

DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Hazardous Materials and Waste Management Division

6 CCR 1007-1

STATE BOARD OF HEALTH

RULES AND REGULATIONS PERTAINING TO RADIATION CONTROL

PART 5:

RADIATION SAFETY REQUIREMENTS FOR INDUSTRIAL RADIOGRAPHIC OPERATIONS

5.1 Purpose and Scope.

5.1.1 Authority.

Rules and regulations set forth herein are adopted pursuant to the provisions of sections 25-1-108, 25-1.5-101(1)(k), 25-1.5-101(1)(l), and 25-11-104, CRS.

5.1.2 Basis and Purpose.

A statement of basis and purpose accompanies this part and changes to this part. A copy may be obtained from the Department.

5.1.3 Scope.

This part establishes requirements for the issuance of licenses or registrations for the industrial use of sources of radiation and radiation safety requirements for persons using these sources of radiation in industrial radiography.

5.1.4 Applicability.

5.1.4.1 Part 5 applies to all licensees or registrants who use sources of radiation for industrial radiography. Radiation machines and sealed radioactive sources are both covered by Part 5, except for sections which are applicable only to sealed radioactive sources.

5.1.4.2 The provisions and requirements of this part are in addition to, and not in substitution for, other requirements of these regulations. In particular, the general requirements and provisions of Parts 1, 2, 3, 4, 10, and 17 apply to applicants, licensees and registrants subject to this part. Parts 3 and 17 apply to licensing and transportation of radioactive material. Part 2 applies to the registration of radiation machines. Part 5 does not apply to medical uses of sources of radiation that are governed by Parts 6 and 20.

5.1.5 Published Material Incorporated by Reference.

Published material incorporated in Part 5 by reference is available in accord with 1.4.

5.2 Definitions.

As used in this part, these terms have the definitions set forth as follows:

“Annual refresher safety training” means a review conducted or provided by the licensee or registrant for its employees on radiation safety aspects of industrial radiography. The review shall include, as a minimum, any results of internal inspections, new procedures or equipment, new or revised regulations, and accidents or errors that have been observed. The review shall also provide opportunities for employees to ask safety questions.

“Associated equipment” means equipment that is used in conjunction with a radiographic exposure device to make radiographic exposures that drives, guides, or comes in contact with the source (e.g., guide tube, control tube, control (drive) cable, removable source stop, “J” tube and collimator when used as an exposure head).

“Cabinet radiography” means industrial radiography conducted in an enclosure or cabinet so shielded that every location on the exterior meets the dose limits for individual members of the public as specified in 4.14.

“Cabinet x-ray system” means an x-ray system with the x-ray tube installed in an enclosure, hereinafter termed a cabinet, that is independent of existing architectural structures except the floor. The cabinet x-ray system 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 radiation. This definition includes 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 that may temporarily or occasionally incorporate portable shielding, is not considered a cabinet x-ray system.

“Camera” (see “radiographic exposure device”).

“Certifiable cabinet x-ray system” means an existing uncertified x-ray system that has been modified to meet the certification requirements specified in 21 CFR 1020.40 (April 1, 2009).

“Certified cabinet x-ray system” means an x-ray system that has been certified in accordance with 21 CFR 1010.2 (April 1, 2009), as being manufactured and assembled pursuant to the provisions of 21 CFR 1020.40 (April 1, 2009).

“Certifying entity” means an independent certifying organization meeting the requirements in Appendix 5A or a state regulatory program meeting the requirements in Appendix 5A, Sections 5A.2 and 5A.3.

“Collimator” means a radiation shield that is placed on the end of the guide tube or directly onto a radiographic exposure device to restrict the size of the radiation beam when the sealed source is cranked into position to make a radiographic exposure.

“Control cable” means the cable that is connected to the source assembly and used to drive the source to and from the exposure location.

“Control drive mechanism” means a device that enables the source assembly to be moved into and out of the exposure device.

“Control tube” means a protective sheath for guiding the control cable. The control tube connects the control drive mechanism to the radiographic exposure device.

“Drive cable” (see “control cable”).

“Exposure head” means a device that locates the gamma radiography sealed source in the selected working position. An exposure head is also known as a source stop.

“Field station” means a facility from which sources of radiation may be stored or used and from which equipment is dispatched.

“Guide tube” means a flexible or rigid tube, or “J” tube, for guiding the source assembly and the attached control cable from the exposure device to the exposure head. The guide tube may also include the connections necessary for attachment to the exposure device and to the exposure head.

“Hands-on experience” means experience in all of those areas considered to be directly involved in the radiography process, and includes taking radiographs, calibration of survey instruments, operational and performance testing of survey instruments and devices, film development, posting of radiation areas, transportation of radiography equipment, posting of records and radiation area surveillance, etc., as applicable. Excessive time spent in only one or two of these areas, such as film development or radiation area surveillance, should not be counted toward the 2000 hours of hands-on experience required for a radiation safety officer in Appendix 5B, Section 5B.2.4 or the hands-on experience for a radiographer as required by Appendix 5C, Section 5C.2.4.

“Independent certifying organization” means an independent organization that meets all of the criteria of Appendix 5A.

“Industrial radiography” means an examination of the structure of materials by the nondestructive method of utilizing ionizing radiation to make radiographic images.

“Lay-barge radiography” means industrial radiography performed on any water vessel used for laying pipe.

“Offshore platform radiography” means industrial radiography conducted from a platform over a body of water.

“Permanent radiographic installation” means an enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed.

“Pigtail” (see “source assembly”).

“Pill” (see “sealed source”).

“Practical examination” means a demonstration through application of the safety rules and principles in industrial radiography including use of all procedures and equipment to be used by radiographic personnel.

“Projection sheath” (see “guide tube”).

“Projector” (see “radiographic exposure device”).

“Radiation safety officer for industrial radiography” means an individual with the responsibility for the overall radiation safety program on behalf of the licensee or registrant and who meets the requirements of 5.16.

“Radiographer” means any individual who performs or who, in attendance at the site where the sources of radiation are being used, personally supervises industrial radiographic operations and who is responsible to the licensee or registrant for assuring compliance with the requirements of the Department's regulations and the conditions of the license or registration.

“Radiographer certification” means written approval received from a certifying entity stating that an individual has satisfactorily met the radiation safety, testing, and experience criteria in 5.17.

“Radiographer's assistant” means any individual who under the personal supervision of a radiographer, uses radiographic exposure devices, sources of radiation, related handling tools, or radiation survey instruments in industrial radiography.

“Radiographic exposure device” means any instrument containing a sealed source fastened or contained therein, in which the sealed source or shielding thereof may be moved, or otherwise changed, from a shielded to unshielded position for purposes of making a radiographic exposure.

“Radiographic operations” means all activities performed with a radiographic exposure device, or with a radiation-producing machine. Such activities include: using; transporting except by common or contract carriers; storing at a temporary job site; performing surveys to confirm the adequacy of boundaries; setting up equipment; and any activity inside restricted area boundaries. Transporting a radiation machine is not considered a radiographic operation.

“Radiography” (see “industrial radiography”).

“S-tube” means a tube through which the radioactive source travels when inside a radiographic exposure device.

“Shielded position” means the location within the radiographic exposure device, source changer, or storage container that, by manufacturer's design, is the proper location for storage of the sealed source.

“Source assembly” means an assembly that consists of the sealed source and a connector that attaches the source to the control cable. The source assembly may include a ballstop to secure the source in the shielded position.

“Source changer” means a device designed and used for replacement of sealed sources in radiographic exposure devices. A source changer may also be used for transporting and storing sealed sources.

“Storage area” means any location, facility, or vehicle that is used to store and secure a radiographic exposure device, a radiation machine, or a storage container when it is not used for radiographic operations. Storage areas are locked or have a physical barrier to prevent accidental exposure, tampering, or unauthorized removal of the device, machine, or container.

“Storage container” means a device in which sealed sources or radiation machines are secured and stored.

“Temporary jobsite” means a location where radiographic operations are performed and where sources of radiation may be stored other than the location(s) of use authorized on the license or registration.

“Underwater radiography” means radiographic operations performed when the radiographic exposure device or radiation machine and/or related equipment are beneath the surface of the water.

5.3 Exemptions.

5.3.1 Uses of certified and certifiable cabinet x-ray systems are exempt from the requirements of Part 5 except for the following:

5.3.1.1 For certified and certifiable cabinet x-ray systems, including those designed to allow admittance of individuals:

- (1) No registrant shall permit any individual to operate a cabinet x-ray system until the individual has received a copy of and instruction in the operating procedures for the unit and has demonstrated competence in its use. Records that demonstrate compliance with this subparagraph shall be maintained for Department inspection until disposal is authorized by the Department.
- (2) Tests for proper operation of interlocks must be conducted and recorded at intervals not to exceed six months. Records of these tests shall be maintained for Department inspection until disposal is authorized by the Department.
- (3) The registrant shall perform an evaluation of the radiation exposure to determine compliance with 4.14.1 and 4.14.3, and 21 CFR 1020.40 (April 1, 2004) (Cabinet X-Ray Systems, 39 Federal Register 12986, April 10, 1974), at intervals not to exceed one year. Records of these evaluations shall be maintained for Department inspection for two years after the evaluation.

5.3.1.2 Certified cabinet x-ray systems shall be maintained in compliance with 21 CFR 1020.40 (April 1, 2004) (Cabinet X-Ray Systems, 39 Federal Register 12986, April 10, 1974), and no modification shall be made to the system unless prior Department approval has been granted.

5.3.2 Industrial uses of hand-held light intensified imaging devices are exempt from the requirements of this Part if the dose rate 45 cm (18 inches) from the source of radiation to any individual does not exceed 0.02 millisievert (2 millirem) per hour. When this dose rate limit is exceeded, such devices shall meet the applicable requirements of this part and the licensing or registration requirements of Part 2 or Part 3, as applicable.

5.4 Licensing and Registration Requirements for Industrial Radiography Operations.

The Department will approve an application for a specific license for Use of licensed material or a registration for use of radiation machines if the applicant meets the following requirements, as applicable:

5.4.1 The applicant satisfies the general requirements specified in Part 2 for radiation machine facilities or Part 3 for radioactive material, as applicable, and any special requirements contained in this part;

5.4.2 The applicant submits documentation demonstrating an adequate program for training radiographers and radiographer's assistants that meets the requirements of 5.17.

5.4.3 The applicant submits procedures for verifying and documenting the certification status of radiographers and for ensuring that the certification of individuals acting as radiographers remains valid;

5.4.4 The applicant submits written operating and emergency procedures as described in 5.18;

- 5.4.5 The applicant submits a description of a program for inspections of the job performance of each radiographer and radiographer's assistant at intervals not to exceed 6 months as described in 5.17.3;
- 5.4.6 The applicant submits a description of the applicant's overall organizational structure as it applies to the radiation safety responsibilities in industrial radiography, including specified delegation of authority and responsibility;
- 5.4.7 The applicant submits the qualifications of the individual(s) designated as the radiation safety officer as described in 5.16.1,
- 5.4.8 If an applicant intends to perform leak testing of sealed sources or exposure devices containing depleted uranium (DU) shielding, the applicant must describe the procedures for performing the test. The description must include the:
 - 5.4.8.1 Methods of collecting the samples;
 - 5.4.8.2 Qualifications of the individual who analyzes the samples;
 - 5.4.8.3 Instruments to be used; and
 - 5.4.8.4 Methods of analyzing the samples.
- 5.4.9 If the applicant intends to perform calibrations of survey instruments and alarming ratemeters, the applicant must describe methods to be used and the experience of the person(s) who will perform the calibrations. All calibrations must be performed according to the procedures described and at the intervals prescribed in 5.9 and 5.20.7.4;
- 5.4.10 The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations;
- 5.4.11 The applicant identifies the location(s) where all records required by this and other parts of these regulations will be maintained;
- 5.4.12 If a license application includes underwater radiography, a description of:
 - 5.4.12.1 Radiation safety procedures and radiographer responsibilities unique to the performance of underwater radiography;
 - 5.4.12.2 Radiographic equipment and radiation safety equipment unique to underwater radiography; and
 - 5.4.12.3 Methods for gas-tight encapsulation of equipment; and
- 5.4.13 If an application includes offshore platform and/or lay-barge radiography, a description of:
 - 5.4.13.1 Transport procedures for radioactive material to be used in industrial radiographic operations;
 - 5.4.13.2 Storage facilities for radioactive material; and
 - 5.4.13.3 Methods for restricting access to radiation areas.

5.5 Reciprocity.

- 5.5.1 All reciprocal recognition of licenses and registrations by the Department will be granted in accordance with Part 3 of these regulations.
- 5.5.2 Reciprocal recognition by the Department of an individual radiographer certification will be granted provided that:
 - 5.5.2.1 The individual holds a valid certification in the appropriate category issued by a certifying entity, as defined in 5.3;
 - 5.5.2.2 The requirements and procedures of the certifying entity issuing the certification affords the same or comparable certification standards as those afforded by 5.17.1 and Appendix 5A;
 - 5.5.2.3 The applicant presents the certification to the Department prior to entry into the state; and
 - 5.5.2.4 No escalated enforcement action is pending with the Nuclear Regulatory Commission or in any other state.
- 5.5.3 Certified individuals who are granted reciprocity by the Department shall maintain the certification upon which the reciprocal recognition was granted, or prior to the expiration of such certification, shall meet the requirements of 5.17.1.

5.6 Performance Requirements for Industrial Radiography Equipment.

Equipment used in industrial radiographic operations must meet the following minimum criteria:

- 5.6.1 Each radiographic exposure device, source assembly or sealed source, and all associated equipment must meet the requirements specified in American National Standard Institute, N432-1980, "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography", published as National Bureau of Standards (NBS) Handbook 136 (January 1981);
- 5.6.2 In addition to the requirements specified in 5.6.1 the following requirements apply to radiographic exposure devices, source changers, source assemblies and sealed sources;
 - 5.6.2.1 The licensee shall ensure that each radiographic exposure device has attached to it a durable, legible, clearly visible label bearing the:
 - (1) Chemical symbol and mass number of the radionuclide in the device;
 - (2) Activity and the date on which this activity was last measured;
 - (3) Model or product code and serial number of the sealed source;
 - (4) Name of the manufacturer of the sealed source; and
 - (5) Licensee's name, address, and telephone number.
 - 5.6.2.2 Radiographic exposure devices intended for use as Type B packages must meet the applicable transportation requirements of Part 17 of these regulations.
 - 5.6.2.3 Modification of radiographic exposure devices, source changers, and source assemblies and associated equipment is prohibited, unless approved by the Department, another Agreement State, or the NRC.

- 5.6.3 In addition to the requirements specified in 5.6.1 and 5.6.2, the following requirements apply to radiographic exposure devices, source assemblies, and associated equipment that allow the source to be moved out of the device for radiographic operations or to source changers:
- 5.6.3.1 The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.
 - 5.6.3.2 The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.
 - 5.6.3.3 The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers which must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.
 - 5.6.3.4 Each sealed source or source assembly must have attached to it or engraved on it, a durable, legible, visible label with the words:

“DANGER — RADIOACTIVE.”

The label may not interfere with the safe operation of the exposure device or associated equipment.
 - 5.6.3.5 The guide tube must be able to withstand a crushing test that closely approximates the crushing forces that are likely to be encountered during use, and be able to withstand a kinking resistance test that closely approximates the kinking forces that are likely to be encountered during use.
 - 5.6.3.6 Guide tubes must be used when moving the source out of the device.
 - 5.6.3.7 An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during industrial radiography operations.
 - 5.6.3.8 The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980, “Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography”, National Bureau of Standards (NBS) Handbook 136 (January 1981).
 - 5.6.3.9 Source changers must provide a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.
- 5.6.4 All radiographic exposure devices and associated equipment in use after January 10, 1996 must comply with the requirements of this section; and
- 5.6.5 As an exception to 5.6.1, equipment used in industrial radiographic operations need not comply with § 8.9.2(c) of the Endurance Test in ANSI N432-1980, “Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography”, National Bureau of Standards (NBS) Handbook 136 (January 1981), if the prototype equipment has been tested using a torque value representative of the torque that an individual using the radiography equipment can reasonably exert on the lever or crankshaft of the drive mechanism.

- 5.6.6 The Department may deny, withdraw, limit or qualify its approval of any person to perform activities upon determining that such action is necessary in order to prevent undue hazard to health and safety, or for other reasonable cause.

5.7 Limits on External Radiation Levels From Storage Containers and Source Changers.

The maximum exposure rate limits for storage containers and source changers are 2 millisievert (200 mrem) per hour at any exterior surface, and 0.1 millisievert (10 mrem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.

5.8 Locking of Sources of Radiation, Storage Containers and Source Changers.

- 5.8.1 Each radiographic exposure device must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position.

5.8.1.1 The exposure device and/or its container must be kept locked (if a keyed lock, the key must be removed at all times) when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in 5.22.

5.8.1.2 In addition, during radiographic operations the sealed source assembly must be secured in the shielded position each time the source is returned to that position.

- 5.8.2 Each sealed source storage container and source changer must have a lock or outer locked container designed to prevent unauthorized or accidental removal of the sealed source from its shielded position. Storage containers and source changers must be kept locked (if a keyed lock, the key must be removed at all times) when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.

- 5.8.3 The control panel of each radiation machine shall be equipped with a lock that will prevent the unauthorized use of an x-ray system or the accidental production of radiation. The radiation machine shall be kept locked and the key removed at all times except when under the direct visual surveillance of a radiographer or a radiographer's assistant.

5.9 Radiation Survey Instruments.

- 5.9.1 The licensee or registrant shall keep sufficient calibrated and operable radiation survey instruments at each location where sources of radiation are present to make the radiation surveys required by this part and by Part 4 of these regulations. Instrumentation required by this section must be capable of measuring a range from 0.02 millisievert (2 mrem) per hour through 0.01 sievert (1 rem) per hour.

- 5.9.2 The licensee or registrant shall have each radiation survey instrument required under 5.9.1 calibrated:

5.9.2.1 At energies appropriate for use and at intervals not to exceed 6 months and after instrument servicing, except for battery changes;

5.9.2.2 For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale; for logarithmic scale instruments, at mid-range of each decade, and at two points of at least one decade; and for digital instruments, at 3 points between 0.02 and 10 millisievert (2 and 1000 mrem) per hour; and

5.9.2.3 So that an accuracy within plus or minus 20 percent of the true radiation dose rate can be demonstrated at each point checked.

- 5.9.3 The licensee or registrant shall maintain records of the results of the instrument calibrations in accordance with 5.26.

5.10 Leak Testing and Replacement of Sealed Sources.

- 5.10.1 The replacement of any sealed source fastened to or contained in a radiographic exposure device and the leak testing of any sealed source must be performed by persons authorized to do so by the Department, the Nuclear Regulatory Commission, or another Agreement State.

- 5.10.2 The opening, repair, or modification of any sealed source must be performed by persons specifically authorized to do so by the Department, the Nuclear Regulatory Commission, or another Agreement State.

- 5.10.3 Testing and recordkeeping requirements.

5.10.3.1 Each licensee who uses a sealed source shall have the source tested for leakage at intervals not to exceed 6 months. The leak testing of the source must be performed using a method approved by the Department, the Nuclear Regulatory Commission, or by another Agreement State. The wipe sample should be taken from the nearest accessible point to the sealed source where contamination might accumulate. The wipe sample must be analyzed for radioactive contamination. The analysis must be capable of detecting the presence of 185 becquerel (0.005 μ Ci) of radioactive material on the test sample and must be performed by a person specifically authorized by the Department, the Nuclear Regulatory Commission, or another Agreement State to perform the analysis.

5.10.3.2 The licensee shall maintain records of the leak tests in accordance with 5.27.

5.10.3.3 Unless a sealed source is accompanied by a certificate from the transferor that shows that it has been leak tested within 6 months before the transfer, it may not be used by the licensee until tested for leakage. Sealed sources that are in storage and not in use do not require leak testing, but must be tested before use or transfer to another person if the interval of storage exceeds 6 months.

- 5.10.4 Any test conducted pursuant to 5.10.2 and 5.10.3 that reveals the presence of 185 becquerel (0.005 μ Ci) or more of removable radioactive material must be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall have it decontaminated and repaired or disposed of in accordance with Department regulations. A report must be filed with the Department within 5 days of any test with results that exceed the threshold in this paragraph, describing the equipment involved, the test results, and the corrective action taken.

- 5.10.5 Each exposure device using depleted uranium (DU) shielding and an "S" tube configuration must be tested for DU contamination at intervals not to exceed 12 months.

5.10.5.1 The analysis must be capable of detecting the presence of 185 becquerel (0.005 μ Ci) of radioactive material on the test sample and must be performed by a person specifically authorized by the Department, the Nuclear Regulatory Commission, or another Agreement State to perform the analysis.

5.10.5.2 Should such testing reveal the presence of DU contamination, the exposure device must be removed from use until an evaluation of the wear of the S-tube has been made.

5.10.5.3 Should the evaluation reveal that the S-tube is worn through, the device may not be used again. DU shielded devices do not have to be tested for DU contamination while not in use and in storage.

5.10.5.4 Before using or transferring such a device, however, the device must be tested for DU contamination, if the interval of storage exceeds 12 months.

5.10.5.5 A record of the DU leak-test must be made in accordance with 5.27.

5.11 Quarterly Inventory.

5.11.1 Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation, and for devices containing depleted uranium received and possessed under the license.

5.11.2 The licensee or registrant shall maintain records of the quarterly inventory in accordance with 5.28.

5.12 Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

5.12.1 The licensee or registrant shall perform visual and operability checks on survey meters, radiation machines, radiographic exposure devices, transport and storage containers, associated equipment and source changers before each day's use, or work shift, to ensure that:

5.12.1.1 The equipment is in good working condition;

5.12.1.2 The sources are adequately shielded; and

5.12.1.3 Required labeling is present.

5.12.2 Survey instrument operability must be performed using check sources or other appropriate means.

5.12.3 If equipment problems are found, the equipment must be removed from service until repaired.

5.12.4 Each licensee or registrant shall have written procedures for, and perform inspection and routine maintenance of, radiation machines, radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments. The inspection and maintenance must be performed at intervals not to exceed 3 months, or before the first use thereafter, to ensure the proper functioning of components important to safety. If equipment problems are found, the equipment must be removed from service until repaired.

5.12.5 The licensee's inspection and maintenance program must include procedures to assure that each Type B package is shipped and maintained in accordance with the certificate of compliance or other approval.

5.12.6 Records of equipment problems and of any maintenance performed under 5.12 must be made in accordance with 5.30.

5.13 Permanent Radiographic Installations.

5.13.1 Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either.

5.13.1.1 An entrance control of the type described in 4.19 of these regulations that causes the radiation level upon entry into the area to be reduced; or

5.13.1.2 Both conspicuous visible and audible warning signals to warn of the presence of radiation. The visible signal must be actuated by radiation whenever the source is exposed or the machine is energized. The audible signal must be actuated when an attempt is made to enter the installation while the source is exposed or the machine is energized.

5.13.2 The alarm system must be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test must include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry as designated in 5.13.1 must be tested monthly.

5.13.3 If an entrance control device or an alarm is operating improperly, it must be immediately labeled as defective and repaired within 7 calendar days. The facility may continue to be used during this 7-day period, provided the licensee or registrant implements the continuous surveillance requirements of 5.22 and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarms must be maintained in accordance with 5.31.

5.14 Labeling, Storage, and Transportation.

5.14.1 The licensee may not use a source changer or a container to store radioactive material unless the source changer or the storage container has securely attached to it a durable, legible, and clearly visible label bearing the standard trefoil radiation caution symbol conventional colors, i.e., magenta, purple or black on a yellow background, having a minimum diameter of 25 mm, and the wording:

CAUTION*

RADIOACTIVE MATERIAL

NOTIFY CIVIL AUTHORITIES [or "NAME OF COMPANY"]

*or "DANGER"

5.14.2 The licensee may not transport radioactive material unless the material is packaged, and the package is labeled, marked, and accompanied with appropriate shipping papers in accordance with regulations set out in Part 17.

5.14.3 Radiographic exposure devices, source changers, storage containers, and radiation machines, must be physically secured to prevent tampering or removal by unauthorized personnel. The licensee shall store radioactive material in a manner that will minimize danger from explosion or fire.

5.14.4 The licensee shall lock and physically secure the transport package containing radioactive material in the transporting vehicle to prevent accidental loss, tampering, or unauthorized removal.

5.14.5 The licensee's or registrant's name and city or town where the main business office is located shall be prominently displayed with a durable, clearly visible label(s) on both sides of all vehicles used to transport radioactive material or radiation machines for temporary job site use.

5.15 Conducting Industrial Radiographic Operations.

5.15.1 Whenever radiography is performed at a location other than a permanent radiographic installation, the radiographer must be accompanied by at least one other qualified radiographer or an individual who has at a minimum met the requirements of Appendix 5C. The additional qualified individual shall observe the operations and be capable of providing immediate assistance to prevent unauthorized entry. Radiography may not be performed if only one qualified individual is present.

5.15.2 All radiographic operations must be conducted in a permanent radiographic installation unless otherwise specifically authorized by the Department.

5.15.3 Except when physically impossible, collimators shall be used in industrial radiographic operations that use radiographic exposure devices that allow the source to be moved out of the device.

5.15.4 A licensee or registrant may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the Department, the Nuclear Regulatory Commission, or by another Agreement State.

5.16 Radiation Safety Officer.

5.16.1 The radiation safety officer shall ensure that radiation safety activities are being performed in accordance with approved procedures and regulatory requirements in the daily operation of the licensee's or registrant's program.

5.16.2 The minimum qualifications, training, and experience for a radiation safety officer for industrial radiography are specified in Appendix 5B.

5.16.3 The specific duties and authorities of the radiation safety officer include:

5.16.3.1 Establishing and overseeing all operating, emergency, and ALARA procedures as required by Part 4 of these regulations and reviewing them regularly to ensure that they conform to Department regulations and to the license or registration conditions;

5.16.3.2 Overseeing and approving the training program for radiographic personnel to ensure that appropriate and effective radiation protection practices are taught;

5.16.3.3 Ensuring that required radiation surveys and leak tests are performed and documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits;

5.16.3.4 Ensuring that personnel monitoring devices are calibrated, if applicable, and used properly; that records are kept of the monitoring results; and that timely notifications are made as required by Part 4 of these regulations; and

5.16.3.5 Ensuring that operations are conducted safely and for implementing corrective actions including terminating operations.

5.17 Training for a Radiographer or a Radiographer's Assistant.

- 5.17.1 The licensee or registrant may not permit any individual to act as a radiographer until the individual has met the requirements of Appendix 5C.
- 5.17.2 The licensee or registrant may not permit any individual to act as a radiographer's assistant until the individual has met the requirements of Appendix 5D.
- 5.17.3 Except as provided in 5.17.3.3, the radiation safety officer or designee shall conduct an inspection program of the job performance of each radiographer and radiographer's assistant to ensure that the Department's regulations, license or registration requirements, and operating and emergency procedures are followed. The inspection program must:
 - 5.17.3.1 Include observation of the performance of each radiographer and radiographer's assistant during an actual industrial radiographic operation, at intervals not to exceed 6 months; and
 - 5.17.3.2 If a radiographer or a radiographer's assistant has not participated in an industrial radiographic operation for more than 6 months since the last inspection, the radiographer must demonstrate knowledge of the training requirements of Appendix 5C, Section 5C.2.3, and the radiographer's assistant must demonstrate knowledge of the training requirements of Appendix 5D, Section 5D.2.2, by a practical examination before these individuals can next participate in a radiographic operation.
 - 5.17.3.3 The Department may consider alternative inspection programs in those situations where one individual serves as the only radiographer and the radiation safety officer.
- 5.17.4 The licensee or registrant shall maintain records of the above training to include certification documents, written, oral and practical examinations, refresher safety training and inspections of job performance in accordance with 5.32.

5.18 Operating and Emergency Procedures.

- 5.18.1 Operating and emergency procedures must include, as a minimum, instructions in the following:
 - 5.18.1.1 Appropriate handling and use of sources of radiation so that no person is likely to be exposed to radiation doses in excess of the limits established in Part 4 of these regulations;
 - 5.18.1.2 Methods and occasions for conducting radiation surveys;
 - 5.18.1.3 Methods for posting and controlling access to radiographic areas;
 - 5.18.1.4 Methods and occasions for locking and securing sources of radiation;
 - 5.18.1.5 Personnel monitoring and Use of personnel monitoring equipment;
 - 5.18.1.6 Transporting equipment to field locations, including packing of radiographic exposure devices and storage containers in the vehicles, placarding of vehicles when required, and control of the equipment during transportation as described in Part 17 of these regulations;
 - 5.18.1.7 The inspection, maintenance, and operability checks of radiographic exposure devices, radiation machines, survey instruments, alarming ratemeters, transport containers, and storage containers;

- 5.18.1.8 Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarming ratemeter alarms unexpectedly;
 - 5.18.1.9 The procedure(s) for identifying and reporting defects and noncompliance, as required by 5.38;
 - 5.18.1.10 The procedure for notifying proper persons in the event of an accident or incident;
 - 5.18.1.11 Minimizing exposure of persons in the event of an accident or incident, including a source disconnect, a transport accident, or loss of a source of radiation;
 - 5.18.1.12 Source recovery procedure if licensee will perform source recoveries; and
 - 5.18.1.13 Maintenance of records.
- 5.18.2 The licensee or registrant shall maintain copies of current operating and emergency procedures in accordance with 5.33 and 5.37.

5.19 Supervision of Radiographer's Assistants.

- 5.19.1 The radiographer's assistant shall be under the personal supervision of a radiographer when using radiographic exposure devices, associated equipment, or a sealed source, or while conducting radiation surveys required by 5.21.2 to determine that the sealed source has returned to the shielded position or the radiation machine is off after an exposure.
- 5.19.2 The personal supervision must include:
- 5.19.2.1 The radiographer's physical presence at the site where the sources of radiation are being used;
 - 5.19.2.2 The availability of the radiographer to give immediate assistance if required; and
 - 5.19.2.3 The radiographer's direct observation of the assistant's performance of the operations referred to in this section.

5.20 Personnel Monitoring.

- 5.20.1 The licensee or registrant shall not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading dosimeter, an operating alarming ratemeter, and a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor. At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, or during radiographic operations using radiation machines, the wearing of an alarming ratemeter is not required.
- 5.20.1.1 Pocket dosimeters must have a range from zero to 2 millisievert (200 mrem) and must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.
 - 5.20.1.2 Each personnel dosimeter must be assigned to and worn by only one individual.
 - 5.20.1.3 Film badges must be exchanged at periods not to exceed one month and other personnel dosimeters processed and evaluated by an accredited NVLAP processor must be replaced at periods not to exceed three months.

- 5.20.1.4 After replacement, each personnel dosimeter must be processed as soon as possible.
- 5.20.2 Direct reading dosimeters, such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at the beginning and end of each shift, and records must be maintained in accordance with 5.34.
- 5.20.3 Pocket dosimeters, or electronic personal dosimeters, must be checked at periods not to exceed 12 months for correct response to radiation, and records must be maintained in accordance with 5.34. Acceptable dosimeters must read within plus or minus 20 percent of the true radiation exposure.
- 5.20.4 If an individual's pocket dosimeter indicates a reading off-scale or if the electronic personal dosimeter reading exceeds 2 millisievert (200 mrem), and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personnel dosimeter must be sent for processing within 24 hours.
 - 5.20.4.1 In addition, the individual may not resume work associated with Use of sources of radiation until a determination of the individual's radiation exposure has been made. This determination must be made by the radiation safety officer or the radiation safety officer's designee.
 - 5.20.4.1 The results of this determination must be included in the records maintained in accordance with 5.34.
- 5.20.5 If the personnel dosimeter that is required by 5.20.1 is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter meeting the requirements of 5.20.1 is provided and the exposure is calculated for the time period from issuance to loss or damage of the personnel dosimeter. The results of the calculated exposure and the time period for which the personnel dosimeter was lost or damaged must be included in the records maintained in accordance with 5.34.
- 5.20.6 Reports received from the accredited NVLAP personnel dosimeter processor must be retained in accordance with 5.34.
- 5.20.7 Each alarming ratemeter must:
 - 5.20.7.1 Be checked to ensure that the alarm functions properly before using at the start of each shift;
 - 5.20.7.2 Be set to give an audible alarm signal at a preset dose rate of 5 millisievert (500 mrem) per hour; with an accuracy of plus or minus 20 percent of the true radiation dose rate;
 - 5.20.7.3 Require special means to change the preset alarm function; and
 - 5.20.7.4 Be calibrated at periods not to exceed 12 months for correct response to radiation. The licensee shall maintain records of alarming ratemeter calibrations in accordance with 5.34.

5.21 Radiation Surveys.

5.21.1 The licensee or registrant shall:

5.21.1.1 Conduct all surveys with a calibrated and operable radiation survey instrument that meets the requirements of 5.9;

5.21.1.2 Conduct a survey of the radiographic exposure device and the guide tube after each exposure when approaching the device or the guide tube.

(1) The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment.

(2) Radiation machines shall be surveyed after each exposure to determine that the machine is off;

5.21.1.3 Conduct a survey of the radiographic exposure device whenever the source is exchanged and whenever a radiographic exposure device is placed in a storage area as defined in 5.3, to ensure that the sealed source is in its shielded position; and

5.21.1.4 Maintain records in accordance with 5.35.

5.22 Surveillance.

5.22.2 During each radiographic operation, the radiographer shall ensure continuous direct visual surveillance of the operation to protect against unauthorized entry into a radiation area or a high radiation area, as defined in Part 1 of these regulations, except at permanent radiographic installations where all entryways are locked and the requirements of 5.13 are met.

5.23 Posting.

All areas in which industrial radiography is being performed must be conspicuously posted as required by 4.28 of these regulations. The exceptions listed in 4.29 of these regulations do not apply to industrial radiographic operations.

RECORDKEEPING REQUIREMENTS

5.24 Records for Industrial Radiography.

5.24.1 Each licensee or registrant shall maintain a copy of its license or registration, documents incorporated by reference, and amendments to each of these items until superseded by new documents approved by the Department, or until the Department terminates the license or registration.

5.25 Records of Receipt and Transfer of Sources of Radiation.

5.25.1 Each licensee or registrant shall maintain records showing the receipts and transfers of sealed sources, devices using DU for shielding, and radiation machines, and retain each record for 3 years after it is made.

5.25.2 These records must include the date, the name of the individual making the record, radionuclide, number of becquerel (curie) or mass (for DU), and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

5.26 Records of Radiation Survey Instruments.

5.26.1 Each licensee or registrant shall maintain records of the calibrations of its radiation survey instruments that are required under 5.9 and retain each record for 3 years after it is made.

5.27 Records of Leak Testing of Sealed Sources and Devices Containing DU.

5.27.1 Each licensee shall maintain records of leak test results for sealed sources and for devices containing DU.

5.27.1.1 The results must be stated in units of becquerel (microcurie).

5.27.1.2 The licensee shall retain each record for 3 years after it is made or until the source in storage is removed.

5.28 Records of Quarterly Inventory.

5.28.1 Each licensee or registrant shall maintain records of the quarterly inventory of sources of radiation, including devices containing depleted uranium as required by 5.11, and retain each record for 3 years.

5.28.2 The record must include the date of the inventory, name of the individual conducting the inventory, radionuclide, number of becquerel (curie) or mass (for DU) in each device, location of sources of radiation and/or devices, and manufacturer, model, and serial number of each source of radiation and/or device, as appropriate.

5.29 Utilization Logs.

5.29.1 Each licensee or registrant shall maintain utilization logs showing for each source of radiation the following information:

5.29.1.1 A description, including the make, model, and serial number of the radiation machine or the radiographic exposure device, transport, or storage container in which the sealed source is located;

5.29.1.2 The identity and signature of the radiographer to whom assigned;

5.29.1.3 The location and dates of use, including the dates removed and returned to storage; and

5.29.1.4 For permanent radiographic installations, the dates each radiation machine is energized.

5.29.2 The licensee or registrant shall retain the logs required by 5.29.1 for 3 years.

5.30 Records of Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

5.30.1 Each licensee or registrant shall maintain records specified in 5.12 of equipment problems found in daily checks and quarterly inspections of radiation machines, radiographic exposure devices, transport and storage containers, associated equipment, source changers, and survey instruments; and retain each record for 3 years after it is made.

5.30.2 The record must include the date of check or inspection, name of inspector, equipment involved, any problems found, and what repair and/or maintenance, if any, was performed.

5.31 Records of Alarm System and Entrance Control Checks at Permanent Radiographic Installations.

Each licensee or registrant shall maintain records of alarm system and entrance control device tests required by 5.13 and retain each record for 3 years after it is made.

5.32 Records of Training and Certification.

5.32.1 Each licensee or registrant shall maintain the following records for 3 years:

5.32.1.1 Records of training of each radiographer and each radiographer's assistant.

- (1) The record must include radiographer certification documents and verification of certification status, copies of written tests, dates of oral and practical examinations, the names of individuals conducting and receiving the oral and practical examinations, and a list of items tested and the results of the oral and practical examinations; and

5.32.2.1 Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant.

- (1) The records must list the topics discussed during the refresher safety training, the dates the annual refresher safety training was conducted, and names of the instructors and attendees.
- (2) For inspections of job performance, the records must also include a list showing the items checked and any noncompliance observed by the radiation safety officer or designee.

5.33 Copies of Operating and Emergency Procedures.

5.33.1 Each licensee or registrant shall maintain a copy of current operating and emergency procedures until the Department terminates the license or registration. Superseded material must be retained for 3 years after the change is made.

5.34 Records of Personnel Monitoring.

Each licensee or registrant shall maintain the following exposure records specified in 5.20:

5.34.1 Direct reading dosimeter readings and yearly operability checks required by 5.20.2 and 5.20.3 for 3 years after the record is made;

5.34.2 Records of alarming ratemeter calibrations for 3 years after the record is made;

5.34.3 Personnel dosimeter results received from the accredited NVLAP processor until the Department terminates the license or registration; and

5.34.4 Records of estimates of exposures as a result of off-scale personal direct reading dosimeters, or lost or damaged personnel dosimeters, until the Department terminates the license or registration.

5.35 Records of Radiation Surveys.

5.35.1 Each licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage as specified in 5.21.3. Each record must be maintained for 3 years after it is made.

5.36 Form of Records.

5.36.1 Each record required by this Part must be legible throughout the specified retention period. The record may be the original or a reproduced copy or a microform provided that the copy or microform is authenticated by authorized personnel and that the microform is capable of reproducing a clear copy throughout the required retention period.

5.36.2 The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period.

5.36.3 Records, such as letters, drawings, and specifications, must include all pertinent information, such as stamps, initials, and signatures.

5.36.4 The licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

5.37 Location of Documents and Records.

5.37.1 Each licensee or registrant shall maintain copies of records required by this Part and other applicable Parts of these regulations at the location specified in 5.5.11.

5.37.2 Each licensee or registrant shall also maintain current copies of the following documents and records sufficient to demonstrate compliance at each applicable field station and each temporary jobsite;

5.37.2.1 The license or registration authorizing Use of sources of radiation;

5.37.2.2 A copy of Parts 1, 4, 5 and 10 of these regulations;

5.37.2.3 Utilization logs for each source of radiation dispatched from that location as required by 5.29;

5.37.2.4 Records of equipment problems identified in daily checks of equipment as required by 5.30.1;

5.37.2.5 Records of alarm system and entrance control checks required by 5.31, if applicable;

5.37.2.6 Records of dosimeter readings as required by 5.34;

5.37.2.7 Operating and emergency procedures as required by 5.33;

5.37.2.8 Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by 5.26;

5.37.2.9 Evidence of the latest calibrations of alarming ratemeters and operability checks of dosimeters as required by 5.34;

- 5.37.2.10 Survey records as required by 5.35 and 4.42 of these regulations as applicable, for the period of operation at the site;
- 5.37.2.11 The shipping papers for the transportation of radioactive materials required by Part 17 of these regulations; and
- 5.37.2.12 When operating under reciprocity pursuant to Part 3 of these regulations, a copy of the applicable State license or registration, or Nuclear Regulatory Commission license authorizing Use of sources of radiation.

NOTIFICATIONS

5.38 Notifications.

- 5.38.1 In addition to the reporting requirements specified in 4.52 of these regulations, each licensee or registrant shall provide a written report to the Department within 30 days of the occurrence of any of the following incidents involving radiographic equipment:
 - 5.38.1.1 Unintentional disconnection of the source assembly from the control cable;
 - 5.38.1.2 Inability to retract the source assembly to its fully shielded position and secure it in this position;
 - 5.38.1.3 Failure of any component, which is critical to safe operation of the device, to properly perform its intended function; or
 - 5.38.1.4 An indicator on a radiation machine fails to show that radiation is being produced, an exposure switch fails to terminate production of radiation when turned to the off position, or a safety interlock fails to terminate x-ray production.
- 5.38.2 The licensee or registrant shall include the following information in each report submitted under 5.38.1, and in each report of overexposure submitted under 4.53.2 of these regulations which involves failure of safety components of radiography equipment:
 - 5.38.2.1 Description of the equipment problem;
 - 5.38.2.2 Cause of each incident, if known;
 - 5.38.2.3 Name of the manufacturer and model number of equipment involved in the incident;
 - 5.38.2.4 Place, date, and time of the incident;
 - 5.38.2.5 Actions taken to establish normal operations;
 - 5.38.2.6 Corrective actions taken or planned to prevent recurrence; and
 - 5.38.2.7 Names and qualifications of personnel involved in the incident.
- 5.38.3 Any licensee or registrant conducting radiographic operations or storing sources of radiation at any location not listed on the license or registration for a period in excess of 90 days in a calendar year, shall notify the Department prior to exceeding the 90 days.

5.39 Specific Requirements for Personnel Performing Industrial Radiography.

- 5.39.1 At a job site, the following shall be supplied by the licensee or registrant:
 - 5.39.1.1 At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;
 - 5.39.1.2 A current whole body personnel dosimeter (OSL dosimeter, TLD or film badge) for each person performing radiographic operations;
 - 5.39.1.3 An operable, calibrated pocket dosimeter with a range of zero to 2 millisievert (200 milliroentgen) for each person performing radiographic operations;
 - 5.39.1.4 An operable, calibrated, alarming ratemeter for each person performing radiographic operations using a radiographic exposure device; and
 - 5.39.1.5 The appropriate barrier ropes and signs.
- 5.39.2 Each radiographer at a job site shall have on their person a valid certification identification card issued by a certifying entity.
- 5.39.3 Industrial radiographic operations shall not be performed if any of the items in 5.39.1 and 5.39.2 are not available at the job site or are inoperable.
- 5.39.4 During an inspection, the Department may terminate an operation if any of the items in 5.39.1 and 5.39.2 are not available or operable, or if the required number of radiographic personnel are not present.
 - 5.39.4.1 Operations shall not be resumed until all required conditions are met.

PART 5, APPENDIX 5A: CERTIFICATION

5A.1 Requirements for an Independent Certifying Organization.

An independent certifying organization shall:

- 5A.1.1 Be an organization such as a society or association, whose members participate in, or have an interest in, the field of industrial radiography;
- 5A.1.2 Make its membership available to the general public nationwide. Membership shall not be restricted because of race, color, religion, sex, age, national origin or disability;
- 5A.1.3 Have a certification program open to nonmembers, as well as members;
- 5A.1.4 Be an incorporated, nationally recognized organization that is involved in setting national standards of practice within its fields of expertise;
- 5A.1.5 Have an adequate staff, a viable system for financing its operations, and a policy and decision-making review board;
- 5A.1.6 Have a set of written organizational by-laws and policies that provide adequate assurance of lack of conflict of interest and a system for monitoring and enforcing those by-laws and policies;
- 5A.1.7 Have a committee, whose members can carry out their responsibilities impartially, to review and approve the certification guidelines and procedures, and to advise the organization's staff in implementing the certification program;
- 5A.1.8 Have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions;
- 5A.1.9 Have written procedures describing all aspects of its certification program and maintain records of the current status of each individual's certification and the administration of its certification program;
- 5A.1.10 Have procedures to ensure that certified individuals are provided due process with respect to the administration of its certification program, including the process of becoming certified and any sanctions imposed against certified individuals;
- 5A.1.11 Have procedures for proctoring examinations, including qualifications for proctors. These procedures must ensure that the individuals proctoring each examination are not employed by the same company or corporation (or a wholly-owned subsidiary of such company or corporation) as any of the examinees;
- 5A.1.12 Exchange information about certified individuals with the Nuclear Regulatory Commission and other independent certifying organizations and/or Agreement States and allow periodic review of its certification program and related records; and
- 5A.1.13 Provide a description to the Nuclear Regulatory Commission of its procedures for choosing examination sites and for providing an appropriate examination environment.

5A.2 Requirements for Certification Programs.

All certification programs must:

5A.2.1 Require applicants for certification to

- (1) Receive training in the topics set forth in Appendix 5C, Section 5C.2, or equivalent State or Nuclear Regulatory Commission regulations, and
- (2) Satisfactorily complete a written examination covering these topics;

5A.2.2 Require applicants for certification to provide documentation that demonstrates that the applicant has:

- (1) Received training in the topics set forth in Appendix 5C, Section 5C.2 or equivalent State or Nuclear Regulatory Commission regulations;
- (2) Satisfactorily completed a minimum period of on-the-job training as specified in Appendix 5C, Section 5C.2.4; and
- (3) Received verification by a State licensee or registrant or a Nuclear Regulatory Commission licensee that the applicant has demonstrated the capability of independently working as a radiographer.

5A.2.3 Include procedures to ensure that all examination questions are protected from disclosure;

5A.2.4 Include procedures for denying an application and revoking, suspending, and reinstating a certification;

5A.2.5 Provide a certification period of not less than 3 years nor more than 5 years;

5A.2.6 Include procedures for renewing certifications and, if the procedures allow renewals without examination, require evidence of recent full-time employment and annual refresher training; and

5A.2.7 Provide a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

5A.3 Requirements for Written Examinations

All examinations must:

5A.3.1 Be designed to test an individual's knowledge and understanding of the topics listed in Appendix 5C, Section 5C.2 or equivalent State or Nuclear Regulatory Commission requirements;

5A.3.2 Be written in a multiple-choice format;

5A.3.3 Have test items drawn from a question bank containing psychometrically valid questions based on the material in Appendix 5C, Section 5C.2.

**PART 5, APPENDIX 5B: INDUSTRIAL RADIOGRAPHY RADIATION SAFETY
OFFICER ADEQUATE RADIATION SAFETY TRAINING AND EXPERIENCE**

The licensee or registrant shall not permit any individual to act as a radiation safety officer for industrial radiography unless and until the individual:

5B.1 Has provided evidence of valid certification (valid identification) through a radiographer certification program by a certifying organization in accordance with the criteria specified in Appendix 5A;

and

5B.2 Has provided evidence of having:

5B.2.1 Satisfactorily completed 40 hours of training including each of the following:

- (1) Fundamentals of radiation safety including:
 - (a) Characteristics of gamma and x-radiation;
 - (b) Units of radiation dose and quantity of radioactivity;
 - (c) Hazards of exposure to radiation;
 - (d) Levels of radiation from sources of radiation;
 - (e) Methods of controlling radiation dose (time, distance, and shielding); and
- (2) Radiation detection instruments including:
 - (a) Use, operation, calibration, and limitations of radiation survey instruments;
 - (b) Survey techniques; and
 - (c) Use of personnel monitoring equipment; and
- (3) Equipment to be used including:
 - (a) Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed);
 - (b) Operation and control of radiation machines;
 - (c) Storage, control, and disposal of sources of radiation; and
 - (d) Inspection and maintenance of equipment; and
- (4) The requirements of pertinent state and federal regulations; and
- (5) Case histories of accidents in radiography; and

5B.2.2 Successfully completed a written or oral examination after having received copies of and instruction in the:

- (1) Requirements of Part 5;
- (2) Requirements of applicable sections of Parts 4, 10 and 17;
- (3) License or registration under which the radiographer will perform industrial radiography; and
- (4) Licensee's or registrant's operating and emergency procedures; and

5B.2.3 Successfully completed a practical examination which demonstrates understanding of the use of the equipment after receiving training in the:

- (1) Use of the registrant's radiation machines; or
- (2) Use of the licensee's radiographic exposure devices and sealed sources;
- (3) Daily inspection of devices and associated equipment; and
- (4) Use of radiation survey instruments; and

5B.2.4 Completed hands-on and on-the-job training in the performance of industrial radiography, including at least 2000 hours of hands-on experience, as defined in 5.2, as a qualified radiographer in industrial radiographic operations, including completion of at least:

- (1) 320 hours (2 months) of on-the-job active participation utilizing radioactive material; and / or
- (2) 160 hours (1 month) of on-the-job active participation utilizing radiation machines; and
- (3) 480 hours (3 months) of on-the-job training for individuals utilizing both radioactive materials and radiation machines; and

5B.2.5 Completed formal training in the establishment and maintenance of a radiation protection program;

or

5B.3 Has demonstrated to the Department an acceptable alternative to 5B.2 when the individual has appropriate training and experience in the field of ionizing radiation, and, in addition, has adequate formal training with respect to the establishment and maintenance of a radiation safety protection program for industrial radiography;

and

5B.4 Has provided evidence of annual refresher safety training, as defined in 5.2, at intervals not to exceed 12 months.

**PART 5, APPENDIX 5C: INDUSTRIAL RADIOGRAPHER
ADEQUATE RADIATION SAFETY TRAINING AND EXPERIENCE**

The licensee or registrant shall not permit any individual to act as a radiographer unless and until the individual:

5C.1 Has provided evidence of valid certification (valid identification) through a radiographer certification program by a certifying organization in accordance with the criteria specified in Appendix 5A;

and

5C.2 Has provided evidence of having:

5C.2.1 Satisfactorily completed 40 hours of training including each of the following:

- (1) Fundamentals of radiation safety including:
 - (a) Characteristics of gamma and x-radiation;
 - (b) Units of radiation dose and quantity of radioactivity;
 - (c) Hazards of exposure to radiation;
 - (d) Levels of radiation from sources of radiation;
 - (e) Methods of controlling radiation dose (time, distance, and shielding); and
- (2) Radiation detection instruments including:
 - (a) Use, operation, calibration, and limitations of radiation survey instruments;
 - (b) Survey techniques; and
 - (c) Use of personnel monitoring equipment; and
- (3) Equipment to be used including:
 - (a) Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed);
 - (b) Operation and control of radiation machines;
 - (c) Storage, control, and disposal of sources of radiation; and
 - (d) Inspection and maintenance of equipment; and
- (4) The requirements of pertinent state and federal regulations; and
- (5) Case histories of accidents in radiography; and

5C.2.2 Successfully completed a written or oral examination after having received copies of and instruction in the:

- (1) Requirements of Part 5;
- (2) Requirements of applicable sections of Parts 4, 10 and 17;
- (3) License or registration under which the radiographer will perform industrial radiography; and
- (4) Licensee's or registrant's operating and emergency procedures; and

5C.2.3 Successfully completed a practical examination which demonstrates understanding of the use of the equipment after receiving training in the:

- (1) Use of the registrant's radiation machines; or
- (2) Use of the licensee's radiographic exposure devices and sealed sources;
- (3) Daily inspection of devices and associated equipment; and
- (4) Use of radiation survey instruments; and

5C.2.4 Completed hands-on and on-the-job training in the performance of industrial radiography, including at least 2000 hours of hands-on experience, as defined in 5.2, as a qualified radiographer in industrial radiographic operations, including completion of at least:

- (1) 320 hours (2 months) of on-the-job active participation utilizing radioactive material; and / or
- (2) 160 hours (1 month) of on-the-job active participation utilizing radiation machines; and
- (3) 480 hours (3 months) of on-the-job training for individuals utilizing both radioactive materials and radiation machines;

or

5C.3 Has demonstrated to the Department an acceptable alternative to 5C.2 when the individual has appropriate training and experience in the field of ionizing radiation, and, in addition, has adequate formal training with respect to radiation protection for industrial radiography;

and

5C.4 Has provided evidence of annual refresher safety training, as defined in 5.2, at intervals not to exceed 12 months.

**PART 5, APPENDIX 5D: INDUSTRIAL RADIOGRAPHER'S ASSISTANT
ADEQUATE RADIATION SAFETY TRAINING AND EXPERIENCE**

The licensee or registrant shall not permit any individual to act as a radiographer's assistant unless and until the individual has:

5D.1 Received initial radiation safety training;

and

5D.2 Has provided evidence of having:

5D.2.1 Successfully completed a written or oral examination after having received copies of and instruction in the:

- (1) Requirements of Part 5;
- (2) Requirements of applicable sections of Parts 4, 10 and 17;
- (3) License or registration under which the radiographer will perform industrial radiography; and
- (4) Licensee's or registrant's operating and emergency procedures; and

5D.2.2 Successfully completed a practical examination which demonstrates understanding of the use of the equipment after receiving training in the:

- (1) Use of the registrant's radiation machines; or
- (2) Use of the licensee's radiographic exposure devices and sealed sources;
- (3) Daily inspection of devices and associated equipment; and
- (4) Use of radiation survey instruments; and

or

5D.3 Has demonstrated to the Department an acceptable alternative to 5D.2 when the individual has appropriate training and experience in the field of ionizing radiation, and, in addition, has adequate formal training with respect to radiation protection for industrial radiography;

and

5D.4 Has provided evidence of annual refresher safety training, as defined in 5.2, at intervals not to exceed 12 months.