

PART E
RADIATION SAFETY REQUIREMENTS FOR
INDUSTRIAL RADIOGRAPHIC OPERATIONS

Sec. E.1 - Purpose. This Part prescribes 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.

Sec. E.2 - Scope. 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 A, B, C, D, J, T, and V of these regulations apply to applicants, licensees and registrants subject to this Part. Parts C and T of these regulations apply to licensing and transportation of radioactive material and Part B of these regulations applies to the registration of radiation machines. Except for sections which are applicable only to sealed radioactive sources, radiation machines and sealed radioactive sources are both covered by this Part. This regulation does not apply to medical uses of sources of radiation which are addressed in Parts G and X of these regulations.

Sec. E.3 - Definitions. As used in this Part, the following definitions apply:

“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.

“ANSI” means the American National Standards Institute.

“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 it is used as an exposure head)

“Certifying entity” means an independent certifying organization meeting the requirements in Appendix A of this Part or an Agreement State meeting the requirements in Appendix A, Parts II and III of this Part.

“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.^{*/}

“Field station” means a facility from which sources of radiation may be stored or used and from where 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 E.16a.ii. or the hands-on experience for a radiographer as required by E.17a.

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

“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” (for States that authorize this activity) means industrial radiography performed on any water vessel used for laying pipe.]

[“Offshore platform radiography” (for States that authorize this activity) 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”.

“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.

^{*/} An exposure head is also known as a source stop.

“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 E.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 Agency’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 certain established radiation safety, testing, and experience criteria.

[“Radiographer's assistant” (for States who authorize this activity) means any individual who under the direct 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 associated with the presence of radioactive sources in a radiographic exposure device, or with a radiation machine. Activities include using, transporting except by common or contract carriers, or 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 or source changer where the sealed source is secured and restricted from movement.

“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. They 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, sealed source 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 container 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” (for States that authorize this activity) means industrial radiography performed when the radiographic exposure device or radiation machine and/or related equipment are beneath the surface of the water.]

Sec. E.4 - Reserved.

Sec. E.5 - Licensing and Registration Requirements for Industrial Radiography Operations. The Agency will approve an application for a specific license for the use of licensed material or a registration for use of radiation machines if the applicant meets the following requirements:

- a. The applicant satisfies the general requirements specified in Part B for radiation machine facilities or Part C for radioactive material, as applicable, and any special requirements contained in this Part;
- b. The applicant submits an adequate program for training radiographers and radiographer's assistants that meets the requirements of E.17. The applicant need not describe the initial training and examination program for radiographers in the subjects outlined in E.17g;
- c. 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;
- d. The applicant submits written operating and emergency procedures as described in E.18;
- e. 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 E.17e.;
- f. 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;
- g. The applicant submits the qualifications of the individual(s) designated as the radiation safety officer as described in E.16a and potential designees responsible for ensuring that the licensee's radiation safety program is implemented in accordance with approved procedures;
- h. 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. If the applicant intends to analyze its own wipe samples, the applicant must include a description of the procedures to be followed. The description must include the:
 - i. Methods of collecting the samples;

- ii. Qualifications of the individual who analyzes the samples;
 - iii. Instruments to be used; and
 - iv. Methods of analyzing the samples.
- i. 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 E.9 and E.20g.iv.;
 - j. The applicant identifies and describes the location(s) of all field stations and permanent radiographic installations;
 - k. The applicant identifies the location(s) where all records required by this and other Parts of these regulations will be maintained;
 - l. [(For States that authorize this activity) If a license application includes underwater radiography/, a description of:
 - i. Radiation safety procedures and radiographer responsibilities unique to the performance of underwater radiography;
 - ii. Radiographic equipment and radiation safety equipment unique to underwater radiography; and
 - iii. Methods for gas-tight encapsulation of equipment; and]
 - m. [(For States that authorize this activity) If an application includes offshore platform and/or lay-barge radiography, a description of:
 - i. Transport procedures for radioactive material to be used in industrial radiographic operations;
 - ii. Storage facilities for radioactive material; and
 - iii. Methods for restricting access to radiation areas.]

Sec. E.6 - Performance Requirements for Industrial Radiography Equipment. Equipment used in industrial radiographic operations must meet the following minimum criteria:

- a. 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 NBS Handbook 136, issued January 1981); This publication

may be purchased from the American National Standards Institute, Inc., 25 West 43rd Street, New York, New York 10036; Telephone: (212) 642-4900. Copies of the document are available for inspection at the Nuclear Regulatory Commission Library, 11545 Rockville Pike, Rockville, Maryland 20852. A copy of the document is also on file at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html;

- b. In addition to the requirements specified in E.6a., the following requirements apply to radiographic exposure devices, source changers, source assemblies and sealed sources;
 - i. 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.
 - ii. Radiographic exposure devices intended for use as Type B packages must meet the applicable transportation requirements of Part T of these regulations.
 - iii. Modification of radiographic exposure devices, source changers, and source assemblies and associated equipment is prohibited, unless the design of any replacement component, including source holder, source assembly, controls or guide tubes would not compromise the design safety features of the system.
- c. In addition to the requirements specified in E.6a. and E.6b., 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;
 - i. 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.
 - ii. 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.

- iii. 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.
- iv. 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.

- v. 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.
 - vi. Guide tubes must be used when moving the source out of the device.
 - vii. 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.
 - viii. The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.
 - ix. 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.
- d. All radiographic exposure devices and associated equipment must comply with the requirements of this section; and
 - e. As an exception to E.6a., equipment used in industrial radiographic operations need not comply with § 8.9.2(c) of the Endurance Test in American National Standards Institute N432-1980, 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.

Sec. E.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 millisieverts (200 mrem) per hour at any exterior surface, and 0.1 millisieverts (10 mrem) per hour at 1 meter from any exterior surface with the sealed source in the shielded position.

Sec. E.8 - Locking Sources of Radiation, Storage Containers and Source Changers.

- a. 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. The exposure device and/or its container must be kept locked^{**/} when not under the direct surveillance of a radiographer or a radiographer's assistant except at permanent radiographic installations as stated in E. 22. 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.
- b. 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^{***} when containing sealed sources except when under the direct surveillance of a radiographer or a radiographer's assistant.
- c. For x-ray machines whose design output is greater than or equal to 1MeV, 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.

Sec. E.9 - Radiation Survey Instruments.

- a. 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 D of these regulations. Instrumentation required by this section must be capable of measuring a range from 0.02 millisieverts (2 mrem) per hour through 0.01 sievert (1 rem) per hour.
- b. The licensee or registrant shall have each radiation survey instrument required under E.9a. calibrated:
 - i. At energies appropriate for use and at intervals not to exceed 6 months or after instrument servicing, except for battery changes;
 - ii. At energies appropriate for use:
 - (1) For linear scale instruments, at two points located approximately one-third and two-thirds of full-scale on each scale;
 - (2) 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 millisieverts (2 and 1000 mrem) per hour;

^{**/} If a keyed lock, the key must be removed at all times.

- iii. So that an accuracy within plus or minus 20 percent of the true radiation dose rate can be demonstrated at each point checked.
- c. The licensee or registrant shall maintain records of the results of the instrument calibrations in accordance with E.26.

Sec. E.10 - Leak Testing and Replacement of Sealed Sources.

- a. The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing of any sealed source must be performed by persons authorized to do so by the Agency, the Nuclear Regulatory Commission, or an Agreement State.
- b. The opening, repair, or modification of any sealed source must be performed by persons specifically authorized to do so by the Agency, the Nuclear Regulatory Commission, or an Agreement State.
- c. Testing and recordkeeping requirements.
 - i. 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 Agency, the Nuclear Regulatory Commission, or by an 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 microcuries) of radioactive material on the test sample and must be performed by a person specifically authorized by the Agency, the Nuclear Regulatory Commission, or an Agreement State to perform the analysis.
 - ii. The licensee shall maintain records of the leak tests in accordance with E.27.
 - iii. 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 and the test results received. 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 storage interval exceeds 6 months.
- d. Any test conducted pursuant to E.10c. that reveals the presence of 185 becquerels (0.005microcuries) 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 Agency regulations. A report must be filed with the Agency 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.
- e. 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. The analysis must be

capable of detecting the presence of 185 becquerels (0.005 microcuries) of radioactive material on the test sample and must be performed by a person specifically authorized by the Agency, the Nuclear Regulatory Commission, or an Agreement State to perform the analysis. Should such testing reveal the presence of 185 becquerel (0.005 microcuries) or more of removable DU contamination, the exposure device must be removed from use until an evaluation of the wear of the S-tube has been made. 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. Before using or transferring such a device, however, the device must be tested for DU contamination, if the interval of storage exceeds 12 months. A record of the DU leak-test must be made in accordance with E.27.

Sec. E.11 - Quarterly Inventory.

- a. 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.
- b. The licensee or registrant shall maintain records of the quarterly inventory in accordance with E.28.

Sec. E.12 - Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

- a. 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:
 - i. The equipment is in good working condition;
 - ii. The sources are adequately shielded; and
 - iii. Required labeling is present.
- b. Survey instrument operability must be performed using check sources or other appropriate means.
- c. If equipment problems are found, the equipment must be removed from service until repaired.
- d. Each licensee or registrant shall have written procedures for performance of inspection and routine maintenance of radiation machines (producing x-rays greater than or equal to 1 MeV), radiographic exposure devices, source changers, associated equipment, transport and storage containers, and survey instruments 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. Replacement components shall meet design specifications.

- e. The licensee's inspection and maintenance program must include written procedures for inspection and maintenance necessary to maintain the Type B packaging used to transport radioactive materials. The inspection and maintenance program must include procedures to assure that Type B packages are shipped and maintained in accordance with the certificate of compliance or other approval.
- f. Records of equipment problems and of any maintenance performed under E.12 must be made in accordance with E.30.

Sec. E.13 - Permanent Radiographic Installations.

- a. Each entrance that is used for personnel access to the high radiation area in a permanent radiographic installation must have either:
 - i. An entrance control of the type described in Part D.1601 of these regulations that causes the radiation level upon entry into the area to be reduced; or
 - ii. 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.
- b. 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 E.13a.i. must be tested monthly. 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 E.22 and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarms must be maintained in accordance with E.31.

Sec. E.14 - Labeling, Storage, and Transportation.

- a. 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 in 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"

- b. 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 T.
- c. Radiographic exposure devices, source changers, storage containers, and radiation machines (of greater than or equal to 1 MeV), 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.
- d. 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.

Radiation Safety Requirements

Sec. E.15 - Conducting Industrial Radiographic Operations.

- a. 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 E.17c. 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.
- b. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation unless otherwise specifically authorized by the Agency.
- c. [(For States who authorize this activity) a licensee or registrant may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the Agency, the Nuclear Regulatory Commission, or by an Agreement State.]

Sec. E.16 - Radiation Safety Officer. 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.

- a. The minimum qualifications, training, and experience for radiation safety officers for industrial radiography are as follows:
 - i. Completion of the training and testing requirements of E.17a.;
 - ii. 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and
 - iii. Formal training in the establishment and maintenance of a radiation protection program.

- b. The Agency will consider alternatives when the radiation safety officer 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.
- c. The specific duties and authorities of the radiation safety officer include:
 - i. Establishing and overseeing all operating, emergency, and ALARA procedures as required by Part D of these regulations and reviewing them regularly to ensure that they conform to Agency regulations and to the license or registration conditions;
 - ii. Overseeing and approving the training program for radiographic personnel to ensure that appropriate and effective radiation protection practices are taught;
 - iii. 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;
 - iv. 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 D of these regulations; and
 - v. Ensuring that operations are conducted safely and for implementing corrective actions including stopping radiographic operations when necessary.

Sec. E.17 - Training.

- a. The licensee or registrant may not permit any individual to act as a radiographer until the individual has received training in the subjects outlined in E.17g., in addition to on-the-job training consisting of hands-on experience under the supervision of a radiographer and is certified through a radiographer certification program by a certifying entity in accordance with the criteria specified in Appendix A of this Part. The on-the-job training shall include a minimum of 2 months (320 hours) of active participation in the performance of industrial radiography utilizing radioactive material and/or 1 month (160 hours) of active participation in the performance of industrial radiography utilizing radiation machines. Individuals performing industrial radiography utilizing radioactive materials and radiation machines must complete both segments of the on-the-job training (3 months or 480 hours).
- b. In addition, the licensee or registrant may not permit any individual to act as a radiographer until the individual:
 - i. Has received copies of and instruction in the requirements described in the regulations contained in this Part, and applicable sections of Parts C, D, J, and T of these regulations, in the license or registration under which the radiographer will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
 - ii. Has demonstrated an understanding of items in E.17b.i. by successful completion of a

written examination;

- iii. Has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices, sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and
 - iv. Has demonstrated understanding of the use of the equipment described in E.17b.iii. by successful completion of a practical examination.
- c. [(For States that authorize this activity), the licensee or registrant may not permit any individual to act as a radiographer's assistant until the individual:
 - i. Has received copies of and instruction in the requirements described in the regulations contained in this Part, and applicable sections of Parts C, D, J, and T of these regulations, in the license or registration under which the radiographer's assistant will perform industrial radiography, and the licensee's or registrant's operating and emergency procedures;
 - ii. Has demonstrated an understanding of items in E.17c.i. by successful completion of a written examination;
 - iii. Has developed competence to use, under the personal supervision of the radiographer, the radiation machines and/or radiographic exposure devices, sealed sources, associated equipment, and the radiation survey instruments that the assistant will use; and
 - iv. Has demonstrated understanding of the use of the equipment described in E.17c.iii. by successful completion of a practical examination.]
- d. The licensee or registrant shall provide annual refresher safety training for each radiographer and radiographer's assistant at intervals not to exceed 12 months.
- e. Except as provided in E.17e.iii., 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 Agency's regulations, license or registration requirements, and operating and emergency procedures are followed.
 - i. The inspection program must:
 - (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
 - (2) Provide that, 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 E.17b.iii. and the radiographer's assistant must demonstrate knowledge of the training requirements of E.17c.iii. by a practical examination

before these individuals can next participate in a radiographic operation.

- ii. The Agency may consider alternatives in those situations where the individual serves as both radiographer and radiation safety officer.
- iii. In those operations where a single individual serves as both radiographer and radiation safety officer, and performs all radiography operations, an inspection program is not required.
- f. The licensee or registrant shall maintain records of the above training to include certification documents, written, and practical examinations, refresher safety training and inspections of job performance in accordance with E.32.
- g. The licensee or registrant shall include the following subjects required in E.17a.:
 - i. Fundamentals of radiation safety including:
 - (1) Characteristics of gamma and x-radiation;
 - (2) Units of radiation dose and quantity of radioactivity;
 - (3) Hazards of exposure to radiation;
 - (4) Levels of radiation from licensed and registered sources of radiation; and
 - (5) Methods of controlling radiation dose (time, distance, and shielding);
 - ii. Radiation detection instruments including:
 - (1) Use, operation, calibration, and limitations of radiation survey instruments;
 - (2) Survey techniques; and
 - (3) Use of personnel monitoring equipment;
 - iii. Equipment to be used including:
 - (1) Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtailed);
 - (2) Operation and control of radiation machines;
 - (3) Storage, control, and disposal of sources of radiation; and
 - (4) Inspection and maintenance of equipment.

- iv. The requirements of pertinent state and federal regulations; and
- v. Case histories of accidents in radiography.

Sec. E.18 - Operating and Emergency Procedures.

- a. Operating and emergency procedures must include, as a minimum, instructions in the following:
 - i. 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 D of these regulations;
 - ii. Methods and occasions for conducting radiation surveys;
 - iii. Methods for posting and controlling access to radiographic areas;
 - iv. Methods and occasions for locking and securing radiographic exposure devices, transport and storage containers and sealed sources;
 - v. Personnel monitoring and the use of personnel monitoring equipment;
 - vi. Transporting sealed sources 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 T of these regulations;
 - vii. The inspection, maintenance, and operability checks of radiographic exposure devices, radiation machines, survey instruments, alarming ratemeters, transport containers, storage containers and associated equipment;
 - viii. 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;
 - ix. The procedure(s) for identifying and reporting defects and noncompliance, as required by E.38;
 - x. The procedure for notifying proper persons in the event of an accident or incident;
 - xi. 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;
 - xii. Source recovery procedure if licensee will perform source recoveries; and
 - xiii. Maintenance of records.
- b. The licensee or registrant shall maintain copies of current operating and emergency procedures in accordance with E.33 and E.37.

[Sec. E.19 - (For States who authorize this activity.) Supervision of Radiographer's Assistants. 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 E.21b. to determine that the sealed source has returned to the shielded position or the radiation machine is off after an exposure. The personal supervision must include:

- a. The radiographer's physical presence at the site where the sources of radiation are being used;
- b. The availability of the radiographer to give immediate assistance if required; and
- c. The radiographer's direct observation of the assistant's performance of the operations referred to in this section.]

Sec. E.20 - Personnel Monitoring.

- a. The licensee or registrant may 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 alarming ratemeter, and personnel dosimeter. At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, or during radiographic operations using radiation machines, the use of an alarming ratemeter is not required.
 - i. Pocket dosimeters must have a range from zero to 2 millisieverts (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.
 - ii. Each personnel dosimeter must be assigned to and worn by only one individual.
 - iii. Film badges must be replaced at least monthly and all other personnel dosimeters that require replacement must be replaced at least quarterly. All personnel dosimeters must be evaluated at least quarterly or promptly after replacement, whichever is more frequent.
- b. 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 E.34.
- c. 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 E.34. Acceptable dosimeters must read within plus or minus 20 percent of the true radiation exposure.
- d. If an individual's pocket dosimeter is found to be off-scale, or the electronic personal dosimeter reads greater than 2 millisieverts (200 mrem), and the possibility of radiation exposure cannot be ruled out as the cause, the individual's personnel dosimeter that requires processing must be sent for processing and evaluation within 24 hours. For personnel dosimeters that do not

require processing, evaluation of the dosimeter must be started within 24 hours. In addition, the individual may not resume work associated with the 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. The results of this determination must be included in the records maintained in accordance with E.34.

- e. If a personnel dosimeter is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter 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 E.34.
- f. Dosimetry results must be retained in accordance with E.34.
- g. Each alarming ratemeter must:
 - i. Be checked to ensure that the alarm functions properly (sounds) before using at the start of each shift;
 - ii. Be set to give an alarm signal at a preset dose rate of 5 millisieverts (500 mrem) per hour; with an accuracy of plus or minus 20 percent of the true radiation dose rate;
 - iii. Require special means to change the preset alarm function; and
 - iv. 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 E.34.

Sec. E.21 - Radiation Surveys. The licensee or registrant shall:

- a. Conduct all surveys with a calibrated and operable radiation survey instrument that meets the requirements of E.9;
- b. Conduct a survey of the radiographic exposure device and the guide tube after each exposure when approaching the device or the guide tube. The survey must determine that the sealed source has returned to its shielded position before exchanging films, repositioning the exposure head, or dismantling equipment. Radiation machines shall be surveyed after each exposure to determine that the machine is off;
- c. 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 E.3, to ensure that the sealed source is in its shielded position; and
- d. Maintain records in accordance with E.35.

Sec. E.22 - Surveillance. During each radiographic operation, the radiographer, or the other individual present as required by E.15, shall maintain 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 A of these regulations, except at permanent radiographic installations where all entryways are locked and the requirements of E.13 are met.

Sec. E.23 - Posting. All areas in which industrial radiography is being performed must be conspicuously posted as required by Part D.1902 of these regulations. The exceptions listed in Part D.1903 of these regulations do not apply to industrial radiographic operations.

Recordkeeping Requirements

Sec. E.24 - Records for Industrial Radiography. 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 Agency, or until the Agency terminates the license or registration.

Sec. E.25 - Records of Receipt and Transfer of Sources of Radiation.

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

Sec. E.26 - Records of Radiation Survey Instruments. Each licensee or registrant shall maintain records of the calibrations of its radiation survey instruments that are required under E.9 and retain each record for 3 years after it is made.

Sec. E.27 - Records of Leak Testing of Sealed Sources and Devices Containing DU. Each licensee shall maintain records of leak test results for sealed sources and for devices containing DU. The results must be stated in units of becquerels (microcuries). The licensee shall retain each record for 3 years after it is made or until the source in storage is removed.

Sec. E.28 - Records of Quarterly Inventory.

- a. Each licensee or registrant shall maintain records of the quarterly inventory of sources of radiation, including devices containing depleted uranium as required by E.11, and retain each record for 3 years after it is made.
- b. The record must include the date of the inventory, name of the individual conducting the inventory, radionuclide, number of becquerels (curies) 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.

Sec. E.29 - Utilization Logs.

- a. Each licensee or registrant shall maintain utilization logs showing for each source of radiation the following information:
 - i. 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;
 - ii. The identity and signature of the radiographer to whom assigned;
 - iii. The location and dates of use, including the dates removed and returned to storage; and
 - iv. For permanent radiographic installations, the dates each radiation machine is energized.
- b. The licensee or registrant shall retain the logs required by E.29a. for 3 years.

Sec. E.30 - Records of Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers, and Survey Instruments.

- a. Each licensee or registrant shall maintain records specified in E.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.
- b. 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.

Sec. E.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 E.13 and retain each record for 3 years after it is made.Sec. E.32 - Records of Training and Certification. Each licensee or registrant shall maintain the following records for 3 years:

- a. Records of training of each radiographer and each radiographer's assistant. 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
- b. Records of annual refresher safety training and semi-annual inspections of job performance for each radiographer and each radiographer's assistant. 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. For inspections of job performance, the records must also include a list showing the items checked and any non-compliance observed by the

radiation safety officer.

Sec. E.33 - Copies of Operating and Emergency Procedures. Each licensee or registrant shall maintain a copy of current operating and emergency procedures until the Agency terminates the license or registration. Superseded material must be retained for 3 years after the change is made.

Sec. E.34 - Records of Personnel Monitoring. Each licensee or registrant shall maintain the following exposure records specified in E.20:

- a. Direct reading dosimeter readings and yearly operability checks required by E.20b. and E.20c. for 3 years after the record is made;
- b. Records of alarming ratemeter calibrations for 3 years after the record is made;
- c. Personnel dosimeter results until the Agency terminates the license or registration; and
- d. Records of estimates of exposures as a result of off-scale personal direct reading dosimeters, or lost or damaged personnel dosimeters, until the Agency terminates the license or registration.

Sec. E.35 - Records of Radiation Surveys. Each licensee shall maintain a record of each exposure device survey conducted before the device is placed in storage as specified in E.21c. Each record must be maintained for 3 years after it is made.

Sec. E.36 - Form of Records. 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. The record may also be stored in electronic media with the capability for producing legible, accurate, and complete records during the required retention period. Records, such as letters, drawings, and specifications, must include all pertinent information, such as stamps, initials, and signatures. The licensee or registrant shall maintain adequate safeguards against tampering with and loss of records.

Sec. E.37 - Location of Documents and Records.

- a. 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 E.5k.
- b. 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;
 - i. The license or registration authorizing the use of sources of radiation;
 - ii. A copy of Parts A, D, E & J of these regulations;
 - iii. Utilization logs for each source of radiation dispatched from that location as required by E.29.

- iv. Records of equipment problems identified in daily checks of equipment as required by E.30a.;
- v. Records of alarm system and entrance control checks required by E.31, if applicable;
- vi. Records of dosimeter readings as required by E.34;
- vii. Operating and emergency procedures as required by E.33;
- viii. Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by E.26;
- ix. Evidence of the latest calibrations of alarming ratemeters and operability checks of dosimeters as required by E.34;
- x. Survey records as required by E.35 and Part D.2103 of these regulations as applicable, for the period of operation at the site;
- xi. The shipping papers for the transportation of radioactive materials required by Part T of these regulations; and
- xii. When operating under reciprocity pursuant to Part C of these regulations, a copy of the applicable State license or registration, or Nuclear Regulatory Commission license authorizing the use of sources of radiation.

Notifications

Sec. E.38 - Notifications.

- a. In addition to the reporting requirements specified in Part D of these regulations, each licensee or registrant shall provide a written report to the Agency within 30 days of the occurrence of any of the following incidents involving radiographic equipment:
 - i. Unintentional disconnection of the source assembly from the control cable;
 - ii. Inability to retract the source assembly to its fully shielded position and secure it in this position;
 - iii. Failure of any component, which is critical to safe operation of the device, to properly perform its intended function; or
 - iv. 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.

- b. The licensee or registrant shall include the following information in each report submitted under E.38a., and in each report of overexposure submitted under Part D.2203 of these regulations which involves failure of safety components of radiography equipment:
 - i. Description of the equipment problem;
 - ii. Cause of each incident, if known;
 - iii. Name of the manufacturer and model number of equipment involved in the incident;
 - iv. Place, date, and time of the incident;
 - v. Actions taken to establish normal operations;
 - vi. Corrective actions taken or planned to prevent recurrence; and
 - vii. Names and qualifications of personnel involved in the incident.
- c. 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 180 days in a calendar year, shall notify the Agency at the location listed in Part A.12 prior to exceeding the 180 days.

Radiographer Certification

[Sec. E.39 - (For States that authorize this activity) Application and Examinations.

- a. Application
 - i. An application for taking the examination shall be on forms prescribed and furnished by the Agency.
 - ii. A non-refundable fee of \$XX.XX shall be submitted with the application to cover certification administrative costs, such as the examination, training documentation review, and issuance of certification.
 - ii. The application and the non-refundable and non-transferable application fee shall be submitted to the Agency on or before the dates specified by the Agency.
 - iii. Applicants who fail to appear at a scheduled exam and do not reschedule 48 hours prior to their assigned exam session shall apply for a future exam session in accordance with Section E.39.a.
 - iv. An individual whose certification ID card has been suspended or revoked shall obtain written approval from the Agency to apply to retake the examination.

- b. Examination. The examination shall be given for the purpose of determining the qualifications of applicants.
- i. A written examination shall be held at times and places determined by the Agency. The scope of the examination and the methods of procedure, including determination of the passing score, shall be prescribed by the Agency. The examination will assess the applicant's knowledge to safely use sources of radiation and related equipment and the applicant's knowledge of Parts D, E and T of these regulations.
 - ii. The examination will be administered by the Agency or persons authorized by the Agency.
 - iii. A candidate failing an examination may apply for re-examination in accordance with E.39a. and will be re-examined. A candidate shall not retake the same version of the examination.
 - iv. The examination will be held at dates, times and locations designated by the Agency.
 - v. The examination will be in English.
 - vi. To take the examination, an individual shall have a picture identification card, such as a driver's license, at the time of the examination.
 - vii. Calculators will be permitted during the examination. However, calculators or computers with preprogrammed data or formulas, including exposure calculators, will not be permitted during the examination.
 - viii. The examination will be a "closed book" examination.
 - ix. Any individual observed by an Agency proctor to be compromising the integrity of the examination shall be required to surrender the examination, the answer sheet, and any work paper. Such individual will not be allowed to complete the examination, will forfeit the examination fee, and will leave the examination site to avoid disturbing other examinees. Such individual must wait 90 days and must resubmit a new application and an additional \$XX.XX fee before taking a new examination.
 - x. Examination material shall be returned to the Agency at the end of the examination. No photographic or other copying of examination questions or materials shall be permitted. Disclosure by any individual of the contents of any examination prior to its administration is prohibited.
 - xi. The names and scores of individuals taking the examination shall be a public record.]

[Sec. E.40 - (For States that authorize this activity) Certification Identification (ID) Card.

- a. A certification ID card shall be issued to each person who successfully completes the

requirements of E.17a and the examination prescribed in E.39b.

- i. Each person's certification ID card shall contain their photograph. The Agency will take the photograph at the time the examination is administered.
 - ii. The certification ID card remains the property of the Agency and may be revoked or suspended.
 - iii. Any individual who wishes to replace their certification ID card shall submit to the Agency a written request for a replacement certification ID card, stating the reason a replacement certification ID card is needed. A non-refundable fee of \$XX.XX shall be paid to the Agency for each replacement of a certification ID card. The prescribed fee shall be submitted with the written request for a replacement certification ID card. The individual shall maintain a copy of the request in their possession while performing industrial radiographic operations until a replacement certification ID card is received from the Agency.
- b. Each certification ID card is valid for a period of five years, unless revoked or suspended in accordance with E.40d. Each certification ID card expires at the end of the day, in the month and year stated on the certification ID card.
- c. Renewal of Certification ID card.
- i. Applications for examination to renew a certification ID card shall be filed in accordance with E.39a.
 - ii. The examination for renewal of a certification ID card shall be administered in accordance with E.39b.
 - iii. A renewal certification ID card shall be issued in accordance with E.40a.
- d. Revocation or suspension of a certification ID card.
- i. Any radiographer who violates these regulations, equivalent State or Nuclear Regulatory Commission regulations, or any applicable statutory requirements may be required to show cause at a formal hearing why their certification ID card should not be revoked or suspended in accordance with E.40d.ii. of these regulations.
 - ii. When an Agency order has been issued for an industrial radiographer to cease and desist from the use of sources of radiation or the Agency revokes or suspends their certification ID card, the industrial radiographer shall surrender the certification ID card to the Agency until the order is changed or the suspension expires.]

Sec. E.41 - Reciprocity.

- a. All reciprocal recognition of licenses and registrations by the Agency will be granted in accordance with Part C of these regulations.
- b. Reciprocal recognition by the Agency of an individual radiographer certification will be granted provided that:
 - i. The individual holds a valid certification in the appropriate category issued by a certifying entity, as defined in E.3;
 - ii. The requirements and procedures of the certifying entity issuing the certification affords the same or comparable certification standards as those afforded by E.17a.;
 - iii. The applicant presents the certification to the Agency prior to entry into the state; and
 - iv. No escalated enforcement action is pending with the Nuclear Regulatory Commission or in any other state.
- c. Certified individuals who are granted reciprocity by the Agency shall maintain the certification upon which the reciprocal recognition was granted, or prior to the expiration of such certification, shall meet the requirements of E.17a.

Sec. E.42 - Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

- a. At a job site, the following shall be supplied by the licensee or registrant:
 - i. At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;
 - ii. A current whole body personnel dosimeter for each person;
 - iii. An operable, calibrated pocket dosimeter with a range of zero to 200 milliroentgens assigned to each person performing radiographic operations. Each dosimeter must be recharged at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters;
 - iv. An operable, calibrated, alarming ratemeter assigned to each person performing radiographic operations using a radiographic exposure device; and
 - v. The appropriate barrier ropes and signs.
- b. Each radiographer at a job site shall have on their person a valid certification ID card issued by a certifying entity.

- c. Industrial radiographic operations shall not be performed if any of the items in E.42a. and E.42b. are not available at the job site or are inoperable.
- d. During an inspection, the Agency may terminate an operation if any of the items in E.42a. and E.42b. are not available or operable, or if the required number of radiographic personnel are not present. Operations shall not be resumed until all required conditions are met.

PART E

APPENDIX A

I. Requirements for an Independent Certifying Organization.

An independent certifying organization shall:

- 1. Be an organization such as a society or association, whose members participate in, or have an interest in, the field of industrial radiography;
- 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;
- 3. Have a certification program open to nonmembers, as well as members;
- 4. Be an incorporated, nationally recognized organization that is involved in setting national standards of practice within its fields of expertise;
- 5. Have an adequate staff, a viable system for financing its operations, and a policy and decision-making review board;
- 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;
- 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;
- 8. Have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions;

9. Have written procedures describing all aspects of its certification program, maintain records of the current status of each individual's certification and the administration of its certification program;
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;
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;
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
13. Provide a description to the Nuclear Regulatory Commission of its procedures for choosing examination sites and for providing an appropriate examination environment.

II. Requirements for Certification Programs.

All certification programs must:

1. Require applicants for certification to:
 - (a) Receive training in the topics set forth in E.17g. or equivalent State or Nuclear Regulatory Commission regulations, and
 - (b) Satisfactorily complete a written examination covering these topics.
2. Require applicants for certification to provide documentation that demonstrates that the applicant has:
 - (a) Received training in the topics set forth in E.17g. or equivalent State or Nuclear Regulatory Commission regulations;
 - (b) Satisfactorily completed a minimum period of on-the-job training as specified in E.17a.; and
 - (c) 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.
3. Include procedures to ensure that all examination questions are protected from disclosure;

4. Include procedures for denying an application and revoking, suspending, and reinstating a certification;
5. Provide a certification period of not less than 3 years nor more than 5 years;
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
7. Provide a timely response to inquiries, by telephone or letter, from members of the public, about an individual's certification status.

III. Requirements for Written Examinations

All examinations must be:

1. Designed to test an individual's knowledge and understanding of the topics listed in E.17g. or equivalent State or Nuclear Regulatory Commission requirements;
2. Written in a multiple-choice format; and
3. Have test items drawn from a question bank containing psychometrically valid questions based on the material in E.17g.

**2021
Rationale for Revisions**

**Part E
Radiation Safety Requirements for Industrial Radiographic Operations**

Part E was last reviewed and published in 2015. Since the last review there have been two changes made to 10 CFR 34 that require changes to Part E to remain compatible with federal regulations. These changes were outlined in RATS 2018-3 (83 FR 30285) and RATS 2020-1 (85 FR 15347).

- | | |
|-----------|---|
| E.20 | Revised to be compatible with changes outlined in RATS 2020-1.
Paragraph a – Removed the phrase “that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor”.
Reworded A.iii.
Deleted redundant A.iv.
Paragraph d – Added evaluation requirement for dosimeters that do not require processing.
Paragraph f – Removed the phrase “Reports received from the accredited NVLAP processor”. |
| E.34.c | Revised to be compatible with changes outlined in RATS 2020-1.
Removed the phrase “received from the accredited NVLAP processor”. |
| E.38.c | Added “at the location listed in A.12”.
See RATS 2018-3 |
| E.42.a.ii | Removed the phrase “that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor”. |

**2015
Rationale for Revisions**

**Part E
Radiation Safety Requirements for Industrial Radiographic Operations**

This regulation was last reviewed in 1999 when 10CFR34 was published on May 28, 1997 in Federal Register (62 FR 28948). This review will encompass any changes made to 10 CFR 34 since it was published. References will be removed relating to x-Ray machines with output less than 1MeV (machines not used to conduct industrial x-ray testing similar to the type of inspections conducted using radiographic cameras.) Requirements for x-ray machines with output less than 1 MeV will now be included in State Regulation Part H Radiation Safety Requirements for Analytical X-Ray Equipment. Reference to the new security requirements in 10CFR 37 will be included. Replace “film badge and TLD” with the term “personnel dosimetry” and insert NVLAP approval to account for other devices that are NVLP approved and are being used. Other paragraphs deleted due to applicability date ranges which no longer apply.

E.4	Change to “Reserve”
E.4.9	Delete x-ray definitions
E.5.b.i	Delete
E.5.b.ii	Delete
E.10.d	Delete
E.10.e	Change unit from Ci to microcuries
E.17.a.ii	Delete
E.20.a	Change “either a film badge or a TLD” to “and a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP)0 processor.
E.20.iii	Replace with “Film badges must be replaced at periods not to exceed one month and other personnel dosimeters processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor must be replaced at periods not to exceed three months.”
E.20.a.iv	Change “film badges and TLD’s” with “personnel dosimeter” in both instances.
E.20.e	Change “film badge or TLD” with “personnel dosimeter”
E20.f	Change “ film badge or TLD” to “accredited NVLP personnel dosimeter”

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|-----------|--|
| E.34.c | Change “film badge or TLD” to “accredited NVLP personnel dosimeter” |
| E.34.d | Change “film badges and TLD’s” with “personnel dosimeter” |
| ALL PARTS | Clarify /remove all references to x-ray devices whose output is less than 1 MeV. |
| E.42 | Add additional requirements for pocket dosimetry as contained in 10CFR34. |

1999 Rationale for Part E

Radiation Safety Requirements for Industrial Radiographic Operations

Introduction

On February 28, 1994, the Nuclear Regulatory Commission published a proposed rule (59 CFR 9429) in the Federal Register. The proposed rule included an overall revision of 10 CFR Part 34 based on comments and recommendations made at meetings with the Agreement States and members of industry in 1991 and 1992. After a comment period, the final rule which was published on May 28, 1997 in the Federal Register (62 FR 28948), included:

1. A requirement for a two-person crew whenever radiographic operations are being conducted outside a permanent installation, and the second person must meet the requirements of a radiographer's assistant as defined in 10 CFR part 34;
2. The addition and modification of many definitions;
3. A requirement to provide the location and description of all field stations and permanent radiographic installations;
4. A change in the field inspection of radiographer and radiographer's assistants from a quarterly interval to semiannually;
5. A change in the survey meter calibration interval from three months to six months with a requirement that the survey meters be checked for operation daily and at a three month interval;
6. A requirement that radiographic exposure devices using depleted uranium, (DU) for shielding be checked for DU contamination annually;
7. Added qualifications and duties of the Radiation Safety Officer;
8. A requirement that radiographers be certified by a certifying entity;
9. Allowance of the replacement of TLD badges on a three month basis; and
10. A requirement that pocket dosimeters be checked for accuracy within 20 percent. In addition, many other additions and changes in wording were made for clarification purposes such as Subpart E which is Recordkeeping Requirements.

Because of the major changes made to 10 CFR Part 34, the equivalent Part E of the Suggested State Regulations for Control of Radiation (SSRCR) was revised in its entirety. In this revision, the items addressed in the Final Rule of 10 CFR Part 34 are included, along with changes made to encompass the use of x-ray equipment in industrial radiography. In addition, specific changes were made to clarify the meaning of the requirements or to add additional requirements. Additional wording was included for States that choose to become certifying entities. These sections include E.39 and E.40 of the revised Part E.

Compatibility Issues

As stated in the NRC's Statements of Consideration, sections of 10 CFR Part 34 will be a matter of compatibility. Radiographic equipment standards, training standards, operational safety standards and technical definitions are identified as Division 2 matters of compatibility. The definitions of lay-barge radiography, radiographer's assistant and underwater radiographer are considered special cases of Division 2 matters of compatibility for States that do not authorize licensees to perform lay-barge or underwater radiography or do not authorize the use of radiographer's assistants. Such States would not be required to adopt these definitions. The NRC's sections entitled Purpose and Scope, Interpretations, Application for a Specific License, Applications for Exemptions, Violations, and Criminal Penalties are identified as Division 3 matters of compatibility. The definition and sections that relate to offshore platform radiography are designated as Division 4 matters of compatibility. A State will need to adopt a definition of platform radiography if it authorizes such activity on inland waters or tidal waters subject to that State's jurisdiction. Although Appendix A is designated as Division 2, the Agreement States are not required to implement a program unless they choose to become a certifying entity. They then would need to adopt only Sections II and III of Appendix A. However, if an Agreement State chooses to identify an independent certifying organization, it would need to adopt Section I of Appendix A.

Specific Provisions

Sec. E.3 - Definitions.

The definitions of Annual refresher safety training, ANSI, Associated equipment, Certifiable Cabinet X-ray System, Certifying Entity, Control (drive) cable, control drive mechanism, Control tube, Exposure head, Field station, Guide tube (projection sheath), Hands-on experience, Independent Certifying Organization, Lay-barge radiography, Offshore platform radiography, Practical examination, Radiation Safety Officer, Radiographer certification, Radiographer's assistant, Radiographic operations, S-tube, Sealed source and Underwater radiography were added to be consistent with the Final Rule of 10 CFR Part 34. The definition of Certifiable Cabinet x-ray system was added to describe a system that has been modified to meet the requirements of 21 CFR 1020.40.

The definitions of Lixiscope, personal supervision, radiographer instructor, radiographer trainee, radiographic personnel, shielded-room radiography and transport container were deleted because they were not used in the first draft of this revised Part E.

Many of the other definitions were changed to clarify the meaning and ensure compatibility with the Final Rule of 10 CFR Part 34.

Sec. E.12 - Inspection and Maintenance of Radiation Machines, Radiographic Exposure Devices, Transport and Storage Containers, Associated Equipment, Source Changers and Survey Instruments

10 CFR 34.31(b)(1) requires that replacement components shall meet design specifications. In section E.12 of the revised part E, this requirement was intentionally removed, as the committee felt it would be difficult to enforce and brings up the same issues relative to the requirements for the associated equipment.

Sec. E.14 - Labeling, Storage and Transportation.

In 10 CFR 34.35(c), the sentence starts with "Locked". This word was deleted from section 14.c because locking requirements are discussed in Section E.8.

Sec. E.17 - Training.

10 CFR 34.43 (a)(1) requires radiographers to be trained in the applicable subjects. For the revised part E, a stipulation that the training be a 40 hour course was added. This was done to provide equivalent training requirements between States. Specifying the hours will allow easier reciprocal recognition of radiographers between the States. Also, 10 CFR 34.43(b)(4) references paragraph (b)(1) of the section which was determined by the committee not applicable to the practical exam. Therefore, the format of section b. was changed to better describe the requirements of this part. Section c. (radiographer's assistant) was also changed to better layout the training requirements.

Sec. E.20 - Personnel Monitoring.

10 CFR 34.47(a)(3) requires film badges be replaced at periods not to exceed one month and TLDs replaced at periods not to exceed three months. The committee decided that replacement of film badges and TLDs at one month intervals was needed for RSOs to better evaluate exposures to radiographic personnel and keep an overexposure from occurring at the end of the year. Also, for Section E.20, the committee decided to exempt users of radiation machines from having an alarming ratemeter during operations. The possibility of x-ray machines having exposures of 500 mR/hr and thereby alarming the ratemeter are remote.

Sec. E.22 - Surveillance

10 CFR 34.51 requires the radiographic personnel to maintain continuous direct visual surveillance of the operation to protect against unauthorized entry into a high radiation area. The revised section E.22 was changed to require visual surveillance of radiographic operations including the radiation area. The wording was changed to make the requirement the responsibility of the radiographer, while allowing the radiographer to employ other individuals to perform this function.

Sec. E.24 - Records For Industrial Radiography.

10 CFR 34.61 requires a licensee to maintain a copy of its license, license conditions, documents incorporated by reference, and amendments to each of these items. In the revised Part E, the committee deleted "license conditions", as the license conditions are part of the license.

Sec. E.29 - Utilization Logs.

In this section of Part E., an extra item was added to require users of radiation machines in permanent radiographic installations to record on the utilization log the dates the machine is energized.

Sec. E.35 - Records of Radiation Surveys.

10 CFR 34.85 requires that the licensee maintain a record of each survey conducted before the device is placed in storage if that survey is the last one performed in the workday. For the revised Part E, this was changed to require that the results of each lock-out survey be recorded by the licensee. This includes such surveys as those done when the device is placed in the truck during lunch hour as well as surveys performed anytime the device is placed in permanent storage, not just the last time it is placed in storage.

Sec. E.37 - Location of Documents and Records.

10 CFR 34.89(10) requires the latest records of the storage surveys be maintained at each field station or temporary job site. For the revised part E, the section was changed to require the area surveys also be maintained. Instead of the latest records, the revised part E requires the records be maintained for the period of operation.

Sec. E.38 - Notifications.

In this section, 10 CFR 30.50 was referenced because the present SSRCR does not address this requirement at this time. Also in this section, a requirement to report events involving x-ray machines was added.

Sec. E.39 - Application and Examinations.

This section is optional wording for States that wish to perform their own certification of radiographers. This section includes the requirements for submitting the application and taking the examination. Within this section, wording in a..2 was used to allow a State to break down the fee structure if they so choose.

Sec. E.40 - Certification ID Card.

This section is also optional wording for States that wish to perform their own certification of radiographers. This section addresses the requirement for the ID card including renewal, revocation and suspension of the card. The requirement that the cards be valid for five years was used because this is the interval used by most of the present certifying entities. In reference to the revocation and

suspension of ID cards, wording was chosen to give a State the authority to revoke or suspend a card based on violations identified in another State or NRC jurisdiction.

Sec. E.41 - Reciprocity.

This section addresses reciprocal recognition of licenses, registrations and radiographer certifications. States should be aware that reciprocal recognition of licenses and registrations is addressed in Part C of the SSRCR and a State could include this in their equivalent Part C if they so choose.

Sec. E.42 - Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

This section was not addressed in the Final Rule of 10 CFR Part 34. This section was added by the committee in an effort to better describe items required at a job site, including the radiographer's certification. In addition, this section gives an inspector the authority to shut down operations if any of the items are not available.

Appendix A

Part I of Appendix A provides the requirements for an independent certifying organization and only apply to organizations other than the Agreement States. Parts II and III of Appendix A provide the requirements for certification programs and written examinations for a certifying entity, and apply to the Agreement States that wish to become certifying entities.

**1988
Rationale for Revisions**

**Part E
Radiation Safety Requirements for Industrial Radiographic Operations**

Introduction

The changes to Part E in this revision of the Suggested State Regulations for Control of Radiation (SSRCR) were based upon changes to Louisiana and Texas industrial radiography regulations since the last revision of the SSRCR. Significant features relevant to improved radiation safety include the "two-man" rule (Paragraph E.305(c)) and the optional requirement for state or third party testing of radiographers (Subparagraph E.201(b)(5)). The U.S. Nuclear Regulatory Commission (NRC) is currently reevaluating its position with regard to licensing of industrial radiographic operations. Nothing in these suggested regulations should be interpreted as reflecting current or future NRC policy with regard to industrial radiographic operations.

Specific Provisions

E.3 Definitions

"Cabinet x-ray system" (rev.). The definition of "cabinet x-ray system" was made into several sentences for easier reading.

"Collimator" (new). The definition of "collimator" was added, with wording identical to the American National Standard definition. The definition was added because of the use of "collimator" in Appendix A.

"Enclosed radiography" (deleted). The definition of "enclosed radiography" was deleted as the term is not used in this edition of the SSRCR. The terms identified in the sub-definitions were retained and, in some cases, modified for clarity.

"Industrial radiography" (rev.). The definition of "industrial radiography" was changed to specifically indicate the use of ionizing radiation to produce radiographic images. This was necessary so that non-destructive testing using nonionizing radiation would be excluded and non-destructive testing not producing an image such as pipe wall thickness gauges would be excluded.

"Lixiscope" (new). The definition of "lixiscope" was added because this term is used in Section E.4.

"Personal supervision" (rev.). The definition of "personal supervision" was changed to incorporate the ideas of guidance and instruction and to remove reference to the radiographer's assistant.

"Radiographer's assistant" (deleted). The definition of "radiographer's assistant" was deleted as the term was

misleading. An assistant is someone who helps you accomplish a task not someone you are training to be a radiographer.

"Radiographer instructor" (new). The definition of "radiographer instructor" was added to specifically require that individuals providing training be radiographers who have been authorized by the Agency.

"Radiographer trainee" (new). The definition of "radiographer trainee" was added to more accurately define the training phase for a radiographer.

"Radiographic personnel" (new). The definition of "radiographic personnel" was added as this term is used in Section E.305.

"Residential location" (new). A definition for "residential location" was added because this term is used in Section E.103.

"Shielded-room radiography" (moved). The definition of "shielded-room radiography" was moved to place it in alphabetical order.

"Storage area" (new). A definition for "storage area" was added for consistency with 10 CFR 34.2.

"Storage container" (rev.). The definition of "storage container" was changed to remove reference to transportation and the word "shielded" was added to modify the word "device". This is a more accurate definition of the term as used in industrial radiography.

"Transport container" (new). A definition for "transport container" was added as reference to transportation was removed from the definition of "storage container".

E.4 Exemptions. Section E.4 was added to insure that the requirements of Part E were not applied to lixiscopes.

E.102 Locking of Sources of Radiation. A requirement for securing the sealed source in its shielded position after each exposure was added. This requirement is imposed upon the licensee through their operating and emergency procedures at this time; therefore, this action is placing the requirement into the regulations. There have been many overexposures because the source was not secured in the shielded position and was inadvertently moved to an unshielded position while moving the exposure device from one location to another.

E.103 Storage Precautions. Paragraphs E.103(b), (c) and (d) were added to prevent the permanent storage of radioactive material, in the large quantities used by radiographers, in residential areas. The potential risk to the public from such storage is believed to outweigh any benefit. Temporary storage at residential locations such as a motel during transportation is allowed.

E.104 Radiation Survey Instruments. Subparagrpah E.104(b)(3) was expanded to give better instructions for

calibration as "two or more widely separated points" is vague. Wording essentially identical to 10 CFR 39.33 was used. Paragraph E.104(d) was added to require an operational check of survey instruments prior to use. This requirement was added because of the importance of an operating survey instrument in industrial radiography.

E.105 Leak Testing, Repair, Tagging, Opening, Modification and Replacement of Sealed Sources. Paragraph E.105(e) was deleted as it refers to "fishpole radiography" which is no longer done. Section E.307 was added to specifically prohibit "fishpole radiography". A new Paragraph E.105(e) was added as requested by the SSRCR Technical Review Committee in the 1982 Rationale for Part E.

E.106 Quarterly Inventory. Section E.106 was changed to better identify the individual making the inventory and the sealed sources. An inventory of radiography exposure devices was also added as requested in the comments to the 1986 draft.

E.107 Utilization Logs. Paragraph E.107(a) was changed to require a unique identification instead of just a description as the same description could fit almost all devices. Also, Paragraph E.107(d) was added to require the dates each source is removed and returned to storage.

E.108 Inspection and Maintenance. Paragraph E.108(a) was changed to require inspections at the beginning of each shift or day of use. Paragraph E.108(b) was changed to require a 2 year record retention. Paragraph E.108(c) was changed to require a label on defective equipment to insure that it is not used until repaired.

E.109 Permanent Radiographic Installations. A requirement was added in Paragraph E.109(b) to label a defective control device or alarm system to insure that radiography is not conducted until repairs are made. A 2 year record retention was used to be consistent with other sections.

E.201 Training and Testing. Section E.201 was changed to improve the training that an individual receives prior to use of sources of radiation. The requirements for a radiographer's assistant have been deleted, and requirements for a radiographer trainee are being substituted. The radiographer's assistant was usually an individual who has received minimum training and then, typically, allowed to use sealed sources and/or x-ray machines under the supervision of a radiographer. However, experience has revealed that the radiographer actually provided very little personal supervision to these individuals during their day-to-day operations. The radiographer used the radiographer's assistant as an assistant. Usually, the radiographer's assistant actually manipulated the exposure device and made surveys while the radiographer is in the darkroom developing and interpreting film. The radiographer's assistant only sought help from the radiographer after he had a serious problem. It seems reasonable that the individual who is responsible for the manipulation of the sealed source should have the benefit of complete training in radiation safety as outlined in Appendix A of Part E. The radiographer trainee is required to use sources of radiation, related handling tools or survey instruments under the direct, personal supervision of a radiographer instructor.

The radiographer trainee requirements were made Paragraph (a) under Section E.201 as this seemed to be a more logical progression making the trainee requirements come before the radiographer requirements. In

Paragraph E.201(b), a requirement for providing the Agency with documentation of training for all radiographers was added. Subparagraph E.201(b)(5) was provided for those states that might want to institute a third party testing program for radiographers. Most of the training requirements are consistent with those currently in place. The major change has been moving the basic training requirements from the radiographer to the radiographer trainee.

E.203 Personnel Monitoring Control. Reference to the radiographer's assistant in Paragraph (a) of Section E.203 was changed to radiographer trainee as the radiographer's assistant is no longer used. In Paragraph (c), a requirement for records of the pocket dosimeter check was added with a 2 year retention time. It is believed that if the pocket dosimeter check is to be required there should be some way of inspecting against the requirement and a record seemed to be the most logical solution. Paragraph (d) was expanded to give more detailed instruction as to the action required in the case of an "off-scale" pocket dosimeter. The primary change was the instruction that radiographic operations shall cease and that the individual shall not return to work until a determination of his radiation exposure has been made. This was done so that the regulations would specifically state the action that is currently expected in the case of an "off-scale" pocket dosimeter. Paragraph (f) was added to give instructions concerning the loss of a TLD or film badge. This action was also taken to give specific instructions as to the action that is currently expected.

E.204 Supervision of Radiographer Trainee. The reference to radiographer's assistant was changed to radiographer trainee and radiographer was changed to radiographer instructor.

E.301 Security. The reference to radiographer's assistant was changed to radiographer instructor or radiographer trainee.

E.303 Radiation Surveys and Survey Records. Paragraphs (b) and (c) of Section E.303 were changed by adding a requirement for survey of the storage area to be consistent with 10 CFR 34.43.

E.304 Documents and Records Required at Temporary Jobsites. Paragraph (d) of Section E.304 was changed to also require a copy of the area survey record.

E.305 Specific Requirements for Radiographic Personnel Performing Industrial Radiography. Paragraph E.305(a) was added to provide a concise listing of safety equipment necessary before industrial radiography can be performed. Paragraph E.305(b) was added to make certain that everyone involved understands that radiography shall not be performed if any of the necessary safety items are not available. Paragraph E.305(c) requires a two-person crew at each temporary jobsite where sources of radiation are used. It is expected that the two-person crew will provide better surveillance of the operation to protect against unauthorized entry into a radiation area or high radiation area, as required in Section E.301. This requirement is also intended to provide at least one knowledgeable person at a temporary jobsite in case of an accident which might incapacitate an individual. Paragraph E.305(d) was added to insure that everyone involved understands who can operate and who cannot operate industrial radiographic equipment. Paragraph E.305(e) was added to specifically give the regulatory agency authorization to terminate an operation if the necessary safety equipment or personnel are not available. Paragraph E.305(f) was added to give specific

requirements for an individual acting as a radiographer instructor. It requires that the instructor meet the minimum requirements for a radiographer as specified in Paragraph E.201(d) and should have had at least 1 year of experience as a radiographer. In addition, it is believed that the licensing agency should be notified of each individual that will be providing training.

E.306 Special Requirements and Exemptions for Cabinet Radiography. This section was renumbered from Sections E.305 to E.306 and the title was changed from "Special Requirements and Exemptions for Enclosed Radiography" to "Special Requirements and Exemptions for Cabinet Radiography". The word "enclosed" in paragraph (a) was also replaced with the word "cabinet". The move was made to allow insertion of a new Section E.305, "Specific Requirements for Radiographic Personnel Performing Industrial Radiography". The content of this new section, which among other things, specifies the items necessary at a temporary jobsite, and the necessity for a two-person crew at temporary jobsites, seem to logically follow Section E.304 which specifies records required at a temporary jobsite.

E.307 Prohibitions. Section E.307 was added to specifically prohibit "fishpole radiography" as Paragraph E.105(e) from the previous edition of the SSRCR was deleted.

Matters for Future Consideration

1. Equipment standards contained in the American National Standard N432, "Radiological Safety for the Design and Construction of Apparatus for Gamma Radiography" (ANSI N432-1980), should be incorporated into Part E of the SSRCR.
2. In the definition of "Residential location" in Section E.3, what about multi-tenant office buildings? The definition appears to need some refinement, particularly regarding the use of the words "area" (as in "area where structures. . .") and "grounds" (as in "grounds on which such. . .").
3. Paragraph (e) of Section E.105 (Leak Testing, Repair, Tagging, Opening, Modification, and Replacement of Sealed Sources) only applies to radiographic exposure devices. Unlike 10 CFR 34.25(e), the SSRCR Paragraph E.105(e) does not require sealed sources which are not fastened to or contained in a radiographic exposure device to be labeled.
4. Under Section E.201 on Training and Testing, consideration should be given to revising Subparagraph E.201(b)(2) to provide for a minimum of 90 days on-the-job training in order to be in line with NRC policy.
5. Under Section E.203 on Personnel Monitoring Control, consideration should be given to amending Paragraph E.203(b) to include a requirement for the retention of exposure records similar to the requirement in 10 CFR 34.33(b).

**1982
Rationale for Revisions**

**Part E
Radiation Safety Requirements for Industrial Radiographic Operations**

Introduction

The changes made to Part E in this revision of the Suggested State Regulations for Control of Radiation (SSRCR) were based on amendments to 10 CFR Part 34 (final rule: 44 FR 50805, August 30, 1979 - proposed rule: 43 FR 12715, March 27, 1978), and recommendations concerning the inclusion of SI units. An effort has also been made to make the regulations more readable and easier to enforce.

Specific Provisions

E.3 Definitions

A definition for "Permanent radiographic installation" was added for consistency with 10 CFR 34.2(h).

The definition for "Personal supervision" was changed to be more compatible with the new 10 CFR 34.44 requirement pertaining to supervision of radiographer's assistants.

A definition for "Source changer" was added with wording essentially identical to 10 CFR 34.2(g).

A definition for "Temporary job site" was added to this revision of Part E.

E.102(a) Locking of Sources of Radiation. The phrase "and source changer" was added following the phrase "each storage container" so that Paragraph E.102(a) is compatible with 10 CFR 34.22(b).

E.102(b) Locking of Sources of Radiation. The phrase "source changers" was added following the phrase "Radiographic exposure devices" so that Paragraph E.102(b) is compatible with 10 CFR 34.22(b).

E.103 Storage Precautions. The phrase "source changers" was added following the phrase "radiographic exposure devices" so that Section E.103 is compatible with 10 CFR 34.22(b).

E.108 Inspection and Maintenance. Since the paragraphs in Section E.108 deal with inspection and maintenance, the title was shortened to "Inspection and Maintenance" rather than adding "source changers" to the previous title (Inspection and Maintenance of Radiographic Exposure Devices and Storage Containers) and making the title excessively long.

E.108(a) Inspection and Maintenance. A new Paragraph E.108(a) was added to be consistent with 10 CFR

34.28(a) except that management is allowed to delegate daily checks of equipment through the use of more permissive language.

E.108(b) Inspection and Maintenance. This provision was moved from Paragraph E.108(a) and changed by adding the phrases "radiation machines" and "source changers" to provide compatibility with the new Paragraph E.108(a) and 10 CFR 34.28(b). (The previous Paragraph E.108(b) provision was moved to Paragraph E.108(c)).

E.109 Permanent Radiographic Installations. The title was changed from "Inspection and Maintenance of High Radiation Area Control Devices or Alarm Systems" as the provisions that follow include requirements other than inspection and maintenance. In addition, the text of Section E.109 was rewritten to provide better organization and to incorporate the provisions of 10 CFR 34.29. The working group elected to require the testing of control devices and alarm systems "at the beginning of each period of use" rather than "at intervals not to exceed 3 months" as specified in 10 CFR 34.29(c). Testing at the beginning of each period of use appeared to be more appropriate from an operational standpoint since failure could occur anytime and if tested only every 3 months could go unnoticed for some time.

E.201 Training and Testing. The title was changed from "Limitations" to "Training and Testing" as the provisions that follow concern training and testing. In addition, the text was reorganized somewhat to better conform with the provisions of 10 CFR 34.31. Finally, a new Paragraph E.201(d) was added by the working group that requires the licensee or registrant to conduct a program of internal audit to ensure that license conditions and emergency procedures are followed.

E.202(e) Operating and Emergency Procedures. This provision was revised to be consistent with 10 CFR 34.32(e) and (k).

E.203(b)-(e) Personnel Monitoring Control. Paragraph E.203(b) was split into three separate provisions, Paragraphs E.203(b), (d), and (e), and a new Paragraph E.203(c) was added requiring that dosimeters, to be acceptable, read within plus or minus 30 percent of the true radiation exposure. These changes were made so that Section E.203 is compatible with 10 CFR 34.33.

E.204 Supervision of Radiographer's Assistants. This is a new section, added to be compatible with 10 CFR 34.44.

E.303(b) Radiation Surveys and Survey Records. This provision was changed to be consistent with 10 CFR 34.43(b).

E.303(d)-(e) Radiation Surveys and Survey Records. Paragraph E.303(d) was changed to Paragraph E.303(e) and a new Paragraph E.303(d) was added requiring that a physical survey be made after each radiographic exposure using radiation machines.

Appendix A. A new item VI, "Case Histories of Radiography Accidents", was added to be consistent with

Appendix A of 10 CFR 34.

Matters for Future Consideration

1. Other industrial uses of radiation sources, such as fluoroscopes and industrial gauges, should be considered for inclusion in future revisions of the SSRCR.
 2. Consideration should be given to establishing more meaningful and descriptive language in Subparagraph E.104(b)(3) than the phrase "widely separated points".
 3. Acting on a request from the U.S. Nuclear Regulatory Commission (NRC), the Technical Review Committee (TRC) of the SSRCR elected to delete the following Paragraph E.105(f) requirement that was proposed by the Part E Working Group for the 1978 revision of Part E.
 - (f) Each radiographic exposure device shall have permanently attached to it a durable label which has, as a minimum, the instruction: "Danger - Radioactive Material - Do Not Handle - Notify Civil Authorities if Found."
- The TRC believed, however, that this requirement was necessary and that the Conference of Radiation Control Program Directors, Inc. (CRCPD) should forward this proposal to the NRC for reconsideration.
4. The National Bureau of Standards expressed concern that the 1978 Edition of the SSRCR treated the matter of instrument and source calibration for absorbed doses and exposure in inconsistent terminology and recommended that the CRCPD develop a single viewpoint concerning this issue. The related matter of "traceability to national standards" has been referred to the Part A working group for coordination.
 5. In Section E.103 the phrase "physically secured to prevent tampering or removal by unauthorized personnel" has been determined to be vague by a state. New language is needed.
 6. Paragraph E.105(e) should be deleted as it refers to "fishpole radiography" only, and this type of radiography is not being done any more.

**1978
Rationale for Revisions**

**Part E
Radiation Safety Requirements for Industrial Radiographic Operations**

This rationale report documents the reasons for those significant changes made to the 1970 Edition of Part E which was included virtually unchanged in the 1974 Edition of the Suggested State Regulations for Control of Radiation (SSRCR).

General. Appropriate sentences were added throughout Part E concerning the preservation of records to be consistent with the U.S. Nuclear Regulatory Commission's (NRC) final regulations as published in the Federal Register on May 3, 1976 (41 FR 18300).

E.2 Scope. The phrase concerning the use of sources of radiation in the healing arts was deleted from this section as Part E applies only to industrial radiographic operations. The addition of the last sentence regarding applicability of provisions in this Part to both radiation machines and sealed radioactive sources is self-explanatory.

E.3 Definitions

- (a) The general definition for "Enclosed radiography" was added so that definitions for "Cabinet radiography", "Cabinet x-ray system", "Certified cabinet x-ray system", and "Shielded room radiography" could be grouped together for convenience and added clarity. The definitions for "Cabinet radiography" and "Shielded room radiography" were modified such that the definitions would be applicable to both sealed radioactive sources and radiation machines. The definitions for "Cabinet x-ray system" and "Certified cabinet x-ray system" were added to incorporate the provisions of the Cabinet X-Ray Systems standard (21 CFR 1020.40).
- (c) The definition for "Personal supervision" was added to eliminate the ambiguity which exists on the supervision required for assistant radiographers.
- (d) The definition for "Radiographer" was modified to accommodate inclusion of the definition for "Personal supervision" and to eliminate duplication of phraseology.
- (g) The definition for "Shielded position" was added as a result of a comment that the phrase "shielded position" was used throughout Part E without being defined.

E.102 Locking of Sources of Radiation.

- (b) This paragraph was added to specify a requirement for locking exposure devices between radiographic

operations which require movement of the source container. Investigations of incidents reveal that failure to lock exposure devices prior to being moved from one location to another is a common source of overexposure that may be eliminated simply without undue restrictions.

E.104 Radiation Survey Instruments. This section was changed as a result of the recommendations made by two Federal agencies to incorporate two additional requirements related to calibration of radiation survey instruments used in industrial radiographic operations, namely, Subparagraphs E.104(b)(2) and (3). The requirement that calibration records be maintained for inspection by the Agency was added to aid in determining that properly calibrated instruments were available.

E.108 Inspection and Maintenance of Radiographic Exposure Devices and Storage Containers. The word "quarterly" was added to this section so that radiographic exposure devices would be inspected at regular intervals to insure their proper and safe function and their removal from service should the inspection indicate an unsafe condition. A sentence was added in Paragraph E.108(a) to require that records be maintained of these inspections and maintenance actions to aid the Agency in conducting its compliance program. Paragraph E.108(b) was added to prevent the continued use of damaged radiographic exposure devices until appropriate repairs or replacements have been made.

E.109 Inspection and Maintenance of High Radiation Area Control Devices or Alarm Systems. This section was added as a minimum requirement for the testing of control devices or alarm systems is essential to insure that they continue to function properly.

E.203 Personnel Monitoring Control. This section was changed to conform with the NRC amendment to 10 CFR 34.33 as published in the Federal Register on May 6, 1976 (41 FR 18645). This final rule allows the use of either thermoluminescent dosimeters or film badges by radiographers and their assistants. The amendment requires that a direct-reading pocket dosimeter be used, instead of allowing the use of a pocket chamber that is indirect reading, in addition to the film badge or thermoluminescent dosimeter. The Part E Working Group believes that the NRC amendment is appropriate and timely and that such provisions should be included in the Part E revision at this time.

E.303 Radiation Surveys and Survey Records. The word "condition" in lines 283 and 285 of the 1974 edition of the SSRCR was changed to "position" in the revised Paragraphs E.303(b) and (c) as a result of the establishment of the definition for "Shielded position".

E.304 Records Required at Temporary Job Sites. This section was added to delineate, to the licensee or registrant, the specific records which must be available at the industrial radiographic job site to provide the means for the Agency to effectively inspect and evaluate the radiographic operation.

E.305 Special Requirements and Exemptions for Enclosed Radiography. The Section E.304 designation was changed to Section E.305 due to the addition of a new Section E.304 as discussed above. The text and title were changed to include the Cabinet X-Ray Systems standard (21 CFR 1020.40). The requirement that certified cabinet x-ray systems shall be maintained in conformance with the provisions of 21 CFR 1020.40 is

necessary to provide the means for insuring that the owner of such a system maintains it in a safe condition. The registrant is required to conduct an evaluation of the system at least annually to determine conformance with 21 CFR 1020.40. This, however, would not preclude a state agency from providing an exemption to an owner registrant (but not to a person engaged in the business of manufacturing, assembling or modifying cabinet x-ray systems) under Paragraph A.3(a) of the SSRCR, from the requirement that the cabinet x-ray system be maintained in conformance with 21 CFR 1020.40. As those cabinet x-ray systems which can be entered by personnel pose radiation safety problems similar to those encountered in shielded room radiography, the Part E Working Group believes that all such systems, whether certified or not, should comply with the applicable provisions of Part E.

Appendix A

Part I.C. was changed to more clearly indicate that discussions of radiation protection standards and the biological effects (both acute and chronic) of radiation dose are to be included in the training courses for radiographers.

Part II.C. was changed by deleting "pocket chambers" and adding "thermoluminescent dosimeters" for reasons stated in the rationale for changes to Section E.203.

Matters for Future Consideration

1. Consideration should be given to establishing specific regulations for governing the use of radiation sources in oil and gas well logging. Also, the question of whether such regulations should be included in Part E, which would need to be retitled, or whether a separate part of the SSRCR should be established for well logging operations.
2. Other industrial uses of radiation sources such as fluoroscopes and industrial gauges should be considered for inclusion in future revisions of the SSRCR.
3. Consideration should be given to establishing more meaningful and descriptive language in Subparagraph E.104(b)(3) than the phrase "widely separated points".
4. Acting on a request from the NRC, the Technical Review Committee of the SSRCR elected to delete the following Paragraph E.105(f) requirement that was proposed by the Part E Working Group:
 - (f) Each radiographic exposure device shall have permanently attached to it a durable label which has, as a minimum, the instruction: "Danger - Radioactive Material - Do Not Handle - Notify Civil Authorities if Found."

The Technical Review Committee believes, however, that this requirement is necessary and that the Conference of Radiation Control Program Directors, Inc., should forward this proposal to the NRC for reconsideration.