** A system that includes: Roles, responsibilities, operating requirements, guidelines and procedures for organizing and operating an on-scene management structure.~~))

Incident safety officer: The person assigned the command staff function of safety officer in the incident command system.

Incipient (phase) fire: The beginning of a fire; where the oxygen content in the air has not been significantly reduced and the fire is producing minute amounts of water vapor, carbon dioxide, carbon monoxide and other gases; the room has a normal temperature and can be controlled or extinguished with a portable fire extinguisher or small hose, e.g., a kitchen stove fire.

Indirect attack: A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favorable breaks in the topography. The intervening fuel is usually backfired; but occasionally the main fire is allowed to burn to the line, depending on conditions.

Industrial fire brigade: An organized group of employees whose primary employment is other than firefighting who are knowledgeable, trained and skilled in specialized operations based on site-specific hazards present at a single commercial facility or facilities under the same management.

Initial action: The actions taken by the first resources to arrive at a wildfire or wildland fire use incident. Initial actions may be size up, patrolling, monitoring, holding action or aggressive initial attack.

Initial attack: A planned response to a wildfire given the wildfire's potential fire behavior. The objective of initial attack is to stop the fire and put it out in a manner consistent with firefighter and public safety and values to be protected.

Initial fire suppression training: The training of firefighters in recognizing sources and locations of potential fires and the method of fire suppression to be used.

Initial stages: Tasks undertaken by the first arriving company with only one crew assigned or operating in the hot zone.

Injury: Physical damage suffered by a person that requires treatment by a practitioner of medicine (a physician, nurse, paramedic or EMT) within one year of the incident regardless of whether treatment was actually received.

Interior structural firefighting: The physical activity of fire suppression, rescue or both, inside of buildings or enclosed structures which are involved in a fire situation beyond the incipient stage. See structural firefighting.

Known rescue: A situation of compelling evidence where a member sees, hears, or is directly told of a trapped and viable victim by an occupant who has escaped or is a credible witness.

Ladder belt: A device that fastens around the waist only and is used as a positioning device for a person on a ladder.

Life safety or rescue rope: Rope dedicated solely for the purpose of constructing lines for supporting people during rescue, firefighting, or other emergency operations, or during training evolutions.

Life safety harness: A configuration of connected straps to distribute a fall arresting force over at least the thighs, shoulders and pelvis, with provisions for attaching a lanyard, lifeline, or deceleration devices.

Live fire: Any unconfined open flame or device that can propagate fire to the building, structure, or other combustible materials.

Live fire training: Any fire set within a structure, tank, pipe, pan, etc., under controlled conditions to facilitate the training of firefighters under actual fire conditions.

Locking in: The act of securing oneself to a ladder by hooking a leg over a rung and placing top of foot against the other leg or against the ladder.

May: A permissive use or an alternative method to a specified requirement.

Mayday: The nationally adopted "call for help" term used to indicate that an emergency responder is in a situation of imminent peril where they are in need of immediate help.

Member: A person involved in performing the duties and responsibilities of a fire department under the auspices of the organization. A fire department member may be a full-time or part-time employee or a paid or unpaid volunteer, may occupy any position or rank within the fire department, and engages in emergency operations. Also see Employee.

Mobile attack: The act of fighting wildland fires from a moving engine.

NFPA: National Fire Protection Association.

NIMS: The National Incident Management System.

NIOSH: National Institute of Occupational Safety and Health.

Nonskid: The surface treatment that lessens the tendency of a foreign substance to reduce the coefficient of friction between opposing surfaces.

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.

Officer: (1) Person in charge of a particular task or assignment.

(2) A supervisor.

OSHA: Occupational Safety and Health Administration.

Other potentially infectious materials (OPIM): (1) The following 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;

(2) Any unfixed tissue or organ (other than intact skin) from a human (living or dead); and

(3) 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.

Outrigger: Manually or hydraulically operated metal enclosures and jacks which are extended and placed in contact with the ground to give the apparatus a wide, solid base to support different loads.

Overhaul: A firefighting term involving the process of final extinguishment after the main body of a fire has been knocked down. All traces of fire must be extinguished at this time.

PACM: Presumed asbestos-containing material. Thermal system insulation and surfacing material found in buildings, vessels and vessel sections constructed no later than 1980.

PASS: Personal alert safety system.

PEL: Permissible exposure limit.

Personal protective equipment (PPE): (1) The equipment provided to shield or isolate a person from the chemical, physical, and thermal hazards that may be encountered at a hazardous materials incident. Personal protective equipment includes both personal protective clothing and respiratory protection. Adequate personal protective equipment should protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing.

(2) 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.

Platform: The portion of a telescoping or articulating boom used as a working surface.

Positive communication: Visual, audible, physical, safety guide rope, or electronic means which allows for two way message generation and reception.

PPE: Personal protective equipment.

Probable fatality: (1) An occupational injury or illness, which, by the doctor's prognosis, could lead to death.

(2) An occupational injury or illness, which by its very nature, is considered life threatening.

Protective clothing: Equipment designed to protect the wearer from heat and/or hazardous materials contacting the skin or eyes. Protective clothing is divided into five types:

(1) Structural firefighting protective clothing;

(2) Liquid splash-protective clothing;

(3) Vapor-protective clothing;

(4) High temperature-protective proximity clothing; and

(5) Wildland firefighting clothing.

Note: See Protective ensemble.

Protective ensemble: Multiple elements of clothing and equipment designed to provide a degree of protection for firefighters from adverse exposures to the inherent risks of structural firefighting operations and certain other emergency operations. The elements of the protective ensemble are helmets, coats, trousers, gloves, footwear, interface components (hoods), and if applicable, personal alert system (PASS) devices, and self-contained breathing apparatus.

Proximity protective clothing: Radiant reflective protective garments configured as a coat and trousers, or as a coverall, and interface components that are designed to provide protection for the firefighter's body from conductive, convective, and radiant heat.

Pumper: See engine.

Qualified: One who by possession of a recognized degree, certificate or professional standing, or who by knowledge, training or experience has successfully demonstrated his/her ability to solve or resolve problems related to the subject matter, the work or the project.

Rapid intervention crew (RIC): On-scene team of at least two members designated, dedicated and equipped to effect an immediate rescue of firefighters if the need arises (also known as RIT).

RCW: Revised Code of Washington.

Rehabilitation: The process of providing mental and medical evaluation, rest, hydration, and nourishment to members who are engaged in emergency operations.

Rescue: Those activities directed at locating endangered persons at an emergency incident and removing those persons from danger.

Rescue craft: Any fire department watercraft used for rescue operations.

Respirator: A device designed to protect the wearer from breathing harmful atmospheres. See respiratory protection.

Respiratory equipment: Self-contained breathing apparatus designed to provide the wearer with a supply of respirable atmosphere carried in or generated by the breathing apparatus. When in use, this breathing apparatus requires no intake of air or oxygen from the outside atmosphere.

(1) Respirators (closed circuit): Those types of respirators which retain exhaled air in the system and recondition such air for breathing again.

(2) Respirators (open circuit): Those types of respirators which exhaust exhaled air to the outside of the mask into the ambient air.

(3) Respirators (demand): Those types of respirators whose input air to the mask is started when a negative pressure is generated by inhalation.

(4) Respirators (pressure demand): Those types of respirators which constantly and automatically maintain a positive

pressure in the mask by the introduction of air when the positive pressure is lowered (usually from .018 psi to .064 psi) through the process of inhalation or leakage from the mask.

Respiratory protection: Equipment designed to protect the wearer from the inhalation of contaminants. Respiratory protection is divided into three types:

(1) Positive pressure self-contained breathing apparatus (SCBA);

(2) Positive pressure airline respirators;

(3) Negative pressure air purifying respirators.

Responding: The usual reference to the act of responding or traveling to an alarm or request for assistance.

Risk assessment: To set or determine the possibility of suffering harm or loss, and to what extent.

Rope rescue equipment: Components used to build rope rescue systems including life safety rope, life safety harnesses and auxiliary equipment.

Rope rescue system: A system composed of rope rescue equipment and an appropriate anchor system intended to support people during rescue, firefighting, or other emergency operations, or during training evolutions.

Safe and healthful working environment: The work surroundings of an employee with minimum exposure to unsafe acts and/or unsafe conditions.

Safety net: A rope or nylon strap net not to exceed 6-inch mesh, stretched and suspended above ground level at the base of drill tower, and at such a height that a falling body would be arrested prior to striking the ground.

Scabbard: A guard which will prevent accidental injury and covers the blade and pick of an axe or other sharp instrument when worn by the firefighter.

SCBA: Self contained breathing apparatus.

Service testing: The regular, periodic inspection and testing of apparatus and equipment according to an established schedule and procedure, to insure that it is in safe and functional operating condition.

Shall: Mandatory.

Should: Recommended.

Standard operating procedure or guidelines: An organizational directive that establishes a standard course of action.

Standby firefighters: On-scene members designated to effect an immediate rescue of the initial team operating in the hot zone.

Station (fire station): Structure in which fire service apparatus and/or personnel are housed.

Structural firefighting: The activities of rescuing, fire suppression, and property conservation involving buildings, enclosed structures, aircraft, vehicles, vessels, or similar properties that are involved in a fire or emergency situation. See interior structural firefighting.

Structural firefighting protective clothing: This category of clothing, often called turnout or bunker gear, means the protective clothing normally worn by firefighters during structural firefighting operations. It includes a helmet, coat, pants, boots, gloves, and a hood. Structural firefighters' protective clothing provides limited protection from heat but may not provide adequate protection from the harmful gases, vapors, liquids, or dusts that are encountered during hazardous materials incidents.

Surf rescue: The rescue of a person(s) who is afloat on the surface or the subsurface retrieval of a person(s) submerged in ocean water or bodies of water that are connected to oceans that either experience a twice daily rise and fall of their surface caused by gravitational pull of the moon or experience a corresponding ebb and flow of water in response to tides with a surf height of 1 foot or greater.

Surface water rescue: The rescue of a person(s) who is afloat on the surface of a body of water. A trained rescuer (surface based swimmer) may dive for submerged victims, limited to the rescuer's ability, with no sustained underwater capability other than a mask, fins, and snorkel in relatively shallow depths and retrieve or mark a victim.

Swift water rescue: The removal of person(s) from threat or harm from water that is moving faster than walking pace (1 Knot, 1.85 km/hr, 1.15 mph).

Tail/running board: Standing space on the side or rear of an engine or pumper apparatus.

Team: Two or more individuals who are working together in positive communication with each other through visual, audible, physical, safety guide rope, electronic, or other means to coordinate their activities and who are in close proximity to each other to provide assistance in case of emergency.

Tillerman: Rear driver of tractor-trailer aerial ladder.

Trench: A narrow excavation made below the surface of the ground. The depth is generally greater than the width, but the width of a trench is not greater than 15 feet.

Turnout clothing: See structural firefighting protective clothing.

Turntable: The rotating surface located at the base of an aerial ladder, or boom, on aerial apparatus.

Uncontrolled fire: Any fire which threatens to destroy life, property, or natural resources; and (a) is not burning within the confines of firebreaks; or (b) is burning with such intensity that it could not be readily extinguished with ordinary tools commonly available.

Urban wildfire: An uncontained fire requiring suppression action, usually spreading through ground cover, vegetative fuels, brush, grass, and landscaping; often threatening residential and commercial structures within an urban environment with access to established roadways and water systems.

Vapor barrier: Material used to prevent or substantially inhibit the transfer of water, corrosive liquids and steam or other hot vapors from the outside of a garment to the wearer's body.

Vapor barrier clothing: Clothing that significantly inhibits or completely prevents sweat produced by the body from evaporating into the outside air. Such clothing includes encapsulating suits, various forms of chemical resistant suits used for PPE, and other forms of nonbreathing clothing.

Variance: An allowed or authorized deviation from specific standard(s) when an employer substitutes measures which afford an equal degree of safety. Variances are issued as temporary or permanent with interim measures issued, when requested, until a determination or decision is made.

Vessel: Means every description of watercraft or other artificial contrivance used or capable of being used as a means of transportation on water, including special-purpose

floating structures not primarily designed for or used as a means of transportation on water.

WAC: Washington Administrative Code.

Warm zone: The control zone outside the hot zone where personnel and equipment decontamination and hot zone support take place.

Note: The warm zone is a limited access area for members directly aiding or in support of operations in the hot zone. Significant risk of human injury (respiratory, exposures, etc.) can still exist in the warm zone.

Water rescue: Any incident that involves the removal of victim(s) from any body of water other than a swimming pool. This includes rivers, creeks, lakes, washes, storm drains, or any body of water, whether still or moving.

Wheel blocks (chocks): A block or wedge placed under a wheel to prevent motion.

Wildland: An area in which development is essentially nonexistent, except for roads, railroads, powerlines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland fire: Any nonstructure fire that occurs in the wildland.

Wildland firefighting: The activities of fire suppression and property conservation in woodlands, forests, grasslands, brush, and other such vegetation or any combination of vegetation, that is involved in a fire situation but is not within buildings or structures.

Wildland firefighting enclosure: A fire apparatus enclosure with a minimum of three sides and a bottom.

Wildland urban interface: The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

WISHA: Washington Industrial Safety Health Act.

Work environment: The surrounding conditions, influences or forces to which an employee is exposed while working.

Any 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. For the purposes of this code, fireground and emergency scenes are also considered places of employment.

Work/rest ratio: An expression of the amount of rest that is required for each hour an individual is in work status. Current NWCG guidelines require one hour of rest for every two hours in work status.

AMENDATORY SECTION (Amending WSR 13-05-070, filed 2/19/13, effective 1/1/14)

WAC 296-305-01509 Management's responsibility. (1) It shall be the responsibility of management to establish, supervise, maintain, and enforce, in a manner which is effective in practice:

(a) A safe and healthful working environment, as it applies to both nonemergency and emergency conditions.

(b) An accident prevention program as required by this chapter.

(c) Programs for training employees in the fundamentals of accident prevention.

(d) Procedures to be used by the fire department health and safety officer and incident commander to ensure that emergency medical care is provided for members on duty.

(e) An accident investigation program as required by this chapter.

(f) Policies that clarify "rules of engagement" or parameters when personnel should commit to work activities within a hot zone.

(g) Policies that clarify the right of every employee to notify the employer of potential life-threatening situations during emergency operations and processes that clarify how this notification is to occur.

(2) The fire department shall be responsible for providing suitable expertise to comply with all testing requirements in this chapter. Such expertise may be secured from within the fire department, from equipment and apparatus manufacturers, or other suitable sources.

(3) Members who are under the influence of alcohol or drugs shall not participate in any fire department operations or other functions. This rule does not apply to persons taking prescription drugs as directed by a physician or dentist providing such use does not endanger the worker or others.

(4) Alcoholic beverages shall not be allowed in station houses, except at those times when station houses are used as community centers, with the approval of management.

(5) A bulletin board or posting area exclusively for safety and health and large enough to display the required safety and health posters. The WISHA poster (WISHA form F416-081-000) and other safety education material shall be provided. A bulletin board of "white background" and "green trim" is recommended.

(6) The fire department shall develop and maintain a hazard communication program as required by WAC ((~~296-800-170~~)) 296-901-14010, which will provide information to all employees relative to hazardous chemicals or substances to which they are exposed, or may routinely be exposed to, in the course of their employment.

(7) Personnel.

(a) The employer shall assure that employees are physically capable of performing duties that may be assigned to them.

(b) The employer shall not permit employees with known physical limitations reasonably identifiable to the employer, for example, heart disease or seizure disorder, to participate in physically demanding activities unless the employee has been released to participate in such activities by a physician or other licensed health care professional (LHCP) who is qualified by training or experience as determined by the fire department to evaluate firefighters.

AMENDATORY SECTION (Amending WSR 13-05-070, filed 2/19/13, effective 1/1/14)

WAC 296-305-05502 Training and member development. (1) The employer must provide training, education and ongoing development for all members commensurate with those duties and functions that members are expected to perform.

(a) Training and education must be provided to members before they perform emergency activities.

(b) Fire service leaders and training instructors must be provided with training and education which is more comprehensive than that provided to the general membership of the fire department.

(c) The fire department shall develop an ongoing proficiency cycle with the goal of preventing skill degradation.

(2) Training on specific positions/duties deemed by the fire department critical to the safety of responders and the effectiveness of emergency operations (such as driver operators or support personnel) shall be provided at least annually.

(3) Firefighters shall be trained in the function, care, use/operation, inspection, maintenance and limitations of the equipment assigned to them or available for their use.

(4) Members who are expected to perform interior structural firefighting shall be provided with an education session or training at least quarterly.

(5) When firefighters are engaged in training above the ten foot level, where use of lifelines or similar activities are to be undertaken, a safety net or other approved secondary means of fall protection recommended in chapter 296-155 WAC, Part C-1, fall protection requirements for construction, shall be used.

(6) Continuing education live fire training.

(a) All members who engage in interior structural firefighting in IDLH conditions shall be provided live fire training appropriate to their assigned duties and the functions they are expected to perform at least every three years. Firefighters who do not receive this training in a three-year period will not be eligible to return to an interior structural firefighting assignment until they do. Responding to a fire scene with a full alarm assignment, an ICS established and a postincident analysis will meet this requirement, but for no more than two training evolutions.

(b) All live fire training shall be conducted by fire department qualified fire service instructors. When conducting their own training, fire departments must meet the requirements set out in the 2007 edition of the NFPA 1403, Standard on Live Fire Training Evolutions.

(c) An incident safety officer shall be appointed for all live fire training evolutions. The incident safety officer function shall be filled by a person who is trained and qualified in the IMS/Incident safety officer duties and who is not responsible for any other function at the training evolution other than the role of incident safety officer.

(7) When using structures for live fire suppression training, activities shall be conducted according to the 2007 edition of NFPA 1403, Standard on Live Fire Training Evolutions. When using structures for nonlive fire training, the following requirements shall be met:

(a) All structures used for training must be surveyed for potential hazardous substances, such as asbestos, prior to the initiation of any training activities. The survey must comply with chapter 296-62 WAC Part I-1 and shall be conducted by an AHERA accredited inspector and performed in accordance with 40 C.F.R. 763, Subpart E. If the hazardous substances or asbestos containing materials of > 1% asbestos are to be disturbed during any training activity they must be removed prior to beginning that activity. Removal of asbestos < or =1% is not required prior to live fire training.

In live fire training structures where < or = 1% asbestos has been disturbed, the fire department will provide written notice to the owner/agent that asbestos has been disrupted and remains on-site.

For structures built before 1978, you must assume that painted surfaces are likely to contain lead and inform workers of this presumption. Surveys for lead containing paints are not required. Lead containing paints are not required to be removed prior to training activities.

If the training activity will not disturb the hazardous substance, the material must be clearly marked and all participants must be shown the location of the substance and directed not to disturb the materials.

(b) Acquired or built structures used for fire service training that does not involve live fire must be surveyed for the following hazards and those hazards abated prior to the commencement of training activities:

(i) In preparation for training, an inspection of the training building shall be made to determine that the floors, walls, stairs and other structure components are capable of withstanding the weight of contents, participants and accumulated water.

(ii) Hazardous materials and conditions within the structure shall be removed or neutralized, except as exempted in (a) of this subsection.

• Closed containers and highly combustible materials shall be removed.

• Oil tanks and similar closed vessels that cannot easily be removed shall be vented sufficiently to eliminate an explosion or rupture.

• Any hazardous or combustible atmosphere within the tank or other vessel shall be rendered inert.

• Floor openings, missing stair treads or railings, or other potential hazards shall be repaired or made inaccessible.

(iii) If applicable, floors, railings and stairs shall be made safe. Special attention shall be given to potential chimney hazards.

(iv) Debris hindering the access or egress of firefighters shall be removed before continuing further operations.

(v) Debris creating or contributing to unsafe conditions shall be removed before continuing further operations.

(c) Asbestos training. Firefighters must be provided asbestos awareness training, including communication of the existence of asbestos-containing material (ACM) and presumed-asbestos-containing material (PACM). Training shall be provided prior to initial assignment and annually thereafter, and must include:

(i) The physical characteristics of asbestos including types, fiber size, aerodynamic characteristics and physical appearance.

(ii) Examples of different types of asbestos and asbestos-containing materials to include flooring, wall systems, adhesives, joint compounds, exterior siding, fire-proofing, insulation, roofing, etc. Real asbestos shall be used only for observation by trainees and shall be enclosed in sealed unbreakable containers.

(iii) The health hazards of asbestos including the nature of asbestos related diseases, routes of exposure, dose-response relationships, synergism between cigarette smoking

and asbestos exposure, latency period of diseases, hazards to immediate family, and the health basis for asbestos standards.

(iv) Instruction on how to recognize damaged, deteriorated, and delamination of asbestos-containing building materials.

(v) Decontamination and clean-up procedures.

(vi) Types of labels that are used within different industries to identify ACM or PACM that is present within structures. The labeling system the employer will use during training to identify asbestos and ACM/PACM during destructive drilling and training.

(vii) The location and types of ACM or PACM within any fire department owned or leased structures and the results of any "Good Faith Survey" done on fire department owned or leased structures.

(8) Asbestos exposure during destructive training activities. Fire department employees are exempt from the requirements of chapter 296-65 WAC and WAC 296-62-077, provided they comply with the following requirements:

(a) Fire departments must obtain a good faith asbestos inspection/survey from the property owner/agent prior to disturbing building materials. The good faith survey must comply with chapter 296-62 WAC Part I-1 and shall be conducted by an AHERA accredited inspector and performed in accordance with 40 C.F.R. 763, Subpart E.

(b) Good faith surveys must be shared with all employers and employees prior to using any structure.

(c) Materials containing >1% asbestos must be marked by a system recognized by all members. ACM/PACM may not be disturbed prior to, or during training, or must be removed by a certified asbestos abatement contractor prior to training activities. The incident safety officer for the training must walk all participants through the structure and inform them of the location of all ACM/PACM and that this material is not to be disturbed. If the structure is used for a black-out drill, the incident safety officer must instruct members that ACM/PACM is present and take precautions to ensure these materials are not disturbed during the training. A walk through is not required for black-out drills.

(d) Destructive drilling must not occur in a structure until the fire department has received a good faith asbestos survey from the owner/agent and ensured that any ACM or PACM has been abated from substrates upon which destructive drill tasks are planned to be performed. All suspect asbestos materials designated for destructive drill tasks will be identified, evaluated and tested by an accredited AHERA lab.

(e) Materials containing < or = 1% asbestos must be labeled by a system recognized by all members. Prior to initiating any destructive drilling on materials containing < or = 1% asbestos, the incident safety officer for the training must walk all participants through the structure and inform them of the location of asbestos.

(f) Firefighters must wear SCBA and turnouts whenever exposed to asbestos.

(g) Firefighters must be provided gross decontamination at the drill site by rinsing/brushing the firefighters turnouts and SCBA with water.

(h) Hand tools and other asbestos contaminated equipment will be rinsed off prior to being returned to the apparatus or service. Tools and equipment that cannot be decontaminated on site must be placed in sealed containers until they can be decontaminated. Care must be taken to not spread the asbestos.

(i) PPE that may have been contaminated with asbestos must be cleaned in a manner recommended by the manufacturer and that prevents the exposure of the employee cleaning the PPE. PPE that cannot be cleaned on-site must be placed in sealed containers until they can be decontaminated.

(j) In structures scheduled for demolition, or that will be turned over to another employer, where < or = 1% asbestos has been disturbed, the fire department will provide written notice to the owner/agent that asbestos has been disrupted and remains on-site. The fire department will inform the owner/agent, in writing, that access to the property must be limited to the demolition or asbestos contractor.

(k) The fire department will secure the structure after all drills and at the conclusion of the use of the structure. Securing the structure may include but not be limited to: Locking or boarding up windows, doors, and wall and roof openings. The site of the structure may also require fencing. When asbestos material of < or = 1% has been disturbed by the fire department's drill activities, the site will be posted with warning signs. These signs will notify entrants onto the site that asbestos debris of < or = 1% has been left on the site. For fire department members who plan to enter the structure or the building footprint, the signs will state the necessity of full turn-outs and SCBA with decontamination procedures. The signs will also state that entry into the building or the building footprint is prohibited by any persons other than the fire department and the demolition/abatement contractor.

(9) Additional training. Training must be provided on topics according to the job duties and potential hazards as outlined in Table 2, Subject Specific Training.

Table 2
Subject Specific Training

Topic	Training requirements found in:
HEALTH AND SAFETY	
Noise and hearing loss prevention	• Chapter 296-817 WAC, Hearing loss prevention (noise) • WAC 296-305-02004
Respiratory equipment	• Chapter 296-842 WAC, Respirators • WAC 296-305-04001
Employee right-to-know procedures	• WAC ((~~296-800-170, Employer chemical hazard communication—Introduction~~)) 296-901-14016 Employee information and training
Identification and handling of asbestos-containing materials likely to be encountered during a fire response	• WAC 296-62-07722(5) as appropriate to asbestos encountered during a fire response, or EPA awareness level asbestos two hour training course

Table 2 Subject Specific Training	
Topic	**Training requirements found in:**
FIRE SUPPRESSION	
Overhaul procedures and operations	• WAC 296-305-05000 and 296-305-05002
Live fire training in structures	• NFPA 1403, Standard on Live Fire Training Evolutions, 2007 Edition
Wildland fires	• WAC 296-305-07010 through 296-305-07019 • The National Wildfire Coordination Group (NWCG) firefighter II • All training for assigned wildland incident command positions must be completed prior to assignment by the IC
INCIDENT MANAGEMENT	
Incident management training	• National Incident Management System • NFPA 1561, Standard on Emergency Services Incident Management System, 2008 edition (available on-line)
EMERGENCY MEDICAL	
Emergency medical training	• WAC 296-305-02501
HAZARDOUS MATERIALS	
Hazardous materials training	• Chapter 296-824 WAC, Emergency response • Nonconflicting portions of NFPA 472, Standard for Competence of Responders to Hazardous Materials/Weapons of Mass Destruction Incidents, 2008 edition
TECHNICAL RESCUE	
Confined space entry and/or rescue	• Chapter 296-809 WAC, Confined spaces • WAC 296-305-05004 • Nonconflicting portions of NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents, 2004 edition • Nonconflicting portions of NFPA 1006, Professional Qualifications for Technical Rescue, 2008 edition
Other technical rescue situations, such as rope, structural collapse, transportation/ machinery, trench, water, and wilderness rescue	• NFPA 1670, Standard on Operations and Training for Technical Rescue Incidents, 2004 edition • Nonconflicting portions of NFPA 1006, Professional Qualifications for Technical Rescue, 2008 edition
POSITION SPECIFIC DEVELOPMENT	
Aircraft	• NFPA 402, Guide for Aircraft Rescue and Firefighting Operations, 2008 edition
Driver training	• WAC 296-305-04505(8)

Part Y-1
Employer Chemical Hazard Communication

Note: Chapter 296-307 WAC Safety standards for agriculture Part Y-1 Employer chemical hazard communication (WAC 296-307-550 through 296-307-55060) and Part Y-2 Material safety data sheets and label preparation (WAC 296-307-560 through 296-307-56050) have been repealed. Please refer to chapter 296-901 WAC Globally harmonized system for hazard communication.

Part Y-2
Material Safety Data Sheets and Label Preparation

Note: Chapter 296-307 WAC Safety standards for agriculture Part Y-1 Employer chemical hazard communication (WAC 296-307-550 through 296-307-55060) and Part Y-2 Material safety data sheets and label preparation (WAC 296-307-560 through 296-307-56050) have been repealed. Please refer to chapter 296-901 WAC Globally harmonized system for hazard communication.

REPEALER

The following sections of the Washington Administrative Code are repealed:

WAC 296-307-550	Employer chemical hazard communication—Introduction.
WAC 296-307-55005	Develop, implement, maintain, and make available a written Chemical Hazard Communication Program.
WAC 296-307-55010	Identify and list all the hazardous chemicals present in your workplace.

WAC 296-307-55015	Obtain and maintain material safety data sheets (MSDSs) for each hazardous chemical used.
WAC 296-307-55020	Make sure material safety data sheets are readily accessible to your employees.
WAC 296-307-55025	Label containers holding hazardous chemicals.
WAC 296-307-55030	Inform and train your employees about hazardous chemicals in your workplace.
WAC 296-307-55035	Follow these rules for laboratories using hazardous chemicals.
WAC 296-307-55040	Follow these rules for handling chemicals in factory-sealed containers.
WAC 296-307-55045	Translate certain chemical hazard communication documents upon request.
WAC 296-307-55050	Attempt to obtain a material safety data sheet (MSDS) upon request.
WAC 296-307-55055	Items or chemicals exempt from the rule, and exemptions from labeling.
WAC 296-307-55060	Definitions.
WAC 296-307-560	Scope.
WAC 296-307-56005	Hazard evaluation.
WAC 296-307-56010	Conduct complete hazard evaluations.
WAC 296-307-56015	Provide access to hazard evaluation procedures.
WAC 296-307-56020	Material safety data sheets.
WAC 296-307-56025	Develop or obtain material safety data sheets (MSDSs).
WAC 296-307-56030	Provide MSDSs for products shipped, transferred or sold over-the-counter.
WAC 296-307-56035	Follow-up if an MSDS is not provided.
WAC 296-307-56040	Labeling.
WAC 296-307-56045	Label containers of hazardous chemicals.
WAC 296-307-56050	Definitions.

EMPLOYER—CHEMICAL HAZARD COMMUNICATION INTRODUCTION

Note: WAC 296-800-170 through 296-800-17055 have been repealed. Please refer to chapter 296-901 WAC Globally harmonized system for hazard communication.

AMENDATORY SECTION (Amending WSR 04-10-026, filed 4/27/04, effective 8/1/04)

WAC 296-800-180 ((~~Material~~)) Safety data sheets (((~~MSDSs~~))) (SDSs) as exposure records. Important: Exposure records contain information about employees' exposure to toxic substances or harmful physical agents. ((~~Material~~)) Safety data sheets (((~~MSDSs~~))) (SDSs) are one type of exposure record. The preservation of and access to exposure records is necessary to improve detection, treatment, and prevention of occupational diseases.

This rule supplements the chemical hazard communication rule by extending access to ((~~MSDSs~~)) SDSs, or their alternative, after employment and after the hazardous chemical is no longer used in the workplace.

Your responsibility:

To preserve and provide access to ((~~material~~)) safety data sheets (((~~MSDSs~~))) (SDSs) or their alternative as exposure records.

You must:

Preserve exposure records for at least thirty years.
WAC 296-800-18005.

Inform current employees of exposure records.
WAC 296-800-18010.

Provide access to exposure records.
WAC 296-800-18015.

Transfer records when ceasing to do business.
WAC 296-800-18020.

Note:
- Employee medical and exposure records, chapter 296-802 WAC, requires the preservation and access to other exposure records including records such as workplace monitoring data and biological monitoring results and medical records. If you keep these other types of employee exposure records or employee medical records, you must comply with these additional requirements.
- This rule applies to every employer who maintains, makes, contracts for, or has access to ((~~MSDSs~~)) SDSs for chemicals used in their workplace.
- The specific identity of a toxic substance may be withheld from a disclosable record if it is a verifiable trade secret. For trade secret requirements see ((~~chapter 296-816~~)) WAC 296-901-14018 Trade secrets.

AMENDATORY SECTION (Amending WSR 01-11-038, filed 5/9/01, effective 9/1/01)

WAC 296-800-18005 Preserve exposure records for at least 30 years. You must:

• Keep ((~~material~~)) safety data sheets (((~~MSDSs~~))) (SDSs) and analysis using ((~~MSDSs~~)) SDSs for at least thirty years, including current, former, and future employers receiving transferred records. Preserve ((~~MSDSs~~)) SDSs in any form, as long as the information is not altered and is retrievable. You may keep alternative records instead of ((~~MSDSs~~)) SDSs concerning the identity of a substance. The alternative record must also be kept for thirty years and contain the following information:

- Some record of the identity (chemical name, if known) of a substance or agent
- Where the substance or agent was used
- When the substance or agent was used

((Note: ~~Keeping alternative records may be less work than you think. When developing your hazard communication program's list of hazardous chemicals (WAC 296-800-17010), add the "where used" and "when used" information required by this rule.~~))

AMENDATORY SECTION (Amending WSR 02-16-047, filed 8/1/02, effective 10/1/02)

WAC 296-800-18010 Inform current employees of exposure records. You must:

• Inform current employees who are, or will be exposed to a toxic chemical of:

Note: A chemical is toxic if:

• The latest printed edition of the National Institute for Occupational Safety and Health (NIOSH) Registry of Toxic Effects of Chemical Substances (RTECS) lists the substance. This may be obtained online, CD-ROM, or on a computer tape.

• Testing by or known to the employer has shown positive evidence that the substance is an acute or chronic health hazard.

• A ((~~material~~)) safety data sheet (((~~MSDS~~))) (SDS) kept by or known to the employer shows the material may be a hazard to human health.

- The existence, location, and availability of ((~~MSDSs~~)) SDSs or alternative records, and any other records covered by this rule.

- The person responsible for maintaining and providing access to records.

- Exposure records when the employee first enters into employment and then once a year thereafter.

- Existence and their rights of access to these records.

Note: Informing employees of the availability of these records may be accomplished by posting, group discussion or by individual notifications.

You must:

• Keep a copy of this rule and make copies available upon request to employees.

• Distribute to employees any informational materials about this rule that are made available to the employer by the department.

AMENDATORY SECTION (Amending WSR 02-16-047, filed 8/1/02, effective 10/1/02)

WAC 296-800-18015 Provide access to exposure records. You must:

• Provide access, whenever requested by an employee or their designated representative, to a relevant exposure record:

- In a reasonable time, place, and manner.

- Within fifteen working days. If the employer cannot meet this requirement, they must inform the requesting party of the reason for the delay and the earliest date the record will be made available.

Note: • Employee means any current, former or transferred worker.

• A relevant exposure record is an ((~~MSDS~~)) SDS or its alternative or analysis using ((~~MSDSs~~)) SDSs or their alternative.

You must:

• Make sure labor and industries has prompt access to any exposure records and related analysis. This must be done without violation of any rights under the Constitution or the Washington Industrial Safety and Health Act that the employer chooses to exercise.

Note: Nothing in this rule is meant to prevent employees and collective bargaining agents from getting access to information beyond that is required by this rule.

You must:

• Make sure that whenever an employee or designated representative requests an initial copy of an exposure record, related analysis or new information added to the record:

- A copy of the record is provided without cost to the employee or their representative or

- The facilities are made available for copying without cost to the employee or their representative or

- The record is loaned to the employee or their representative for a reasonable time to enable a copy to be made.

Note: Whenever a record has been previously provided without cost to an employee or designated representative, and they request additional copies, the employer may charge reasonable, nondiscriminatory administrative costs (e.g., search and copying expenses, but no overhead expenses).

AMENDATORY SECTION (Amending WSR 01-23-060, filed 11/20/01, effective 12/1/01)

WAC 296-800-18020 Transfer records when ceasing to do business. You must:

• Transfer all ((~~material~~)) safety data sheets (((~~MSDSs~~))) (SDSs) as exposure records to the successor employer, who must do the following to these records:

- Received

- Preserve

- Keep unchanged

• If there is no successor to receive and preserve the employee exposure records:

- Notify affected current employees of their rights of access to records at least 3 months prior to the cessation of the employer's business

and

- Transfer the records to the department, if required by a specific WISHA safety and health rule.

REPEALER

The following sections of the Washington Administrative Code are repealed:

WAC 296-800-170	Employer chemical hazard communication—Introduction.
WAC 296-800-17005	Develop, implement, maintain, and make available a written Chemical Hazard Communication Program.
WAC 296-800-17007	Include multiemployer workplaces in your program if necessary.
WAC 296-800-17010	Identify and list all the hazardous chemicals present in your workplace.
WAC 296-800-17015	Obtain and maintain material safety data sheets (MSDSs) for each hazardous chemical used.

WAC 296-800-17020	Make sure material safety data sheets (MSDSs) are readily accessible to your employees and NIOSH.
WAC 296-800-17025	Label containers holding hazardous chemicals.
WAC 296-800-17030	Inform and train your employees about hazardous chemicals in your workplace.
WAC 296-800-17035	Follow these rules for laboratories using hazardous chemicals.
WAC 296-800-17040	Follow these rules for handling chemicals in factory-sealed containers.
WAC 296-800-17045	Translate certain chemical hazard communication documents upon request.
WAC 296-800-17050	Attempt to obtain a material safety data sheet (MSDS) upon request.
WAC 296-800-17055	Items or chemicals exempt from the rule, and exemptions from labeling.

REPEALER

The following chapter of the Washington Administrative Code is repealed:

WAC 296-816-100	Scope.
WAC 296-816-200	Protecting trade secrets.
WAC 296-816-20005	Indicate when trade secret information has been withheld.
WAC 296-816-20010	Provide trade secret information in a medical emergency.
WAC 296-816-20015	Respond to requests for trade secret information in nonemergency situations.
WAC 296-816-20020	Provide trade secret information when requested by WISHA.
WAC 296-816-300	Definitions.

AMENDATORY SECTION (Amending WSR 15-24-102, filed 12/1/15, effective 1/5/16)

WAC 296-828-099 Definitions. Action level. An airborne concentration of a hazardous substance that is calculated as an 8-hour time-weighted average, and initiates certain requirements to be followed such as exposure monitoring or medical surveillance.

Carcinogens. See **"Select carcinogen."**

Chemical hygiene officer. An employee designated by the employer who is qualified by training or experience to provide technical guidance in the development and implementation of the chemical hygiene plan. This definition is not intended to place limitations on the designated employee's position description or job classification within the employer's organization.

Chemical hygiene plan. A written program developed and implemented by the employer that establishes procedures, equipment, personal protective equipment, and work practices to protect employees from the health hazards of the chemicals used in the laboratory.

Container. Any container, except for pipes or piping systems that contains a hazardous substance. For example, it can be any of the following:

(a) Barrel.

(b) Bottle.

(c) Can.

(d) Cylinder.

(e) Drum.

(f) Reaction vessel.

(g) Storage tank.

Day. Any part of a calendar day.

Designated representative. Any one of the following:

(a) Any individual or organization to which an employee gives written authorization.

(b) A recognized or certified collective bargaining agent without regard to written employee authorization.

(c) The legal representative of a deceased or legally incapacitated employee.

Emergency. Any event that could or does result in the unexpected, significant release of a hazardous substance. Examples of emergencies include equipment failure, container rupture, or control equipment failure.

Exposure. The contact an employee has with a hazardous substance, whether or not protection is provided by respirators or other personal protective equipment (PPE). Exposure can occur through various routes of entry such as inhalation, ingestion, skin contact, or skin absorption.

Hazardous chemical. Any chemical which is classified as health hazard or simple asphyxiate in accordance with the Hazard Communication Standard, WAC 296-901-140.

Health hazard. A chemical ((~~that~~)) which is classified as posing one of the following hazardous effects: ((~~Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self-reactive; pyrophoric (gas, liquid, or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in Appendix B of the Hazard Communication Standard, WAC 296-901-14024 and 296-901-14006 (definitions of "combustible dust" and "pyrophoric gas")~~)) Acute toxicity (any route of exposure); skin corrosion or irritation; serious eye damage or eye irritation; respiratory or skin sensitization; germ cell mutagenicity; carcinogenicity; reproductive toxicity; specific target organ toxicity (single or repeated exposure); or aspiration hazard. The criteria for determining whether a chemical is classified as a health hazard are detailed in WAC 296-901-14022, Appendix A—Health hazard criteria.

Laboratory. A facility where the "laboratory use of hazardous substances" takes place. A workplace where relatively small amounts of hazardous substances are used on a nonproduction basis.

Laboratory-type hood. A device located in a laboratory, enclosure on five sides with a moveable sash or fixed partially enclosed on the remaining side; constructed and maintained to draw air from the laboratory and to prevent or minimize the escape of air contaminants into the laboratory; and allows chemical manipulations to be conducted in the enclosure without insertion of any portion of the employee's body other than hands and arms.

Note: Walk-in hoods with adjustable sashes meet the above definition provided that the sashes are adjusted during use so that the airflow and the exhaust of air contaminants are not compromised and employees do not work inside the enclosure during the release of airborne hazardous substances.

Laboratory scale. Work with substances in which the containers used for reactions, transfers, and other handling of the substances are designed to be easily and safely manipulated by one person. "Laboratory scale" **does not** include workplaces producing commercial quantities of materials.

Laboratory use. The handling or use of hazardous substances that includes **all** the following:

(a) Chemical manipulations conducted on a "laboratory scale";

(b) Multiple chemical procedures or chemicals are used;

(c) The procedures are not part of a production process, nor in any way simulate a production process; and

(d) "Protective laboratory practices and equipment" are available and are commonly used to minimize the potential for employee exposures to hazardous substances.

Licensed health care professional (LHCP). An individual whose legally permitted scope of practice allows him or her to provide some or all of the health care services required for medical evaluations.

Mutagen. Chemicals that cause permanent changes in the amount or structure of the genetic material in a cell. Chemicals classified as mutagens in accordance with the Hazard Communication Standard, WAC 296-901-140 must be considered mutagens for purposes of this section.

Permissible exposure limits (PELs). PELs are employee exposures to toxic substances or harmful physical agents that must not be exceeded. PELs are also specified in WISHA rules found in other chapters.

Physical hazard. A chemical that is classified as posing one of the following hazardous effects: Explosive; flammable (gases, aerosols, liquids, or solids); oxidizer (liquid, solid, or gas); self-reactive; pyrophoric (gas, liquid, or solid); self-heating; organic peroxide; corrosive to metal; gas under pressure; in contact with water emits flammable gas; or combustible dust. The criteria for determining whether a chemical is classified as a physical hazard are in Appendix B of the Hazard Communication Standard, WAC 296-901-14024 and 296-901-14006 (definitions of "combustible dust" and "pyrophoric gas").

Protective laboratory practices and equipment. Laboratory procedures, practices, and equipment accepted by laboratory health and safety experts as effective, that can be shown to be effective, in minimizing the potential for employee exposure to hazardous substances.

Reproductive toxin. Chemicals that affect the reproductive capabilities including adverse effects on sexual function and fertility in adult males and females, as well as adverse effects on the development of the offspring. Chemicals classified as reproductive toxins in accordance with the Hazard Communication Standard, WAC 296-901-140 shall be considered reproductive toxins for purposes of this section.

Safety data sheet (SDS). Written, printed, or electronic information (on paper, microfiche, or on-screen) that informs manufacturers, distributors, employers or employees about a hazardous substance, its hazards, and protective measures as required by safety data sheet and label preparation, WAC 296-901-14012 and 296-901-14014.

Select carcinogen. Any substance meeting one of the following criteria:

(a) Regulated by WISHA as a carcinogen.

(b) Listed in the "known to be carcinogens" category in the latest edition of the *Annual Report on Carcinogens* by the National Toxicity Program (NTP).

(c) Listed in Group I (carcinogenic to humans) in the latest editions of the International Agency for Research on Cancer (IARC) Monographs.

(d) Listed in either group 2A or 2B by IARC **or** in the category "reasonably anticipated to be carcinogens" by the NTP, and causes statistically significant tumor incidence in experimental animals in accordance with any of the following criteria:

(i) After an inhalation exposure of six to seven hours a day; five days a week; for a significant portion of a lifetime to dosages of less than 10 mg/m^3; **or**

(ii) After repeated skin application of less than 300 mg/kg of body weight per week; **or**

(iii) After oral dosages of less than 50 mg/kg of body weight per day.

Time-weighted average (TWA_8). An exposure limit averaged over an 8-hour period that must not be exceeded during an employee's workday.

AMENDATORY SECTION (Amending WSR 02-15-102, filed 7/17/02, effective 10/1/02)

WAC 296-835-11030 Make sure employees working near dip tanks know appropriate first-aid procedures.

You must:

• Make sure your employees know the appropriate first-aid procedures for the hazards of your dipping and coating operations.

Note:
• First-aid procedures are contained in the ((~~Material~~)) Safety Data Sheet (((~~MSDS~~))) (SDS) for the chemicals used in the dip tank.
• First-aid supplies appropriate for the hazards of the dipping or coating operation need to be located near the dip tank to be considered "readily available" as required by WAC 296-800-15020.

Reference: There are additional requirements that may include providing emergency washing facilities and employee training. See first aid, WAC 296-800-150, and ((~~employer chemical hazard communication, WAC 296-800-170~~)) chapter 296-901 WAC, Globally harmonized system for hazard communication, in the safety and health core rules, chapter 296-800 WAC.

REPEALER

The following chapter of the Washington Administrative Code is repealed:

WAC 296-839-100	Scope.
WAC 296-839-200	Hazard evaluation.
WAC 296-839-20005	Conduct complete hazard evaluations.
WAC 296-839-20010	Provide access to hazard evaluation procedures.
WAC 296-839-300	Material safety data sheets.
WAC 296-839-30005	Develop or obtain material safety data sheets (MSDSs).
WAC 296-839-30010	Provide MSDSs for products shipped, transferred or sold over-the-counter.
WAC 296-839-30015	Follow-up if an MSDS is not provided.
WAC 296-839-400	Labeling.
WAC 296-839-40005	Label containers of hazardous chemicals.
WAC 296-839-500	Definitions.

PART B-1
TRADE SECRETS

Note: Chapter 296-62 WAC General occupational health standards Part B-1 Trade secrets (WAC 296-62-05301 through 296-62-05325) has been repealed. Please refer to WAC 296-901-14018 Trade secrets.

AMENDATORY SECTION (Amending WSR 97-01-079, filed 12/17/96, effective 3/1/97)

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 magnesium 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~~)) SDS).

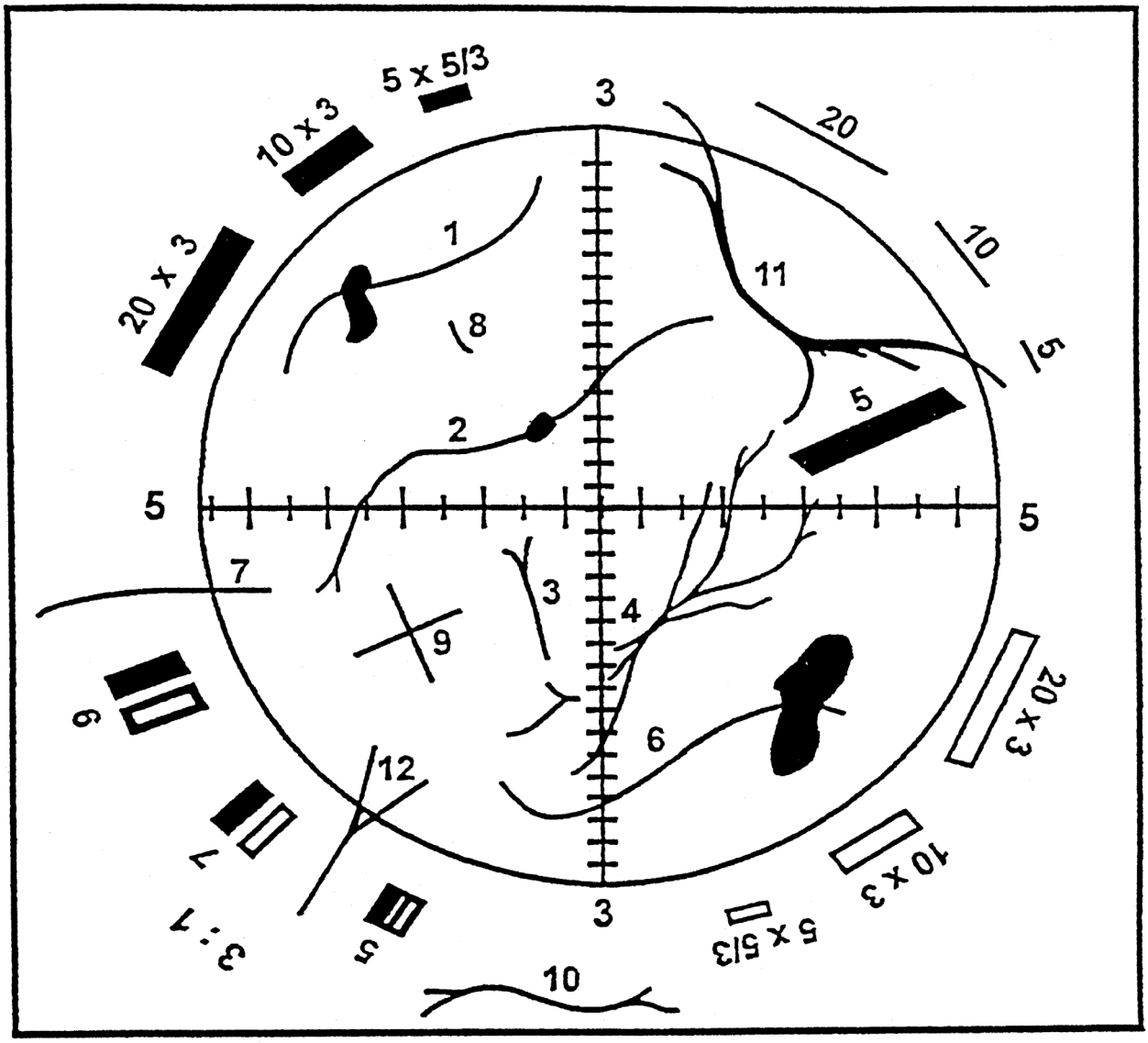


Figure 1: Walton-Beckett Graticule with some explanatory fibers.

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 silver 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.

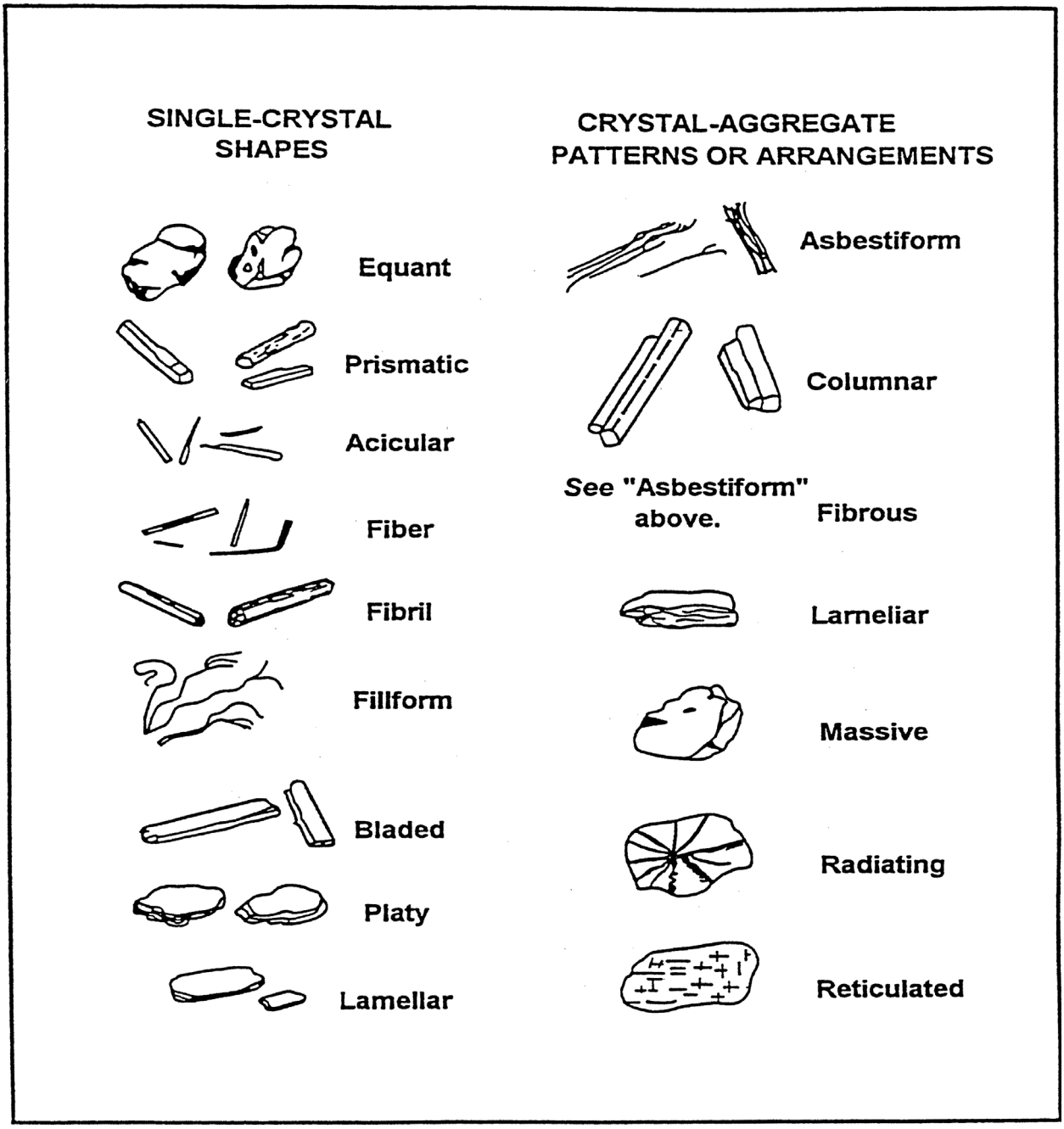


Figure 1. Particle definitions showing mineral growth habits. From the U.S. Bureau of Mines.

(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=(Microvisual result in percent)x(Fraction remaining after step 2)x(Fraction remaining of original sample after step 1)

R=(5)x(.30)x(.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 degrees 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 degrees 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 axises. 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 prepreparation. 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.

((~~(8)~~)) (5) References

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REPEALER

The following sections of the Washington Administrative Code are repealed:

WAC 296-62-05301	Definitions.
WAC 296-62-05305	Meet certain conditions if you withhold trade secret information.
WAC 296-62-05310	Reveal trade secret information when it is needed in order to treat a medical or first-aid emergency.
WAC 296-62-05315	Reveal trade secret information in nonemergency situations when requested by a health professional, employee, or designated representative.
WAC 296-62-05320	Deny a written request for disclosure of a specific chemical identity in the manner specified in this rule.
WAC 296-62-05325	Understand what is a trade secret.

WSR 16-20-084
EXPEDITED RULES
DEPARTMENT OF LABOR AND INDUSTRIES

[Filed October 4, 2016, 12:11 p.m.]

Title of Rule and Other Identifying Information: Chapter 296-823 WAC, Occupational exposure to bloodborne pathogens; chapter 296-869 WAC, Elevating work platforms; chapter 296-870 WAC, Powered platforms; and chapter 296-874 WAC, Scaffolds.

NOTICE

THIS RULE IS BEING PROPOSED UNDER AN EXPEDITED RULE-MAKING PROCESS THAT WILL ELIMINATE THE NEED FOR THE AGENCY TO HOLD PUBLIC HEARINGS, PREPARE A SMALL BUSINESS ECONOMIC IMPACT STATEMENT, OR PROVIDE RESPONSES TO THE CRITERIA FOR A SIGNIFICANT LEGISLATIVE RULE. IF YOU OBJECT TO THIS USE OF THE EXPEDITED RULE-MAKING PROCESS, YOU MUST EXPRESS YOUR OBJECTIONS IN WRITING AND THEY MUST BE SENT TO Chris Miller, Department of Labor and Industries, P.O. Box 44610, Olympia, WA 98504, AND RECEIVED BY December 5, 2016.

Purpose of the Proposal and Its Anticipated Effects, Including Any Changes in Existing Rules: The purpose of this proposal is to fix any outstanding housekeeping issues that are on the department of labor and industries division of occupational safety and health's change log for the chapters listed above, as well as proposing to add language back in that is currently in federal Occupational Safety and Health Administration (OSHA) rules that was inadvertently removed from chapter 296-870 WAC during previous rule making.

WAC 296-823-16015 Provide the results of the source person's blood test to the exposed employee.

- Correct the terms [in] item 3 of the note from "rules" to "statutes" for references to the Revised Code of Washington.
- Correct the web site link to the direct readers to the Revised Code of Washington web page (http://app.leg.wa.gov/rcw) and not the Washington Administrative Code web page (http://www.leg.wa.gov/wac).

WAC 296-869-60040 Working from the platform.
- Add "self-propelled elevating work platforms" to the note to clarify that guardrails are the primary means of fall protection for both manually propelled and self-propelled elevating work platforms.

WAC 296-870-099 Definitions.
- Update bullets to letters throughout section.
- Add the definition for "verified" that had been accidentally deleted when the requirements for powered platforms where [were] moved from chapter 296-24 WAC, Part Y-3 to chapter 296-870 WAC in 2006. Federal OSHA's rules also have the term "verified" defined under 29 C.F.R. 1910.66(d).

WAC 296-870-20010 Personnel requirements.
- Clarified number 2 in reference by changing the term "using" to "operate and inspect" as follows, "Training requirements for persons who operate and inspect powered platforms are found in WAC 296-870-400."

WAC 296-870-50010 Fall protection.
- Correct the term "that" to "than" in subsection (2)(a).

WAC 296-870-60005 Design.
- Add language that was left out of final version when the requirements for powered platforms where [were] moved from chapter 296-24 WAC, Part Y-3 to chapter 296-870 WAC in 2006. Language in new subsection (5) now reads: "You must make sure the building design and installation provides:

(a) Safe access to and egress from the equipment; and
(b) Sufficient space to conduct maintenance of the equipment."

Federal OSHA rule also has these requirements under 29 C.F.R. 1910.66 (e)(1)(iii).

WAC 296-870-70050 Suspended working platforms and manned platforms used on supported equipment.
- Update subsection (3) in reference include fixed ladders as follows, "Ladders, portable and fixed, chapter 296-876 WAC.["]

WAC 296-874-40006 Make sure supported scaffolds are properly supported.
- Corrected the forklift and other powered industrial trucks chapter number in reference to "chapter 296-863 WAC."

WAC 296-874-40030 Meet these requirements when using pole scaffolds.
- Corrected the conversation [conversion] of pounds to kilograms, replacing "222 kg" with "22.7 kg" in subsection (3)(c).

Reasons Supporting Proposal: Updating these housekeeping errors and replacing the language that was inadvertently removed will ensure that all readers of these rule sections can clearly understand the rules, keeping employers and employees safe on the job.

Statutory Authority for Adoption: RCW 49.17.010, 49.17.040, 49.17.050, 49.17.060.

Statute Being Implemented: Chapter 49.17 RCW.

Rule is necessary because of federal law, [no further information supplied by agency].

Name of Proponent: Department of labor and industries, governmental.

Name of Agency Personnel Responsible for Drafting: Chris Miller, Tumwater, (360) 902-5516; Implementation and Enforcement: Anne Soiza, Tumwater, (360) 902-5090.

October 4, 2016
Joel Sacks
Director

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-823-16015 Provide the results of the source person's blood test to the exposed employee. (1) You must make sure the results of the source person's blood test are provided to the exposed employee, if possible.

(2) You must make sure the exposed employee is informed of applicable laws and regulations regarding disclosure of the identity and infection status of the source person.

Note: Law and regulations that currently apply are:
1. Chapter 70.02 RCW, Medical records—Health care information access and disclosure.
2. Chapter 70.24 RCW, Control and treatment of sexually transmitted diseases.
3. Both ((~~rules~~)) statutes can be found at ((~~http://www.leg.wa.gov/wac~~)) http://app.leg.wa.gov/rcw/ and click on Title 70 RCW to find these ((~~rules~~)) statutes.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-869-60040 Working from the platform. (1) You must make sure persons working from the platform:

(a) Keep a firm footing on the platform; and

(b) Do not use guardrails, planks, ladders, or any other device to gain additional height or reach.

(2) You must make sure all persons on the platform of boom-supported elevating work platforms wear a full body harness and lanyard fixed to manufacturer provided and approved attachment points.

(3) You must make sure the rated capacities of the platform are not exceeded when transferring loads to the platform at any height.

Note: Guardrails are the primary means of fall protection for manually propelled elevating work platforms and self-propelled elevating work platforms.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-870-099 Definitions.

Anemometer. An instrument for measuring wind velocity.

Angulated roping. A suspension method where the upper point of suspension is inboard from the attachments on the suspended unit, thus causing the suspended unit to bear against the face of the building.

Building face rollers. A specialized form of guide roller designed to ride on the face of the building wall to prevent the platform from abrading the face of the building and to assist in stabilizing the platform.

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

Cable. A conductor, or group of conductors, enclosed in a weatherproof sheath, that may be used to:

((•)) (a) Supply electrical power or control current for equipment; or

((•)) (b) Provide voice communication circuits.

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

Certification. A written, signed, and dated statement confirming the performance of a requirement.

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.

Competent person. Someone who:

((•)) (a) Is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees; and

((•)) (b) Has the authority to take prompt corrective measures to eliminate them.

Continuous pressure. Operation of a control by requiring constant manual actuation for the control to function.

Control. A system or mechanism used to regulate or guide the operation of equipment.

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.

Design factor. The ratio of the rated strength of the suspension wire rope to the rated working load. It is calculated using the following formula:

F = (S x 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.

Equivalent. Alternative design, material or method to protect against a hazard. You have to demonstrate it provides an equal or greater degree of safety for employees than the method, material or design specified in the rule.

Existing installation. A permanent powered platform installation that:

((•)) (a) Was completed before July 23, 1990; and

((•)) (b) Has had no major modification done after July 23, 1990.

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

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

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

Guide roller. A rotating cylindrical member that provides continuous engagement between the suspended or supported equipment and the building guides. It may operate separately or as part of a guide assembly.

Guide shoe. A device that is similar to a guide roller but is designed to provide a sliding contact between the shoe and the building guides.

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

Installation. A powered platform installation consists of all the equipment and the parts of the building involved with using the powered platform for building maintenance.

Interlock. A device designed to ensure that operations or motions occur in proper sequence.

Intermittent stabilization. A method of platform stabilization in which the angulated suspension wire ropes are secured to regularly spaced building anchors.

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.

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

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

New installation. A permanent powered platform installation that was completed, or an existing installation that has had major modifications done, after July 23, 1990.

Operating control. A mechanism regulating or guiding the operation of equipment that makes sure the equipment operates in a specific mode.

Operating device. A push button, lever, or other manual device used to actuate a control.

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.

Poured socket. A method of providing wire rope termination in which the ends of the rope are held in a tapered socket by means of poured spelter or resins.

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

Prime mover. The source of mechanical power for a machine.

Rated load. The manufacturer's specified maximum load.

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

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

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.

Roof-powered platform. A powered platform having the raising and lowering mechanism located on the roof.

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.

Rope. The equipment, such as wire rope, that is used to suspend a component of an equipment installation.

Safe surface. A horizontal surface that provides reasonable assurance that personnel occupying the surface will be protected from falls. This protection can be provided by location, a fall protection system, or other equivalent method.

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

Stability factor. The ratio of the stabilizing moment to the overturning moment.

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

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

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.

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.

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

Type F powered platform. A powered platform that has both of the following characteristics:

((•)) (a) The working platform is suspended by at least four wire ropes and designed so that failure of any one wire rope will not substantially alter the normal position of the working platform; and

((•)) (b) Only one layer of hoisting rope is permitted on the winding drums.

Type T powered platform. A powered platform installation that has a working platform suspended by at least two wire ropes. The platform will not fall to the ground if a wire rope fails, but the working platform's normal position would be upset.

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

Weatherproof. Constructed or protected so that exposure to the weather will not interfere with successful operation.

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

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.

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

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-870-20010 Personnel requirements. (1) You must prohibit employees from using the installation until the building owner has provided the required written certifications.

(2) You must make sure working platforms are operated only by persons proficient in the operation, safe use and inspection of the particular working platform.

References:
1. Building owner certification requirements are found in Building owner certifications, WAC 296-870-20005.
2. Training requirements for persons ((~~using~~)) who operate and inspect powered platforms are found in ((~~Existing installations,~~)) WAC 296-870-400.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-870-50010 Fall protection. (1) You must make sure the fall protection system of both Type F and Type T powered platforms meet the requirements of Appendix C—Personal fall arrest system, WAC 296-24-88050, found in the General safety and health standards, chapter 296-24 WAC.

(2) You must make sure working platforms have permanent guardrails that meet all of the following requirements:

(a) Guardrails on the building side (front) of the platform have a top rail that is not less ((~~that~~)) than thirty-eight inches and not more than forty-five inches high.

(b) Guardrails on the other three sides have a top rail that is not less than forty-five inches high.

(c) Top rails are able to withstand a force of at least two hundred pounds.

(d) Guardrails have a midrail around the entire platform between the top rail and the toeboard.

Reference: Ramps and walkways that are four feet (1.2 m) or more above a lower level need to have a guardrail system. These requirements are found in Working Surfaces, Guarding Floors and Wall Openings, Ladders, Part J-1, in the General safety and health standards, chapter 296-24 WAC.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-870-60005 Design. (1) You must make sure structural supports, tie-downs, tie-in guides, anchoring devices and any affected parts of the building included in the installation are designed by, or under the direction of, a registered professional engineer experienced in such design.

(2) You must make sure affected parts of the building are capable of sustaining all the loads imposed by the equipment.

(3) You must make sure exterior installations are capable of withstanding prevailing climatic conditions.

(4) You must make sure the affected parts of the building allow employees to use the equipment without being exposed to a hazardous condition.

(5) You must make sure the building design and installation provides:

(a) Safe access to and egress from the equipment; and

(b) Sufficient space to conduct maintenance of the equipment.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-870-70050 Suspended working platforms and manned platforms used on supported equipment. (1) You must make sure the width of the working platform is:

(a) At least twenty-four inches (610 mm); and

(b) Allows a minimum of a twelve-inch (305 mm) wide passage at or past any obstruction on the platform.

(2) You must make sure the platform has slip-resistant flooring.

(3) You must make sure any opening in the platform is either:

(a) Small enough to prevent passage of life lines, cables, and other potential falling objects; or

(b) Protected by material under the opening which prevents the passage of life lines, cables, and potential falling objects.

(4) You must make sure means are provided to store any cable suspended from above the platform to keep it from accumulating on the floor of the platform.

(5) You must make sure means are provided to secure all tools, water tanks, and other accessories to keep them from moving or accumulating on the floor of the platform.

(6) You must make sure flammable liquids are not carried on the working platform.

(7) You must make sure a type B-C portable fire extinguisher is provided and securely attached on all working platforms.

(8) You must make sure operating controls for vertical travel of the platform are:

(a) Continuous-pressure type; and

(b) Located on the platform.

(9) You must make sure the maximum rated speed of the platform is limited to:

(a) Fifty feet per minute (0.3 ms) for single speed hoists; and

(b) Seventy-five feet per minute (0.4 ms) for multispeed hoists.

(10) You must make sure access to and egress from a working platform, except for those that land directly on a safe surface, is provided by stairs, ladders, platforms or runways.

(11) You must make sure access gates are self-closing and self-latching.

Reference: Requirements for stairs, ladders, platforms and runways are found in other chapters:

1. Working Surfaces, Guarding Floors and Wall Openings, Ladders, Part J-1 in the General safety and health standards, chapter 296-24 WAC.

2. Scaffolds, chapter 296-874 WAC.

3. Ladders, portable and fixed, chapter 296-876 WAC.

(12) You must make sure a suspended platform's suspension system restricts the platform inboard to outboard roll around its longitudinal axis to not more than fifteen degrees from the horizontal when moving the live load from the inboard to the outboard side of the platform.

Note: The roll limitation does not apply to supported equipment.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-874-40006 Make sure supported scaffolds are properly supported. (1) You must make sure supported scaffold poles, legs, posts, frames, and uprights are:

(a) Plumb; and

(b) Braced to prevent swaying or displacement.

(2) You must make sure supported scaffold poles, legs, posts, frames, and uprights, bear on base plates that rest on:

(a) Mudsills; or

(b) Other firm foundations such as concrete or dry, compacted soil.

(3) You must make sure foundations are all of the following:

(a) Level;

(b) Sound;

(c) Rigid;

(d) Capable of supporting the loaded scaffold without settling or displacement.

Note: The condition of the foundation may change due to weather or other factors. If changes occur, the foundation needs to be evaluated by a competent person to make sure it will safely support the scaffold.

(4) You must make sure unstable objects are not used:

(a) To support scaffolds or platform units; or

(b) As working platforms.

(5) You must make sure mobile scaffolds meet these additional requirements:

(a) Wheel and caster stems are pinned or otherwise secured in the scaffold legs or adjustment screws;

(b) Wheels and casters are locked, or equivalent means are used, to prevent movement when the scaffold is being used;

(c) Screw jacks or other equivalent means are used if it's necessary to level the work platform.

(6) You must make sure front-end loaders and similar equipment used to support scaffold platforms have been specifically designed for such use by the manufacturer.

Reference: When forklifts or other powered industrial trucks are used for personnel lifting on support scaffold platforms, follow the requirements found in Forklifts and other powered industrial trucks, chapter ((~~296-868~~)) 296-863 WAC.

AMENDATORY SECTION (Amending WSR 15-23-086, filed 11/17/15, effective 12/18/15)

WAC 296-874-40030 Meet these requirements when using pole scaffolds. (1) You must make sure pole scaffolds over sixty feet high are:

(a) Designed by a registered professional engineer; and

(b) Constructed and loaded as specified in the design.

(2) You must leave existing platforms undisturbed until new bearers have been set in place and braced before moving the platforms to the new level.

(3) You must install bracing on double-pole scaffolds as follows:

(a) Crossbracing between the inner and outer sets of poles;

(b) Diagonal bracing in both directions across the entire outside face of the scaffold;

(c) Diagonal bracing in both directions across the entire inside face of scaffolds that are used to support loads equivalent to a uniformly distributed load of fifty pounds (((~~222~~)) 22.7 kg) or more per square foot (929 square cm).

(4) You must install diagonal bracing on single pole scaffolds in both directions across the entire outside face of the scaffold.

(5) You must make sure runners meet all of the following:

(a) Are installed on edge;

(b) Extend over a minimum of two poles;

(c) Are supported by bearing blocks securely attached to the poles.

(6) You must make sure bearers are:

(a) Installed on edge; and

(b) Extend a minimum of three inches (7.6 cm) over the outside edges of runners.

(7) You must make sure runners, bearers, and braces are not spliced between poles.

(8) You must make sure wood poles that are spliced together meet both of the following:

(a) The ends of the poles at the splice:

(i) Are square; and

(ii) The upper section rests squarely on the lower section.

(b) Wood splice plates are provided that meet all of the following:

(i) Are installed on at least two adjacent sides;

(ii) Extend at least two feet (0.6 m) on either side of the splice;

(iii) Overlap the abutted ends equally;

(iv) Have the same cross-sectional areas as the pole.

Note: Splice plates of material other than wood may be used if they are of equivalent strength.