SECTION E

RADIATION SAFETY REQUIREMENTS FOR

INDUSTRIAL RADIOGRAPHIC OPERATIONS

801.E.1 Purpose. ~~The regulations in~~ This section prescribes ~~establish~~ requirements for the issuance of licenses or registrations for the industrial ~~radiography~~ use of sources of radiation and radiation safety requirements for persons using these sources of radiation in industrial radiography.

801.E.2 Scope. The provisions and requirements of this section are in addition to, and not in substitution for, other applicable requirements of these regulations. ~~The regulations in this section apply to all licensees or registrants who use sources of radiation for industrial radiography.~~ Except for those regulations of this section clearly applicable only to sealed radioactive sources, both radiation machines and sealed radioactive sources are covered by this section.

801.E.3 Definitions. As used in this section, 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.

"ANS" 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. */

"Cabinet radiography" means industrial radiography conducted in an enclosure or cabinet so shielded that radiation levels at every location on the exterior meet the ~~limitations~~ dose limits for individual members of the public as specified in 801.D.301 of these regulations.

"Cabinet x-ray system" means an x-ray system with the x-ray tube installed in an enclosure independent of existing architectural structures except the floor on which it may be placed. The cabinet x-ray system is intended to contain at least that portion of a material being irradiated, provide radiation attenuation, and exclude personnel from its interior during generation of radiation. Included are all x-ray systems designed primarily for the inspection of carry-on baggage at airline,

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*/ *e.g., guide tube, control tube, control (drive) cable, removable source stop, "J" tube and collimator when used as an exposure head.*

railroad, and bus terminals, and in similar facilities. An x-ray tube used within a shielded part of a building, or x-ray equipment which may temporarily or occasionally incorporate portable shielding, is not considered a cabinet x-ray system.

"Camera" see "Radiographic exposure device".

"Certifiable cabinet x-ray system" means an existing uncertified x-ray system that has been modified to meet the certification requirements specified in 21 CFR 1020.40.

"Certified cabinet x-ray system" means an x-ray system which has been certified in accordance with 21 CFR 1010.2 as being manufactured and assembled pursuant to the provisions of 21 CFR 1020.40.

"Certifying entity" means an independent certifying organization meeting the requirements in Appendix A of this section or a state regulatory program meeting the requirements in Appendix A, Sections II and III of this section.

"Collimator" means a ~~device used to limit the size, shape, and direction of the primary radiation beam~~ 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 which equipment is dispatched.

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

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

"Hands-on experience" means experience in all of those areas considered to be directly involved in the radiography process.

"Independent certifying organization" means an independent organization that meets all of the criteria of Appendix A of this section.

"Industrial radiography" means an examination of the ~~macroscopic~~ structure of materials by nondestructive methods ~~using~~ utilizing ~~sources of~~ ionizing radiation to ~~produce~~ make radiographic images.

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

~~"Lixiscope" means a portable light-intensified imaging device using a sealed source.~~

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

"Permanent radiographic installation" means an ~~installation or structure designed or intended for radiography and~~ enclosed shielded room, cell, or vault, not located at a temporary jobsite, in which radiography is performed.

"Pigtail" see "Source assembly".

"Pill" see "Sealed source".

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

"Projection sheath" see "Guide tube".

"Projector" see "Radiographic exposure device".

~~"Personal supervision" means supervision in which the radiographer is physically present at the site where sources of radiation and associated equipment are being used, watching the performance of the radiographer's assistant and in such proximity that immediate assistance can be given if required.~~

"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 801.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 these regulations and the conditions of the license or registration.

"Radiographer certification" means written approval received from a certifying entity stating that an individual has satisfactorily met the radiation safety, testing, and experience criteria in 801.E.17.

"Radiographer's assistant" means any individual who, under the ~~personal~~ 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 personnel" means any radiographer, or radiographer's assistant.~~

"Radiographic operations" means all activities performed with 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."

~~"Residential location" means any area where structures in which people lodge or live are located, and the grounds on which such structures are located including, but not limited to, houses, apartments, condominiums, and garages.~~

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

"Sealed source" means any radioactive material that is encased in a capsule designed to prevent leakage or escape of the radioactive material.

"Shielded position" means the location within the radiographic exposure device, source changer, or storage container ~~which, by manufacturer's design, is the proper location for storage of~~ where the sealed source is secured and restricted from movement.

~~"Shielded-room radiography" means industrial radiography conducted in a room shielded so that radiation levels at every location on the exterior meet the limitations specified in 801.D.301 of these regulations~~.

"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, including those source changers also used for transporting and storage of sealed sources.

"Storage area" means any location, facility, or vehicle which is used to store, ~~to transport~~, or to secure a radiographic exposure device, a radiation machine, a storage container, or a sealed source when it is not in use and which is locked or has a physical barrier to prevent accidental exposure, tampering with, or unauthorized removal of the device, container, or source.

"Storage container" means a ~~shielded device~~ container in which sealed sources are secured and stored.

"Temporary jobsite" means a location where ~~industrial radiography is~~ radiographic operations are performed and where sources of radiation may be stored other than the location(s) of use authorized on the ~~listed in a specific~~ license or ~~certificate of~~ registration.

~~"Transport container" means a package that is designed to provide radiation safety and security when sealed sources are transported and which meets all applicable requirements of the U.S. Department of Transportation.~~

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

801.E.4 Exemptions.

~~(a) Except for the requirements of 801.E.306(b) and (c), certified cabinet x-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this section.~~

~~(b) Industrial uses of lixiscopes are exempt from the requirements in this section.~~

(a) Uses of certified and certifiable cabinet x-ray systems are exempt from the requirements of this section except for the following:

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

(i) No registrant shall permit any individual to operate a cabinet x-ray system until the individual has received a copy of and instruction in the operating

procedures for the unit. Records that demonstrate compliance with this subparagraph shall be maintained for Agency inspection until disposal is authorized by the Agency.

(ii) Tests for proper operation of interlocks must be conducted and recorded at intervals not to exceed six months. Records of these tests shall be maintained for Agency inspection until disposal is authorized by the Agency.

(iii) The registrant shall perform an evaluation of the radiation dose limits to determine compliance with 801.D.301(a), (b), and (c) of these regulations, and 21 CFR 1020.40, Cabinet X-Ray Systems (39 Federal Register 12986, April 10, 1974), at intervals not to exceed one year. Records of these evaluations shall be maintained for Agency inspection for two years after the evaluation.

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

(b) Industrial uses of hand-held light intensified imaging devices are exempt from the requirements of this section if the dose rate 18 inches from the source of radiation to any individual does not exceed 2 millirem per hour. Devices which exceed this limit shall meet the applicable requirements of this section and the licensing or registration requirements of Section B or Section C of these regulations, as applicable.

801.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 Section B for radiation machine facilities or Section C for radioactive material, as applicable, and any special requirements contained in this section;

(b) The applicant submits an adequate program for training radiographers and radiographer's assistants that meets the requirements of 801.E.17:

(1) After 2 years after the effective date of these regulations, the applicant need not describe the initial training and examination program for radiographers in the subjects outlined in 801.E.17(g).

(2) From [insert effective date of final rule] to 2 years after the effective date of the

regulations is published, the applicant may affirm that all individuals acting as industrial radiographers will be certified in radiation safety by a certifying entity before commencing duty as radiographers. This affirmation substitutes for a description of its initial training and examination program for radiographers in the subjects outlined in 801.E.17(g).

(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 801.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 801.E.17(e);

(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 801.E.16(a);

(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. The description must include the:

(1) Methods of collecting the samples;

(2) Qualifications of the individual who analyzes the samples;

(3) Instruments to be used; and

(4) 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 801.E.9 and 801.E.20(g)(4);

(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 sections of these regulations will be maintained;

(l) If a license application includes underwater radiography, a description of:

(1) Radiation safety procedures and radiographer responsibilities unique to the performance of underwater radiography;

(2) Radiographic equipment and radiation safety equipment unique to underwater radiography; and

(3) Methods for gas-tight encapsulation of equipment; and

(m) If an application includes offshore platform and/or lay-barge radiography, a description of:

(1) Transport procedures for radioactive material to be used in industrial radiographic operations;

(2) Storage facilities for radioactive material; and

(3) Methods for restricting access to radiation areas.

(n) A license or registration will be issued if 801.E.5(a) through 801.E.5(m), as applicable, are met.

~~**Equipment Control**~~

801.E.6 Performance Requirements for Industrial Radiography ~~Radiographic~~ 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);

(b) In addition to the requirements specified in 801.E.6(a), the following requirements apply to radiographic exposure devices, source changers, source assemblies or sealed sources. ~~and associated equipment.~~

(1) The licensee shall ensure that each radiographic exposure device has ~~must have~~

attached to it ~~by the user~~ a durable, legible, clearly visible label bearing the:

(i) Chemical symbol and mass number of the radionuclide in the device;

(ii) Activity and the date on which this activity was last measured;

(iii) Model number or product code and serial number of the sealed source;

(iv) Name of the manufacturer of the sealed source; and

(v) Licensee's name, address, and telephone number.

(2) Radiographic exposure devices intended for use as Type B packages ~~transport containers~~ must meet the applicable transportation requirements of Section T of these regulations. ~~10 CFR Part 71.~~

(3) Modification of any 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~~ approved by the Agency or other approval body.

(c) In addition to the requirements specified in 801.E.6(a) and (b), 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 ~~routine operation~~ radiographic operations or to source changers;

(1) The coupling between the source assembly and the control cable must be designed in such a manner that the source assembly will not become disconnected if cranked outside the guide tube. The coupling must be such that it cannot be unintentionally disconnected under normal and reasonably foreseeable abnormal conditions.

(2) The device must automatically secure the source assembly when it is cranked back into the fully shielded position within the device. This securing system may only be released by means of a deliberate operation on the exposure device.

(3) The outlet fittings, lock box, and drive cable fittings on each radiographic exposure device must be equipped with safety plugs or covers which must be installed during storage and transportation to protect the source assembly from water, mud, sand or other foreign matter.

(4) Each sealed source or source assembly must have attached to it or engraved on it, a durable, legible, visible label with the words: "DANGER - RADIOACTIVE." The label must not interfere with the safe operation of the exposure device or associated

equipment.

(5) The guide tube must be able to withstand a ~~have passed the~~ crushing test ~~for the control tube as specified in ANSI N432 and a kinking resistance test~~ that closely approximates the ~~kinking~~ 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.

(6) Guide tubes must be used when moving the source out of the device.

(7) An exposure head or similar device designed to prevent the source assembly from passing out of the end of the guide tube must be attached to the outermost end of the guide tube during radiographic operations.

(8) The guide tube exposure head connection must be able to withstand the tensile test for control units specified in ANSI N432-1980.

(9) Source changers must provide a system for ensuring that the source will not be accidentally withdrawn from the changer when connecting or disconnecting the drive cable to or from a source assembly.

~~(d) All newly manufactured radiographic exposure devices and associated equipment acquired by licensees after the effective date of these regulations must comply with the requirements of this section.~~

(d) All radiographic exposure devices and associated equipment in use after January 10, 1996, must comply with the requirements of this section; and

(e) As an exception to 801.E.6(a), 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.

801.E.7 Limits on External ~~Levels of~~ Radiation Levels from ~~Radiographic Exposure Devices and~~ Storage Containers and Source Changers. ~~Radiographic exposure devices measuring less than 4 inches (10 cm) from the sealed source storage position to any exterior surface of the device shall have no radiation level in excess of 50 milliroentgens (1.29×10^{-5} C/kg) per hour at 6 inches (15 cm) from any exterior surface of the device. Radiographic exposure devices measuring a minimum of 4 inches (10 cm) from the sealed source storage position to any exterior surface of the device, and all storage containers for sealed sources or outer containers for radiographic exposure devices, shall have no radiation level in excess of 200 milliroentgens (5.16×10^{-5} C/kg) per hour at any exterior~~

~~surface, and 10 milliroentgens (2.58 x 10^{-6} C/kg) per hour at 39.4 inches (1 m) from any exterior surface. The radiation levels specified are with the sealed source in the shielded position.~~ 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.

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

~~(a) Each source of radiation shall be provided with a lock or lockable outer container designed to prevent unauthorized or accidental production of radiation or removal or exposure of a sealed source and shall be kept locked at all times except when under the direct surveillance of a radiographer or radiographer's assistant, or as may be otherwise authorized pursuant to 801.E.301. Each storage container and source changer likewise shall be provided with a lock and shall be kept locked when containing sealed sources except when the container is under the direct surveillance of a radiographer or radiographer's assistant.~~

~~(b) Radiographic exposure devices, source changers, and storage containers, prior to being moved from one location to another and also prior to being secured at a given location, shall be locked and surveyed to assure that the sealed source is in the shielded position.~~

~~(c) The sealed source shall be secured in its shielded position by locking the exposure device or securing the remote control each time the sealed source is returned to its shielded position. Then a survey shall be performed to determine that the sealed source is in the shielded position pursuant to 801.E.303(b).~~

(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 801.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) 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

[***/] *If a keyed lock, the key must be removed at all times.*

surveillance of a radiographer or a radiographer's assistant.

~~801.E.103 Storage Precautions.~~

~~(a) Locked radiographic exposure devices, source changers, storage containers, and radiation machines shall be physically secured to prevent tampering or removal by unauthorized personnel.~~

~~(b) Radiographic exposure devices, source changers, or transport containers that contain radioactive material shall not be stored in residential locations. This requirement does not apply to storage of radioactive material in a vehicle in transit for use at temporary job sites, if the licensee complies with 801.E.103(c), and if the vehicle does not constitute a permanent storage location as described in 801.E.103(d).~~

~~(c) If a vehicle is to be used for storage of radioactive material, a vehicle survey shall be performed after securing radioactive material in the vehicle and before transport to ensure that radiation levels do not exceed the limits specified in 801.D.301 of these regulations at the exterior surface of the vehicle.~~

~~(d) A storage or use location is permanent if radioactive material is stored at the location for more than 90 days and any one or more of the following applies to the location:~~

~~(1) Telephone service is established by the licensee;~~

~~(2) Industrial radiographic services are advertised for or from the location; or~~

~~(3) Industrial radiographic operations are conducted at other sites due to arrangements made from the location.~~

801.E.9 Radiation Survey Instruments.

(a) The licensee or registrant shall maintain sufficient calibrated and operable radiation survey instruments **at each location where sources of radiation are present** to make ~~physical~~ radiation surveys required by this section and 801.D.501 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. ~~shall have a range such that 2 milliroentgens (5.16×10^{-7} C/kg) per hour through 1 roentgen (2.58×10^{-4} C/kg) per hour can be measured.~~

(b) The licensee or registrant shall have each radiation survey instrument required under 801.E.9(a) calibrated:
~~Each radiation survey instrument shall be calibrated:~~

(1) at energies appropriate for use and at intervals not to exceed ~~3~~ 6 months and after each instrument servicing, **except for battery changes;**

(2) for linear scale instruments at 2 points located approximately 1/3 and 2/3 of full-scale on each scale; for logarithmic scale instruments at mid-range of each decade, and at 2 points of at least 1 decade; and for digital instruments at 3 points ~~appropriate~~ between 0.02 and 10 millisieverts (2 and 1000 mrem) per hour; and

(3) 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 801. E.26. ~~Records of these calibrations shall be maintained for 2 years after the calibration date for inspection by the Agency.~~

(d) Each radiation survey instrument shall be checked with a radiation source at the beginning of each day of use and at the beginning of each work shift to ensure it is operating properly.

801.E.10 Leak Testing ~~Repair, Tagging, Opening, Modification,~~ and Replacement of Sealed Sources.

(a) The replacement of any sealed source fastened to or contained in a radiographic exposure device and leak testing, ~~repair, tagging, opening, or any other modification~~ of any sealed source shall be performed only by persons specifically authorized to do so by the Agency, the U.S. 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 U.S. Nuclear Regulatory Commission, or another Agreement State. ~~Each sealed source shall be tested for leakage at intervals not to exceed 6 months. In the absence of a certificate from a transferor indicating that a test has been made within the 6-month period prior to the transfer, the sealed source shall not be put into use until tested.~~

(c) Testing and recordkeeping requirements.

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

(2) The licensee shall maintain records of the leak tests in accordance with 801.E.27.

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

~~The leak test shall be capable of detecting the presence of 0.005 microcurie (185 Bq) of removable contamination on the sealed source. An acceptable leak test for sealed sources in the possession of a radiography licensee would be to test at the nearest accessible point to the sealed source storage position, or other appropriate measuring point, by a procedure to be approved pursuant to 801.C.26(e)(5) of these regulations. Records of leak test results shall be kept in units of microcuries (Becquerels) and maintained for inspection by the Agency for 2 years after the next required leak test is performed or until the sealed source is transferred or disposed.~~

(d) Any test conducted pursuant to 801.E.10(b) and (c) which reveals the presence of 185 becquerel (0.005 µCi) or more of removable radioactive material shall be considered evidence that the sealed source is leaking. The licensee shall immediately withdraw the equipment involved from use and shall have ~~cause~~ it ~~to be~~ decontaminated and repaired or ~~to be~~ disposed of in accordance with regulations of the Agency. A report must be filed with the Agency within 5 days ~~after obtaining results~~ of any test with results that exceed the threshold in this paragraph, ~~the licensee shall file a report with the Agency~~ 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 becquerel (0.005 µCi) of radioactive material on the test sample and must be performed by a person specifically authorized by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State to perform the analysis. Should such testing reveal the presence of DU contamination, the exposure device must be removed from use until an evaluation of the wear of the S-tube has been made. 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 801.E.27. ~~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."~~

801.E.11 Quarterly Inventory. ~~Each licensee or registrant shall conduct a quarterly physical inventory to account for all sources of radiation and radiographic exposure devices possessed by him. The records of the inventories shall be maintained for 2 years from the date of the inventory for~~

~~inspection by the Agency and shall include the quantities and kinds of sources of radiation, the location of sources of radiation, the date of the inventory, the name of the individual conducting the inventory, the manufacturer, the model number, and the serial number.~~

(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 801.E.28.

801.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:

(1) The equipment is in good working condition;

(2) The sources are adequately shielded; and

(3) Required labeling is present.

(b) Survey instrument operability must be performed using checks 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 and perform inspection and routine maintenance of radiation machines, 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.

(e) The licensee's 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 801.E.12 must be made in accordance with 801.E.30.

~~(a) Each licensee or registrant shall ensure that checks for obvious defects in radiation machines, radiographic exposure devices, storage containers, and source changers are performed prior to each day or shift of use. Records of these checks shall be kept for 2 years for inspection by the Agency.~~

~~(b) Each licensee or registrant shall conduct a program of at least quarterly inspection and maintenance of radiation machines, radiographic exposure devices, storage containers, and source changers to assure proper functioning of components important to safety. All appropriate parts shall be maintained in accordance with manufacturer's specifications. Records of inspection and maintenance shall be maintained for inspection by the Agency for 2 years from the date of the recorded event.~~

~~(c) If any inspection conducted pursuant to 801.E.108(a) or (b) reveals damage to components critical to radiation safety, the device shall be removed from service and labelled as defective until repairs have been made.~~

801.E.13 Permanent Radiographic Installations. ~~Permanent radiographic installations having high radiation area entrance controls of the type described in 801.D.601(a)(2), (a)(3) or (b) of these regulations shall also meet the following requirements:~~

~~(a) Each entrance that is used for personnel access to the high radiation area shall have both visible and audible warning signals to warn of the presence of radiation. The visible signal shall be activated by radiation. The audible signal shall be activated when an attempt is made to enter the installation while the source is exposed.~~

~~(b) The control device or alarm system shall be tested for proper operation at the beginning of each day of equipment use. If a control device or alarm system is operating improperly, it shall be immediately labelled as defective and repaired before industrial radiographic operations are resumed. Records of these tests shall be maintained for inspection by the Agency for 2 years from the date of the event.~~

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

(1) An entrance control of the type described in 801.D.601 of these regulations that causes the radiation level upon entry into the area to be reduced; or

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

(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 801.E.13(a)(1) 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 801.E.22 and uses an alarming ratemeter. Test records for entrance controls and audible and visual alarms must be maintained in accordance with 801.E.31.

801.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 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 Section T.

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

(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

801.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 801.E.17(c). 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 must be conducted in a permanent radiographic installation unless otherwise specifically authorized by the Agency.

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

(d) A licensee or registrant may conduct lay-barge, offshore platform, or underwater radiography only if procedures have been approved by the Agency, the U.S. Nuclear Regulatory Commission, or by another Agreement State.

801.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:

(1) Completion of the training and testing requirements of 801.E.17(a);

(2) 2000 hours of hands-on experience as a qualified radiographer in industrial radiographic operations; and

(3) 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:

(1) Establishing and overseeing all operating, emergency, and ALARA procedures as required by Section D of these regulations and reviewing them regularly to ensure that they conform to Agency regulations and to the license or registration conditions;

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

(3) Ensuring that required radiation surveys and leak tests are performed and

documented in accordance with the regulations, including any corrective measures when levels of radiation exceed established limits

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

(5) Ensuring that operations are conducted safely and for implementing corrective actions including terminating operations.

(d) Licensees and registrants will have 2 years from the effective date of these regulations to meet the requirements of 801.E.16(a) and 801.E.16(b).

~~Personal Radiation Safety Requirements for Radiographic Personnel~~

~~801.E.201 Training and Testing.~~

~~(a) No licensee or registrant shall permit any individual to act as a radiographer, as defined in this section, until such individual:~~

~~(1) has been instructed in the subjects outlined in Appendix A of this section;~~

~~(2) has received copies of and instruction in the regulations contained in this section and the applicable sections of Sections D, J, and T of these regulations, appropriate license or certificate of registration and the licensee's or registrant's operating and emergency procedures;~~

~~(3) has demonstrated competence to use the licensee's or registrant's sources of radiation, radiographic exposure devices, related handling tools, and radiation survey instruments;~~

~~(4) has demonstrated an understanding of the instructions in 801.E.201(a) by successful completion of a written test and a field examination on the subjects covered; and~~

~~(5) has provided the Agency with documentation on Agency Form RH-20 or equivalent showing the completion of the requirements of 801.E.201(a).~~

~~(b) No licensee or registrant shall permit any individual to act as a radiographer's assistant, as defined in this section, until such individual:~~

~~(1) has received copies of and instruction in the licensee's or registrant's operating and emergency procedures;~~

~~(2) has demonstrated competence to use, under the personal supervision of the radiographer, the licensee's or registrant's sources of radiation, radiographic exposure devices, related handling tools, and radiation survey instruments which will be used in industrial radiographic assignments; and~~

~~(3) has demonstrated an understanding of the instructions in 801.E.201(b) by successfully completing a written or oral test and a field examination on the subjects covered.~~

~~(c) Records of the above training, including copies of written tests and dates of oral tests and field examinations, shall be maintained by the licensee or registrant for inspection by the Agency for 3 years following termination of employment.~~

~~(d) Each licensee or registrant shall conduct an internal audit program to ensure that the Agency's radioactive material license conditions and the licensee's or registrant's operating and emergency procedures are followed by each radiographer and radiographer's assistant. These internal audits shall be performed at least quarterly, and each radiographer and radiographer's assistant shall be audited at least quarterly. Records of internal audits shall be maintained for inspection by the Agency for 2 years from the date of the audit.~~

801.E.17 Training.

(a) The licensee or registrant may not permit any individual to act as a radiographer until the individual:

(1) Has received at least 40 hours of training in the subjects outlined in 801.E.17(g), 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 section. 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); or

(2) The licensee or registrant may, until [2 years after the effective date of these regulations], allow an individual who has not met the requirements of 801.E.17(a)(1), to act as a radiographer after the individual has received at least 40 hours of training in the subjects outlined in 801.E.17(g) and demonstrated an understanding of these subjects by successful completion of a written examination that was previously submitted to and approved by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State, in addition to on-the-job training consisting of hands-on

experience under the supervision of a radiographer. 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:

(1) Has received copies of and instruction in the requirements described in the regulations contained in this section, and applicable sections of Sections 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;

(2) Has demonstrated an understanding of items in 801.E.17(b)(1) by successful completion of a written or oral examination;

(3) 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

(4) Has demonstrated understanding of the use of the equipment described in 801.E.17(b)(3) by successful completion of a practical examination.

(c) The licensee or registrant may not permit any individual to act as a radiographer's assistant until the individual:

(1) Has received copies of and instruction in the requirements described in the regulations contained in this section, and applicable sections of Sections D, J, and T of these regulation, 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;

(2) Has demonstrated an understanding of items in 801.E.17(c)(1) by successful completion of a written or oral examination;

(3) Under the personal supervision of a radiographer, has received training in the use of the registrant's radiation machines, or the licensee's radiographic exposure devices and sealed sources, in the daily inspection of devices and associated equipment, and in the use of radiation survey instruments; and

(4) Has demonstrated understanding of the use of the equipment described in 801.E.17(c)(3) 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 801.E.17(e)(4), 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. 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 801.E.17(b)(3) and the radiographer's assistant must demonstrate knowledge of the training requirements of 801.E.17(c)(3) by a practical examination before these individuals can next participate in a radiographic operation.

(3) The Agency may consider alternatives in those situations where the individual serves as both radiographer and radiation safety officer.

(4) 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, oral and practical examinations, refresher safety training and inspections of job performance in accordance with 801.E.32.

(g) The licensee or registrant shall include the following subjects required in 801.E.17(a):

(1) Fundamentals of radiation safety including:

(i) Characteristics of gamma and x-radiation;

(ii) Units of radiation dose and quantity of radioactivity;

(iii) Hazards of exposure to radiation;

(iv) Levels of radiation from sources of radiation; and

(v) Methods of controlling radiation dose (time, distance, and shielding);

(2) Radiation detection instruments including:

(i) Use, operation, calibration, and limitations of radiation survey instruments;

(ii) Survey techniques; and

(iii) Use of personnel monitoring equipment;

(3) Equipment to be used including:

(i) Operation and control of radiographic exposure equipment, remote handling equipment, and storage containers, including pictures or models of source assemblies (pigtails);

(ii) Operation and control of radiation machines;

(iii) Storage, control, and disposal of sources of radiation; and

(iv) Inspection and maintenance of equipment.

(4) The requirements of pertinent state and federal regulations; and

(5) Case histories of accidents in radiography.

(h) Licensees and registrants will have one year from the effective date of these regulations to comply with the additional training requirements specified in 801.E.17(b)(1) and 801.E.17(c)(1).

801.E.18 Operating and Emergency Procedures. ~~The licensee's or registrant's~~ (a) Operating and emergency procedures ~~shall~~ must include, as a minimum, instructions in at least the following:

(1) Appropriate handling and use of sources of radiation ~~to be employed such~~ so that no person ~~individual~~ is likely to be exposed to radiation doses in excess of the limits established in Section D of these regulations;

(2) methods and occasions for conducting radiation surveys;

(3) methods for posting and controlling access to radiographic areas;

(4) methods and occasions for locking and securing sources of radiation;

(5) personnel monitoring and the use of personnel monitoring equipment, ~~including steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale;~~

(6) transporting equipment to field locations, including packing of radiographic exposure devices and storage containers ~~sources of radiation~~ in the vehicles, placarding ~~posting~~ of vehicles when required, and control of equipment ~~sources of radiation~~ during transportation as described in Section T of these regulations;

~~(7) minimizing exposure of individuals in the event of an accident;~~

~~(8) the procedure for notifying proper personnel in the event of an accident;~~

(7) the inspection, maintenance, and operability checks of radiographic exposure devices, ~~source changers,~~ radiation machines, survey instruments, alarming ratemeters, transport containers, and storage containers;

(8) Steps that must be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off-scale or an alarming ratemeter alarms unexpectedly;

(9) The procedure(s) for identifying and reporting defects and noncompliance, as required by 801.E.38;

(10) The procedure for notifying proper persons in the event of an accident or incident;

(11) Minimizing exposure of persons in the event of an accident or incident, including a source disconnect, a transport accident, or loss of a source of radiation;

(12) Source recovery procedure if licensee will perform source recoveries; and

(13) Maintenance of records.

(b) The licensee or registrant shall maintain copies of current operating and emergency procedures in accordance with 801.E.33 and 801.E.37.

801.E.19 Supervision of Radiographer's Assistants. The radiographer's assistant shall be under the personal supervision of a radiographer when using radiation machines, radiographic exposure devices, associated equipment, or a sealed source, or while conducting radiation surveys required by 801.E.21(b) 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.

801.E.20 Personnel Monitoring ~~Control~~.

(a) The licensee or registrant shall not permit any individual to act as a radiographer or a radiographer's assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a direct reading pocket dosimeter, an alarming ratemeter, and a personnel dosimeter that is processed and evaluated by an accredited National Voluntary Laboratory Accreditation Program (NVLAP) processor. ~~either a film badge or a thermoluminescent dosimeter (TLD). except that for~~ At permanent radiographic installations where other appropriate alarming or warning devices are in routine use, the use ~~wearing~~ of an alarming ratemeter is not required .

(1) Pocket dosimeters must have a range from zero to 2 millisieverts (200 mrem) and must be recharged ~~daily or~~ at the start of each shift. Electronic personal dosimeters may only be used in place of ion-chamber pocket dosimeters.

(2) Each personnel dosimeter ~~each film badge and TLD~~ must be assigned to and worn by only one individual.

(3) Personnel dosimeters must be exchanged at periods not to exceed one month.

(4) After replacement, each personnel dosimeter must be returned to the supplier for processing within 14 calendar days of the end of the monitoring period, or as soon as practicable. In circumstances that make it impossible to return each personnel dosimeter in 14 calendar days, such circumstances must be documented and available for review by the Agency.

(b) Direct reading dosimeters such as pocket dosimeters or electronic personal dosimeters, must be read and the exposures recorded at ~~least once daily.~~ the beginning and end of each shift, and records must be maintained in accordance with 801.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 801.E.34. Acceptable dosimeters shall read within plus or minus ~~30~~ 20 percent of the true radiation exposure. ~~Records of this check shall be maintained for inspection by the Agency for 2 years from~~

~~the date of the event.~~

(d) If an individual's pocket dosimeter is found to be offscale ~~discharged~~ beyond its range, or the electronic personal dosimeter reads greater than 2 millisieverts (200 mrem), ~~industrial radiographic operations by that individual shall cease and~~ the individual's personnel dosimeter ~~film badge or TLD~~ must be sent for processing 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 801.E.34 ~~shall be processed immediately. The individual shall not return to work with sources of radiation until a determination of the radiation exposure has been made.~~

~~(e) Reports received from the film badge or TLD processor and records of daily pocket dosimeter readings shall be kept for inspection by the Agency until the Agency authorizes disposition.~~

(e) If an personnel dosimeter ~~film badge or TLD~~ is lost or damaged, the worker shall cease work immediately until a replacement personnel dosimeter ~~film badge or TLD~~ is provided and the exposure is calculated for the time period from issuance to loss or damage of the personnel dosimeter ~~film badge or TLD~~. 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 801.E.34.

(f) Dosimetry Reports received from the accredited (NVLAP) personnel dosimeter processor must be retained in accordance with 801.E.34.

(g) Each alarming ratemeter must:

(1) be checked to ensure that the alarm functions properly (sounds) before using ~~prior to use~~ at the start of each shift;

(2) 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;

(3) require special means to change the preset alarm function; and

(4) be calibrated at periods not to exceed 12 months for correct response to radiation. ~~Acceptable ratemeters must alarm within plus or minus 20 percent of the true radiation dose rate.~~ The licensee shall maintain records of alarming ratemeter calibrations in accordance with 801.E.34.

~~801.E.204 Supervision of Radiographer's Assistants. Whenever a radiographer's assistant uses radiation machines, radiographic exposure devices, sealed sources or related source handling tools,~~

~~or conducts radiation surveys required by 801.E.303(b) and (c) to determine that the sealed source has returned to the shielded position after an exposure, the radiographer's assistant shall be under the personal supervision of a radiographer.~~

801.E.21 Radiation Surveys ~~and Survey Records~~. The licensee or registrant shall:

(a) ~~No radiographic operation shall be~~ conduct~~ed unless~~ all surveys with a calibrated and operable radiation survey instrument~~ation~~ that meets the requirements of 801.E.9; ~~as described in 801.E.104, is available and used at each site where radiographic exposures are made.~~

(b) Conduct a survey ~~with a calibrated and operable radiation survey instrument shall be made after each radiographic exposure to determine that the sealed source has been returned to its shielded position~~ of the entire circumference of the radiographic exposure device ~~shall be surveyed. If the radiographic exposure device has a source guide tube, the survey shall also include~~ and the entire length of 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) ~~A survey with a calibrated and operable radiation survey instrument, as specified in 801.E.102, shall be made to determine that each sealed source is in its shielded position prior to securing the radiographic exposure device, storage container, or source changer in a storage area as defined in 801.E.3. The entire circumference of the radiographic exposure device, storage container, or source changer shall be surveyed.~~ 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 801.E.3, to ensure that the sealed source is in its shielded position; and

~~(d) A survey with a calibrated and operable radiation survey instrument shall be made of the storage area as defined in 801.E.3 whenever a radiographic exposure device is placed in storage.~~

~~(e) A survey with a calibrated and operable radiation survey instrument shall be made after each radiographic exposure using radiation machines to determine that the machine is "off".~~

(d) An area survey of the perimeter of the restricted area with a calibrated and operable radiation survey instrument shall be made with the source exposed before or during each radiographic exposure. Except for the initial radiographic exposure on each shift, the survey may be omitted when the source-target configuration for an exposure is substantially the same as that of the preceding exposure or if the exposure is made in a permanent radiographic facility.

(e) Maintain records in accordance with 801.E.35 ~~shall be kept of the surveys required by 801.E.303(c), (d) and (f). Such records shall be maintained for inspection by the Agency for 2 years after completion of the survey. If the survey was used to determine an individual's exposure, however, the records of the survey shall be maintained until the Agency authorizes their disposition~~.

~~**Precautionary Procedures in Radiographic Operations**~~

801.E.22 Surveillance ~~Security~~. During each radiographic operation, the radiographer or radiographer's assistant shall ~~maintain~~ ensure continuous direct visual surveillance of the operation to protect against unauthorized entry into a radiation area or a high radiation area, as defined in Section A of these regulations, except at permanent radiographic installations where all entryways are locked and the requirements of 801.E.13 are met.

~~(a) where the high radiation area is equipped with a control device or alarm system as described in 801.D.601(a) of these regulations, or~~

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

801.E.23 Posting. ~~Notwithstanding any provisions in 801.D.903 of these regulations,~~ All areas in which industrial radiography is being performed shall be conspicuously posted as required by 801.D.902(a) and (b) of these regulations. The exceptions listed in 801.D.903 of these regulation do not apply to industrial radiographic operations.

Recordkeeping Requirements

801.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.

801.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.

801.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 801.E.9 and retain each record for 3 years after it is made.

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

801.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 801.E.11, and retain each record for 3 years.

(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.

801.E.29 Utilization Logs.

(a) Each licensee or registrant shall maintain ~~current~~ utilization logs ~~which shall be kept available for inspection by the Agency for 2 years from the date of the recorded event,~~ showing for each source of radiation the following information:

(1) a ~~unique~~ description, including the make, model, and ~~identification, such as a~~ serial number of the radiation machine, or the radiographic exposure device, transport, or storage container in which a sealed source is located; ~~and each sealed source;~~

(2) the identity and signature of the radiographer to whom assigned;

(3) the locations ~~where used~~ and dates of use including the dates removed and returned to storage; and

~~(d) the date(s) each source of radiation is removed from storage and returned to storage.~~

(4) For permanent radiographic installations, the dates each radiation machine is energized.

(b) The licensee or registrant shall retain the logs required by 801.E.29(a) for 3 years.

801.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 801.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.

801.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 801.E.13 and retain each record for 3 years after it is made.

801.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 or designee.

801.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.

801.E.34 - Records of Personnel Monitoring. Each licensee or registrant shall maintain the following exposure records specified in 801.E.20:

(a) Direct reading dosimeter readings and yearly operability checks required by 801.E.20(b) and 801.E.20(c) for 3 years after the record is made.

(b) Records of alarming ratemeter calibrations for 3 years after the record is made.

(c) Reports received from the accredited (NVLAP) personnel dosimeter processor 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.

801.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 801.E.21(c). Each

record must be maintained for 3 years after it is made.

801.E.36 - Form of Records. Each record required by the section 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.

~~801.E.304 Documents and Records Required at Temporary Jobsites. Each licensee or registrant conducting industrial radiography at a temporary job site shall have the following documents and records available at that site for inspection by the Agency:~~

~~(a) current copy of the appropriate license or certificate of registration or equivalent document;~~

~~(b) operating and emergency procedures;~~

~~(c) applicable regulations;~~

~~(d) survey records required pursuant to 801.E.303 of these regulations for the period of operation at the site;~~

~~(e) daily pocket dosimeter records for the period of operation at the site;~~

~~(f) the latest radiation survey instrument and alarm ratemeter calibrations and leak test records for specific devices and sealed sources in use at the site. Acceptable records include tags or labels which are affixed to the device or survey meter and alarm ratemeter; and~~

~~(g) records required pursuant to 801.E.108 for the period of operation at the site.~~

~~801.E.305 Specific Requirements for Radiographic Personnel Performing Industrial Radiography.~~

~~(a) At a jobsite, the following shall be supplied by the licensee or registrant:~~

~~(1) at least one operable and calibrated radiation survey instrument;~~

~~(2) a current whole body personnel monitor (TLD or film badge) for each individual;~~

~~(3) an operable and calibrated pocket dosimeter with a range of 0 to 200 milliroentgens (5.16×10^{-5} C/kg) for each worker;~~

~~(4) an operable and calibrated alarm ratemeter for each individual; and~~

~~(5) the appropriate barrier ropes and signs.~~

~~(b) Industrial radiographic operations shall not be performed if any of the items in 801.E.305(a) are not available at the jobsite or are inoperable.~~

~~(c) Each licensee or registrant shall provide as a minimum two radiographic personnel when sources of radiation are used at temporary Jobsites. If one of the personnel is a radiographer's assistant, the other shall be a radiographer.~~

~~(d) No individual other than a radiographer or a radiographer's assistant who is under the personal supervision of a radiographer shall manipulate controls or operate equipment used in industrial radiographic operations.~~

~~(e) During an inspection by the Agency, the Agency inspector may terminate an operation if any of the items in 801.E.305(a) are not available and operable or if the required number of radiographic personnel are not present. Operations shall not be resumed until authorized by the Agency.~~

801.E.37 Location Of Documents and Records.

(a) Each licensee or registrant shall maintain copies of records required by this section and other applicable sections of these regulations at the location specified in 801.E.5(k).

(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;

(1) The license or registration authorizing the use of sources of radiation;

(2) A copy of Sections A, D, E & J of these regulations;

(3) Utilization logs for each source of radiation dispatched from that location as required by 801.E.29;

(4) Records of equipment problems identified in daily checks of equipment as required by 801.E.30(a);

(5) Records of alarm system and entrance control checks required by 801.E.31, if applicable;

(6) Records of dosimeter readings as required by 801.E.34;

(7) Operating and emergency procedures as required by 801.E.33;

(8) Evidence of the latest calibration of the radiation survey instruments in use at the site, as required by 801.E.26;

(9) Evidence of the latest calibrations of alarming ratemeters and operability checks of dosimeters as required by 801.E.34;

(10) Survey records as required by 801.E.35 and 801.D.1103 of these regulations as applicable, for the period of operation at the site;

(11) The shipping papers for the transportation of radioactive materials required by Section T of these regulations; and

(12) When operating under reciprocity pursuant to Section C of these regulations, a copy of the applicable State license or registration, or U.S. Nuclear Regulatory Commission license authorizing the use of sources of radiation.

Notifications

801.E.38 Notifications ~~Reporting Requirements~~.

(a) In addition to the reporting requirements specified in 801.A.7 and under other sections 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:

(1) Unintentional disconnection of the source assembly from the control cable.

(2) Inability to retract the source assembly to its fully shielded position and secure it in this position.

(3) Failure of any component (critical to safe operation of the device) to properly perform its intended function.

(4) An indicator on a radiation-producing 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 in accordance with 801.E.38(a) and in each report of overexposure submitted under Section D.1203 of these regulations which involves failure of safety components of radiography equipment:

(1) A description of the equipment problem.

(2) Cause of each incident, if known.

(3) Manufacturer and model number of equipment involved in the incident.

(4) Place, time and date of the incident.

(5) Actions taken to establish normal operations.

(6) Corrective actions taken or planned to prevent recurrence.

(7) Names and qualifications of personnel involved in the incident.

(c) ~~Reports of overexposure submitted under 801.D.1203 which involve failure of safety components of radiography equipment must also include the information specified in 801.E.110(b).~~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 prior to exceeding the 180 days.

801.E.39 Specific Requirements for Radiographic Personnel Performing Industrial Radiography.

(a) At a job site, the following shall be supplied by the licensee or registrant:

(1) At least one operable, calibrated survey instrument for each exposure device or radiation machine in use;

(2) A current ~~whole body personnel monitor (TLD or film badge)~~ personnel dosimeter that is processed and evaluated by an accredited (NVLAP) processor for each person performing radiographic operations;

(3) An operable, calibrated pocket dosimeter with a range of zero to 200 milliroentgens for each person performing radiographic operations ;

(4) An operable, calibrated, alarming ratemeter for each person performing radiographic operations using a radiographic exposure device; and

(5) 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 801.E.39(a) and 801.E.39(b) 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 801.E.39(a) and 801.E.39(b) 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.

~~801.E.306 Special Requirements and Exemptions for Cabinet Radiography.~~

~~(a) Systems for cabinet radiography designed to allow admittance of individuals shall:~~

~~(1) Comply with all applicable requirements of this section and 801.D.301 of these regulations. If such a system is a certified cabinet x-ray system, it shall comply with all applicable requirements of this section and 21 CFR 1020.40.~~

~~(4) Be evaluated at intervals not to exceed 1 year to assure compliance with the applicable requirements as specified in 801.E.306(a)(1). Records of these evaluations shall be maintained for inspection by the Agency for a period of 2 years after the evaluation.~~

~~(b) Certified cabinet x-ray systems designed to exclude individuals from the interior of the cabinet are exempt from the requirements of this section except that:~~

~~A. Operating personnel must be provided with either a film badge or a thermoluminescent dosimeter, and reports of the results shall be maintained for inspection by the Agency.~~

~~B. No registrant shall permit any individual to operate a cabinet x-ray system until such individual has received a copy of and instruction in the operating procedures for the unit and has demonstrated competence in its use. Records which demonstrate compliance with this subparagraph shall be maintained for inspection by the Agency until disposition is authorized by the Agency.~~

~~C. Tests for proper operation of high radiation area control devices or alarm systems, where applicable, shall be conducted, recorded, and maintained in accordance with 801.E.109.~~

~~D. The registrant shall perform an evaluation, at intervals not to exceed 1 year, to determine conformance with 801.D.301 of these regulations. If such a system is a certified cabinet x-ray system, it shall be evaluated at intervals not to exceed 1 year to determine conformance with 21 CFR 1020.40. Records of these evaluations shall be maintained for inspection by the Agency for a period of 2 years after the~~

evaluation.

(c) Certified cabinet x-ray systems shall be maintained in compliance with 21 CFR 1020.40 unless prior approval has been granted by the Agency pursuant to 801.A.3(a) of these regulations.

801.E.307 Prohibitions. Industrial radiography performed with a sealed source which is not fastened to or contained in a radiographic exposure device, known as fishpole radiography, is prohibited unless specifically authorized in a license issued by the Agency.

PART 801
SECTION E
APPENDIX A
SUBJECTS TO BE COVERED DURING THE INSTRUCTION OF RADIOGRAPHERS

Training provided to qualify individuals as radiographers in compliance with 801.E.201(a) shall be presented on a formal basis. The training shall include the following subjects:

I. Fundamentals of Radiation Safety

- A. Characteristics of radiation
- B. Units of radiation dose and quantity of radioactivity
- C. Significance of radiation dose
  - 1. Radiation protection standards
  - 2. Biological effects of radiation
  - 3. Cases histories of radiography accidents
- D. Levels of radiation from sources of radiation
- E. Methods of controlling radiation dose
  - 1. Working time
  - 2. Working distances
  - 3. Shielding

II. Radiation Detection Instrumentation to be Used

- A. Use of radiation survey instruments
  - 1. Operation
  - 2. Calibration
  - 3. Limitations
- B. Survey techniques
- C. Use of personnel monitoring equipment
  - 1. Film badges and thermoluminescent dosimeters (TLD's)
  - 2. Pocket dosimeters
  - 3. Alarm ratemeters

III The Requirements of Pertinent Federal and State Regulations

IV. The Licensee's or Registrant's Written Operating and Emergency Procedures

V. Radiographic Equipment to be Used

- A. Remote handling equipment
- B. Operation and control of radiographic exposure devices and sealed sources, including pictures or models of source assemblies (pigtails)

C. Storage and transport containers, source changers
D. Operation and control of x-ray equipment
E. Collimators

VI. Inspection and Maintenance Performed by the Radiographer

Part 801

Section E

APPENDIX A

Radiographer Certification

I. Requirements for an Independent Certifying Organization.

An independent certifying organization shall:

A. Be an organization such as a society or association, whose members participate in, or have an interest in, the field of industrial radiography;

B. 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;

C. Have a certification program open to nonmembers, as well as members;

D. Be an incorporated, nationally recognized organization, that is involved in setting national standards of practice within its fields of expertise;

E. Have an adequate staff, a viable system for financing its operations, and a policy and decision-making review board;

F. 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;

G. 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;

H. Have a committee, whose members can carry out their responsibilities impartially, to review complaints against certified individuals and to determine appropriate sanctions;

I. 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;

J. 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;

K. 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;

L. Exchange information about certified individuals with the U.S. Nuclear Regulatory Commission and other independent certifying organizations and/or Agreement States and allow periodic review of its certification program and related records; and

M. Provide a description to the U.S. 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:

A. Requires applicants for certifications to (a) receive training in the topics set forth in 801.E.17(g) or equivalent Agreement State or U.S. Nuclear Regulatory Commission regulations, and (b) satisfactorily complete a written examination covering these topics;

B. Require applicants for certification to provide documentation that demonstrates that the applicant has:

(1) Received training in the topics set forth in 801.E.17(g) or equivalent Agreement State or U.S. Nuclear Regulatory Commission regulations;

(2) satisfactorily completed a minimum period of on-the-job training as specified in 801.E.17(a); and

(3) received verification by a State licensee or registrant or a U.S. Nuclear Regulatory Commission licensee that the applicant has demonstrated the capability of independently working as a radiographer.

C. Include procedures to ensure that all examination questions are protected from disclosure;

D. Include procedures for denying an application and revoking, suspending, and reinstating a certification;

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

F. 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

G. 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:

A. Designed to test an individual's knowledge and understanding of the topics listed in 801.E.17(g) or equivalent Agreement State or U.S. Nuclear Regulatory Commission requirements;

B. Written in a multiple-choice format; and

C. Have test items drawn from a question bank containing psychometrically valid questions based on the material in 801.E.17(g).