

**Chapter 246-227 WAC**  
**RADIATION PROTECTION—INDUSTRIAL**  
**X-ray**

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**WAC**

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**DISPOSITION OF SECTIONS FORMERLY CODIFIED IN THIS CHAPTER**

246-227-010	Scope. [Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-010, filed 12/9/93, effective 1/9/94.] Repealed by WSR 97-20-101, filed 9/29/97, effective 10/30/97. Statutory Authority: RCW 43.70.040.
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**WAC 246-227-001 Purpose.** The regulations in this chapter establish radiation safety requirements for persons utilizing X-ray machines for industrial radiography. The requirements of this part are in addition to and not in substitution for the other requirements of these regulations.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-001, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-020 Definitions.** As used in this part:

(1) "Enclosed radiography" means industrial radiography employing radiation machines conducted in an enclosed cabinet or room and includes cabinet radiography and shielded room radiography.

(a) "Cabinet radiography" means industrial radiography employing radiation machines conducted in an enclosure or cabinet so shielded that every location at the exterior of the enclosure or cabinet meets the condition specified in WAC 246-221-060.

"Cabinet X-ray system" means an X-ray system with the X-ray tube installed in an enclosure (hereinafter termed "cabinet") which, independently of existing architectural structure except the floor on which it may be placed, is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of x-radiation. Included are all X-ray systems designed primarily for the inspection of carry-on baggage at airline, railroad, and bus terminals, and in similar facilities. An X-ray tube used within a shielded part of a building, or X-ray equipment which may temporarily or occasionally incorporate portable shielding is not considered a cabinet X-ray system.

(b) "Shielded-room radiography" means industrial radiography conducted in a room so shielded that every location on the exterior of the room meets the conditions specified in WAC 246-221-060.

(2) "Industrial radiography" means the examination of the macroscopic structure of materials by nondestructive methods utilizing X-

ray machines. Industrial radiography as used in this chapter does not include well logging operations.

(3) "Permanent radiographic installation" means an installation in which the shielding is an integral part to the building structure, such that the radiographic operations conducted there are not mobile and not temporary.

(4) "Personal supervision" means supervision by a radiographer such that the radiographer is physically present at the radiography site and in such proximity that communication can be maintained and immediate assistance given as required.

(5) "Radiographer" means any individual who performs or who, in attendance at the site where X-ray machines are being used, personally supervises industrial radiographic operations and who is responsible to the registrant for assuring compliance with the requirements of these regulations.

(6) "Radiographer's assistant" means any individual who, under the personal supervision of a radiographer, uses radiation machines, or radiation survey instruments in industrial radiography.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-020, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-040 Radiation survey instruments.** (1) The registrant shall maintain sufficient calibrated and operable radiation survey instruments to make physical radiation surveys as required by this part and chapter 246-221 WAC. Instrumentation required by this section shall have a range such that two milliroentgens per hour through one roentgen per hour can be measured.

(2) Each radiation survey instrument shall be calibrated:

(a) At energies appropriate for use and at intervals not to exceed three months and after each instrument servicing;

(b) Such that accuracy within  $\pm$  twenty percent traceable to a national standard can be demonstrated; and

(c) At two or more widely separated points, other than zero, on each scale.

(3) Records of these calibrations shall be maintained for three years after the most recent calibration date.

(4) The requirements of this section do not apply to registrants using only radiation machines in enclosed radiographic systems.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-040, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-050 Utilization and survey records.** (1) Each registrant shall maintain records of the following information for three years after the date of each radiographic operation and shall maintain these records for inspection by the department:

(a) A description (or make and model number) of the radiation machine used along with the techniques utilized for each job;

(b) The identity of the radiographer and radiographer's assistant performing the work;

(c) Locations where used and dates of use;

(d) A physical radiation survey made of the boundary of the restricted area during radiographic operations. The maximum reading at the boundary shall be recorded. The records shall indicate approximate

distance from source to boundaries and any occupied areas with exposure levels greater than 2 mR in any hour during radiographic operations; and

(e) The model and serial number of the survey meter used in (d) of this subsection.

(2) The requirements of subsection (1) of this section shall not apply in industrial radiography utilizing radiation machines in enclosed interlocked cabinets or rooms which are not occupied during radiographic operations, which are equipped with interlocks such that the radiation machine will not operate unless all openings are securely closed and which is so shielded that every location on the exterior meets conditions for an unrestricted area, as specified in WAC 246-221-060.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-050, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-060 Limitations—Personal radiation safety requirements for radiographers and radiographer's assistants.** (1) No registrant shall permit any individual to act as a radiographer as defined in this chapter until such individual:

(a) Has been instructed in the subjects outlined in WAC 246-227-170;

(b) Has received copies of and instruction in the regulations contained in chapters 246-220, 246-222, 246-221 and 246-227 WAC, and the registrant's operating and emergency procedures, and shall have demonstrated understanding thereof;

(c) Has demonstrated competence to use the radiation machine and the radiation survey instruments which will be employed in the individual's assignment; and

(d) Has demonstrated understanding of the instructions in this paragraph by successful completion of written test or oral test on the subjects covered.

(2) No registrant shall permit any individual to act as a radiographer's assistant as defined in this part until such individual:

(a) Has received copies of an instruction in the registrant's operating and emergency procedures;

(b) Has demonstrated competence to use, under the personal supervision of the radiographer, the radiation survey instruments which will be employed in the individual's assignment;

(c) Has demonstrated understanding of the instructions in this paragraph by successfully completing a written or oral test.

(3) Each registrant shall maintain records of training and testing which demonstrate that the requirements of subsections (1) and (2) of this section are met. These records shall be retained for at least one year following termination of employment.

(4) When a radiographer's assistant is using an X-ray machine, the radiographer shall maintain direct surveillance.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-060, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-070 Operating and emergency procedures.** The registrant's operating and emergency procedures shall include instructions in at least the following:

- (1) The handling and use of radiation machines to be employed such that no individual is likely to be exposed to radiation doses in excess of the limits established in chapter 246-221 WAC;
- (2) Methods and occasions for conducting radiation surveys;
- (3) Methods for controlling access to radiographic areas;
- (4) Methods and occasions for locking or securing radiation machines;
- (5) Personnel monitoring and the use of personnel monitoring equipment including steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale;
- (6) The procedure for notifying proper personnel in the event of a theft, loss, overexposure or accident involving a radiation machine; and
- (7) Maintenance of records.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-070, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-080 Personnel monitoring control.** (1) No registrant shall permit any individual to act as a radiographer or as a radiographer's assistant unless, at all times during radiographic operations, each such individual shall wear a film or TLD badge and a direct reading pocket dosimeter. Pocket dosimeters shall be capable of measuring exposures from zero to at least two hundred milliroentgens. A film or TLD badge shall be assigned to and worn by only one individual.

(2) Pocket dosimeters shall be read and doses recorded daily. Pocket dosimeters shall be charged at the beginning of each working day. Pocket dosimeters shall be checked at least annually for correct response to radiation. Acceptable dosimeters shall read within  $\pm$  thirty percent of the true radiation exposure. A film or TLD badge shall be immediately processed if a pocket dosimeter is discharged beyond its range during normal use. The film or TLD badge reports received from the film or TLD badge processor and records of pocket dosimeter readings shall be maintained until the department authorizes their disposal.

(3) The requirements for use of pocket dosimeter or pocket chamber shall not apply in industrial radiography utilizing radiation machines in enclosed interlocked cabinets or rooms which are not occupied during radiographic operations, which are equipped with interlocks such that the radiation machine will not operate unless all openings are securely closed and which are so shielded that every location on the exterior meets conditions for an unrestricted area, as specified in WAC 246-221-060.

(4) The requirement for film badges or TLDs do not apply to those users of cabinet X-ray systems which do not allow human access and which meet the requirements of WAC 246-227-130.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-080, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-090 Security—Precautionary procedures in radiographic operations.** (1) During each radiographic operation, the radiographer or radiographer's assistant shall maintain a direct surveillance of the operation to protect against unauthorized entry into a high radiation area, as defined in chapter 246-220 WAC except:

(a) Where the high radiation area is equipped with a control device or alarm system as described in WAC 246-221-120 (1)(e)(ii); or

(b) Where the high radiation area is locked to protect against unauthorized or accidental entry.

(2) When not in operation or when not under direct surveillance, radiation machines shall be secured to prevent use by unauthorized personnel.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-090, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-095 Posting.** Notwithstanding any provisions in WAC 246-221-130, areas in which radiography is being performed shall be conspicuously posted and access to the area shall be controlled as required by WAC 246-221-120. This requirement shall not apply to areas using enclosed radiography systems (cabinets) which do not allow human access and in which the requirements of WAC 246-221-060 are met at the surface of the cabinet.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-095, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-120 Other records required.** Each registrant conducting industrial radiography shall have the following documents, where applicable, available on site for inspection by the department:

(1) Operating and emergency procedures;

(2) Applicable regulations;

(3) Survey records required pursuant to WAC 246-227-050;

(4) Daily pocket dosimeter records for the period of operation at the site pursuant to WAC 246-227-080; and

(5) Proof of the latest calibration for specific instruments in use at the site pursuant to WAC 246-227-040.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-120, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-130 Special requirements for enclosed radiography.**

(1) Shielded room radiography systems and cabinet systems shall:

(a) Comply with all applicable requirements of this chapter and WAC 246-221-060;

(b) Be interlocked such that the exposure will terminate if a door or port accessible to individuals is opened during the exposure, except for those systems employing conveyor belts or sample ports; and

(c) Be tested for the proper operation of interlocks, high radiation area control devices or alarm systems, where applicable, at the beginning of each day of use. The results of these tests shall be recorded and maintained for three years.

(2) The registrant shall perform an evaluation, at intervals not to exceed one year, to determine conformance with this chapter and WAC 246-221-060. Records of each evaluation shall be maintained for three years.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-130, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-150 Special requirements for permanent radiographic installation.** Permanent radiographic installations having high radiation area entrance controls of the types described in WAC 246-221-102(1) or where the high radiation area is locked to protect against unauthorized or accidental entry, shall also meet the following special requirements:

(1) Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation to which this section applies shall have both visible and audible warning signals to warn of the presence of radiation. The visible signal shall be actuated by radiation whenever the x-rays are exposed. The audible signal shall be actuated when an attempt is made to enter the installation while x-rays are being generated.

(2) Both visible and audible alarm systems are required and shall be tested prior to the first use of a source in the installation and thereafter at intervals not to exceed three months. Records of the tests shall be kept for three years.

(3) The department shall review and approve, in advance of construction, plans for permanent radiographic installations whose construction had not commenced by the effective date of these regulations. Construction of the permanent facility shall be in accordance with the plans approved by the department.

(4) A physical radiation survey shall be conducted and results recorded following construction or major modification of the facility to be used in the installation. Radiography shall not be conducted if exposure levels in unrestricted areas are greater than 2mR in any hour. Any increase in output capability of radiation machines will require resurvey of the installation prior to the conduct of industrial radiography.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-150, filed 12/9/93, effective 1/9/94.]

**WAC 246-227-170 Appendix A—Minimum subjects to be covered in training radiographers.** (1) Fundamentals of radiation safety:

- (a) Characteristics of ionizing radiation;
- (b) Units of radiation dose (mrem) and quantity of radioactivity (curie);
- (c) Hazards of exposure to radiation:
  - (i) Radiation protection standards;
  - (ii) Biological effects of radiation dose;
- (d) Levels of radiation from X-ray machines;
- (e) Methods of controlling radiation dose:
  - (i) Working time;
  - (ii) Working distances;
  - (iii) Shielding.

- (2) Radiation detection instrumentation to be used:
  - (a) Use of radiation survey instruments:
    - (i) Operation;
    - (ii) Calibration;
    - (iii) Limitations;
  - (b) Survey techniques;
  - (c) Use of personnel monitoring equipment:
    - (i) Film badges;
    - (ii) Pocket dosimeters;
    - (iii) Thermoluminescent dosimeters.
- (3) Operation and control of X-ray equipment.
- (4) The requirements of pertinent federal and state regulations.
- (5) The registrant's written operating and emergency procedures.
- (6) Case histories of radiography accidents.

[Statutory Authority: RCW 70.98.050. WSR 94-01-073, § 246-227-170, filed 12/9/93, effective 1/9/94.]