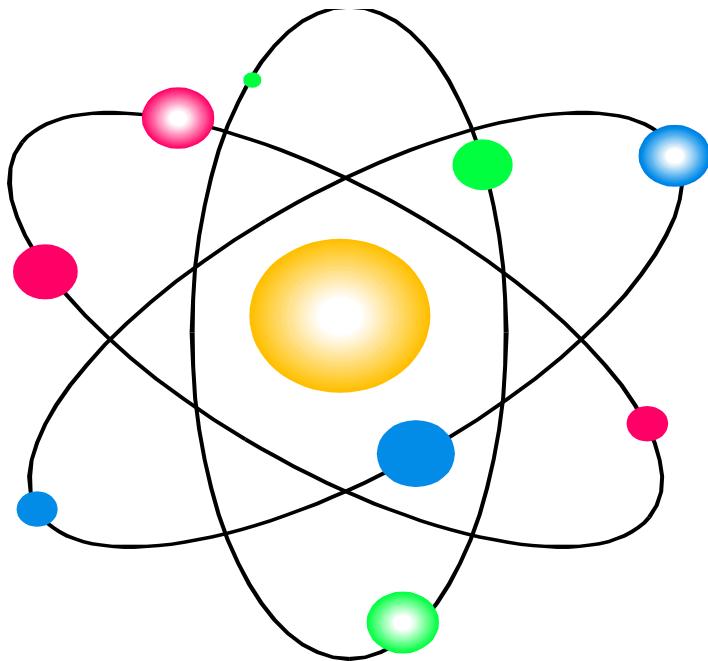


**STATE OF TENNESSEE  
DEPARTMENT OF ENVIRONMENT AND CONSERVATION  
DIVISION OF RADIOLOGICAL HEALTH**



**INDUSTRIAL RADIOGRAPHY  
APPLICATION GUIDE**  
**FOR RADIOACTIVE MATERIAL LICENSE (RHS 8-5R)**

Rev. JANUARY 2014

# **INDUSTRIAL RADIOGRAPHY APPLICATION GUIDE**

## **INSTRUCTIONS FOR COMPLETING RADIOACTIVE MATERIAL LICENSE APPLICATION (FORM RHS 8-5R)**

JANUARY 2014

An applicant for a Tennessee Radioactive Material License to possess and use radioisotopes in the form of sealed sources for radiography must complete Form RHS 8-5R and must attach to the completed form the additional information indicated. Two copies of the complete application should be sent to the Division of Radiological Health, Tennessee Department of Environment & Conservation. The applicant may refer to Tennessee State Regulations for Protection Against Radiation (SRPAR) at [www.state.tn.us/sos/rules/0400/0400-20/0400-20.htm](http://www.state.tn.us/sos/rules/0400/0400-20/0400-20.htm).

### **EXPLANATION OF FORM RHS 8-5R**

SRPAR designates “State Regulations for Protection Against Radiation”

**Notice:** **Pages of your application should be numbered to provide for easy reference. Also, all attachments to your application should be keyed to the application form by page number.**

- Item 1      (a) Enter the name, mailing address, and telephone number of the applicant as they are authorized to do business in Tennessee.  
  
                      (b) Check appropriate block indicating organizational structure of applicant.
- Item 2      List previous radioactive material licenses by number. If the application is for renewal of an existing license, the license number should be included and the word “renewal” inserted.
- Item 3      Specify the location at which the sealed sources will be used and/or stored.  
  
                      • If sources are to be used only at “temporary jobsites” as defined in SRPAR 0400-20-08-.03, please so specify.  
  
                      • If sources are to be used for industrial radiography at the licensee’s address, the work must be conducted within a permanent radiographic installation.  
  
                      • If sources are to be used at a field station, please specify address. Also, field station radiography must be conducted in a permanent radiographic installation.  
  
                      • If replacement or changing of radiography sources is to be performed at the licensee’s address and not in permanent radiographic installation, provide the location where this will be performed and how the dose to the public is maintained.

- Item 4 The sealed sources including calibration sources that the applicant will possess and use should be listed by radioisotope, manufacturer (or distributor), and model number. The maximum amount of radioactivity in each source needs to be specified. The maximum number of sources that the applicant wishes to be licensed for needs to be specifically stated.
- Item 5 Radiographic exposure devices and source changers should be designated by manufacturer (or distributor) and model number and should be keyed alphabetically to the sources listed in Item 4 with which they will be used. Any depleted uranium utilized as shielding material in exposure devices or source changers should be listed. Depleted uranium (999 kilograms) will be authorized to allow the applicant to possess adequate shielding material. Radiographic exposure devices and associated equipment must meet the requirements specified in SRPAR 0400-20-08-.04(10).
- If necessary, the suppliers of equipment should be contacted concerning the model numbers of sources, devices, and source changers to ensure that the information contained in the application is accurate. Improperly identified equipment may require additional correspondence.
- Item 6(a) This item applies only to permanent radiographic installations as defined in SRPAR 0400-20-08-.03. A facility is considered "permanent" if it is intended to be used for radiography, even if radiography is rarely performed there. All radiographic operations conducted at specific locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized otherwise by the Department. If a permanent radiographic installation will be used for performance of radiography, a detailed description of the installation that includes the following information should be submitted.
- A. Annotated drawings or sketches of the installation and its surroundings, including (1) dimensions of each enclosed area; (2) thickness, density, and type of shielding material on all sides, above and below; (3) identification of entranceways; and (4) a description of the general location of the installation including current uses of surrounding areas; and (5) distances to all areas adjacent to, above, and below each exposure area.
  - B. A description of the area security safeguards, such as locks, signs, warning lights and alarms, and interlocking systems for each enclosed exposure area and adjacent areas. Particular attention shall be given to the description of the high radiation area entrance controls that are required by SRPAR 0400-20-05-.80(1).
  - C. The results of calculations or radiation level measurements showing maximum anticipated radiation levels in all areas adjacent to each exposure area including the roof or ceiling. As a basis for calculations, the type of source, quantity of activity in the source, and position of the source within the installation shall be identified. Particular attention shall be given to radiation levels on the roof of the installation. If those levels may exceed 2 millirem per hour, the

application shall show how access to the roof will be controlled. If the calculations or measurements show that radiation levels on the roof might exceed 100 millirem per hour, the applicant should consider the use of collimating devices or additional shielding in the roof or ceiling.

A properly shielded installation will permit the performance of radiography within the facility with the areas outside the facility considered as unrestricted areas if they meet the radiation level limitations in SRPAR 0400-20-05-.60(l)(b). A radiation level of not more than 2 millirems per hour at a distance of 12 inches from an external surface of the facility will be considered acceptable for considering the area as an unrestricted area. The licensee is also required to conduct operations such that the dose to individual members of the public does not exceed 100 mrem (1 mSv) in a year. Reasonable occupancy factors may be used in demonstrating compliance with this limit.

Item 6(b)

Confirm that you will maintain sufficient calibrated and operable radiation survey instruments for surveys are required by SRPAR 0400-20-08-.04(4). These survey instruments shall have a range such that two millirems (0.02 millisievert) per hour through one rem (0.01 Sievert) per hour can be measured.

Item 6(c)

SRPAR 0400-20-08-.04(4) requires that radiation survey instruments used in radiographic operations be calibrated at intervals not to exceed 6 months and after each instrument servicing, except for battery changes. Appendix A contains a description of an acceptable procedure for calibrating survey instruments.

If an applicant wishes to calibrate his or her own instruments, the following information shall be submitted:

- A. The type (radioisotope, manufacturer, and model number) and activity of any source to be used for calibration.
- B. The accuracy of the source. Accuracy is the maximum deviation of the nominal value of the source from the true value. This information is normally provided by the manufacturer.
- C. The specific procedures to be used for calibration including radiation safety procedures to be followed for use of the source.
- D. The name and pertinent experience of each individual who will perform instrument calibration. This information may be omitted if the individual is a radiographer and the applicant has an adequate program for the training of radiographers [See 6(f)] that includes instrument calibration procedures.

If radiographers will perform instrument calibration, specific instructions and procedures shall be written for use by radiographers and shall be included in the operating and emergency procedures [See 6(e)].

If instrument calibration will be performed by an organization other than the applicant, the applicant shall confirm that the organization is licensed to perform this service by the U.S. Nuclear Regulatory Commission or an Agreement State.

Item 6(d) The applicant shall confirm that individuals performing industrial radiography will use personnel monitoring as required in SRPAR 0400-20-08-.05(3)(a).

Item 6(e) The applicant shall describe the operating and emergency procedures that will be followed by radiography personnel. Appendix B describes items and procedures that should be included.

Item 6(f) In addition to the requirement of radiographer certification referenced in SRPAR 0400-20-08-.07(1)(a), the applicant shall provide a description of the training program for radiographers, and radiographer's assistants as required by SRPAR 0400-20-08-.10(1). Also refer to SRPAR 0400-20-08-.05 and 0400-20-08-.07 for training requirements and subjects to be covered. The submitted description shall also include annual refresher training, on-the-job training, and means to be used by the licensee to determine the radiographer's and radiographers assistant's ability to comply with Division regulations, licensing requirements, and operating and emergency procedures. Appendix C describes the elements of an acceptable training program and what shall be submitted for DRH approval.

The name, training, and experience with radiation of each person who is to participate in the instruction, examination, or qualification of trainees should be given in sufficient detail to establish his or her qualifications to perform these services. If an individual will teach only certain parts of the course, this should be specified. Individuals who provide instruction in the hands-on use of radiography equipment should be certified radiographers with at least one year experience in performing radiography, or should possess a thorough understanding of the operation of radiographic equipment (e.g. a manufacturer's service representative).

Confirm that the subjects listed in SRPAR 0400-20-08-.07 will be included in the training program.

Item 6(g) The applicant shall provide a description of the internal inspection system for controlling the receipt, possession, and use of radioactive material. The description should show how the system ensures that license conditions, State regulations, and operating and emergency procedures are followed by radiographers and radiographer's assistants as required by SRPAR 0400-20-08-.10(3).

Other management controls, including a description of (1) the qualifications of each person responsible for maintaining such control, (2) the type of internal inspections to be made and their frequency, (3) the responsibilities of each person to the program, (4) the procedure for recording and reporting deficiencies to appropriate management personnel, and (5) the education and follow-up program to be used in correcting deficiencies noted during inspections shall be specified in the application. The type and extent of the radiography program to be conducted will usually determine the nature of the system and the inspection frequency. Internal inspections shall not exceed six-month intervals.

Internal inspections, including evaluation of each radiographer, shall be made by a person of authority in management. These inspections may be announced or unannounced as necessary to ensure compliance. This person should have a thorough knowledge of equipment, procedures, and regulations and level of competence at or above that expected of a radiographer. Management shall make a continuing review of quarterly inventories, utilization logs, records of receipt and disposal of licensed material, personnel monitoring results, and surveys.

Item 6(h)

SRPAR 0400-20-08-.10(4) requires that the license applicant submit a description of the overall organizational structure pertaining to the radiography program, including specific delegations of authority and responsibility for the program. Each individual in the line of authority should be identified by name and title. In addition, the applicant should provide the name, training, and experience of an individual who will be assigned duties established by the licensee for maintaining an active management control of the radiation program and radiographic operations. Appendix D describes acceptable qualifications for such individuals and the responsibilities of the positions.

Item 6(i)

The applicant shall submit a description of the leak testing program for the sealed sources as follows:

- A. If the services of a consultant or commercial organization licensed by this State, the U.S. Nuclear Regulatory Commission or another Agreement State to take the necessary test samples (smears), evaluate the samples, and report the results to the customer are used, the name, address, and license number of the consultant or commercial organization shall be specified.
- B. If the applicant wishes to be licensed by the State to use a commercially available leak-test kit, the application should identify each kit to be used by designating the kit supplier and the kit model number. Only leak-test kits that are identified will be authorized. The application shall also identify the individuals who will perform the leak test (using the kit).

- C. If an applicant wishes to be licensed by the State to perform leak tests, including taking and evaluating the smears, SRPAR 0400-20-08-10(5) requires the applicant to describe the procedures to be used. The following information should be included:
- (1) A description of the instrumentation to be used in evaluating the smears, including its sensitivity and accuracy;
  - (2) A description of the calibrating and standardizing procedures with a sample calculation showing conversion of results to the required microcurie units. Survey instruments are generally not designed for such measurements and may not be acceptable for this use;
  - (3) A description of the material to be used in taking the smear, the points on the equipment that will be smeared; [Smears are not normally taken directly from the surface of a source. See SRPAR 0400-20-08-.04(5)(c)].
  - (4) The radiation safety procedures to be followed during the smearing process, the method for handling and disposing of the smears; and
  - (5) A description of the pertinent training and experience of each person who will take or evaluate the smears.

Distributors, of sealed sources usually supply a certificate with each source giving the results and date of the last leak test performed on a source. If such a certificate is not received, the source may not be used until a leak test has been performed and the results of the test showing that the source is not leaking or contaminated have been received. Thereafter, the source must be tested for leakage and contamination at intervals not to exceed 6 months. Records of the testing identifying each source tested, the date of the test, and the results of the test in units of microcuries must be maintained for State inspection.

- Item 6(j) The applicant shall submit an inspection and maintenance program for radiographic exposure devices, source changes, and storage containers.
- A. The licensee shall check for obvious defects in radiographic exposure devices, storage containers, and source changes prior to use each day the equipment is used.
  - B. The licensee shall conduct a program for inspection and maintenance of radiographic exposure devices, source changers, and storage containers prior to the first use and at intervals not to exceed three (3) months thereafter to assure proper functioning of components important to safety. Records of these inspections and maintenance shall be kept for inspection by the Department.

## **AMENDMENTS TO LICENSES**

Licensees are required to conduct their programs in accordance with statements, representations, and procedures contained in the license application and supportive documents and in the conditions of the license. The license must therefore be amended if the licensee plans to make any changes in facilities, equipment (including monitoring and survey instruments), procedures, personnel, or byproduct material to be used.

Applications for license amendments may be filed in letterform. The letter should identify the license by number and should clearly describe the exact nature of the requested changes, additions, or deletions. References to previously submitted information and documents should be clear and specific and should identify the pertinent information by date, page, and paragraph.

## **RENEWAL OF A LICENSE**

Radioactive material licenses are issued for a period not exceeding ten years.

An application for renewal of a license shall be filed at least 30 days prior to the expiration date as provided for in SRPAR 0400-20-10-.18(2). This will ensure that the license does not expire until final action on the application has been taken.

Renewal applications must be filed on Form RHS 8-5R appropriately supplemented and should contain complete and up-to-date information about the applicant's current program.

In order to facilitate the review process, the application for renewal may reference previously submitted documents and information.

You are encouraged to submit updated information so as to make the renewed license a more concise document. However, you may reference previously submitted documents in accordance with SRPAR 0400-20-10-.11(2).

## **APPENDIX A** **CALIBRATION OF INSTRUMENTS**

1. Sealed source(s) used for calibrating of survey instruments shall:
  - A. Approximate a point source
  - B. Have its exposure rate at a given distance traceable by documented measurements to a standard certified to be within  $\pm 5\%$  accuracy by NIST
  - C. Approximate the same photon energy (Ir-192, Co-60) as the source to be used in the radiography device.
  - D. Be of sufficient strength to give an exposure rate of about 0.3 mSv/hr (30 mrem/hr) at 100 cm. (85 millicuries of Cs-137 or 21 millicuries of Co-60)
2. Use the inverse square law and radioactive decay law to correct changes in exposure rate due to source decay or different distances from the source.
3. Record survey meter calibration data and maintain written records for each instrument being used to satisfy regulatory requirements. Survey meter calibration reports shall contain the following information and must be maintained 3 years from date of calibration of each instrument:
  - A. Owner or user identification, including name, address, and person to be contacted.
  - B. Instrument description that includes manufacturer, model number, serial number, and type of detector.
  - C. Calibration source description that includes exposure rate, indicated exposure rate at a specified distance on a specified date, and the calibration procedure.
  - D. Each calibration point identifying the calculated exposure rate, the indicated exposure rate, the deduced correction factor, and the scale selected on the instrument.
  - E. Exposure reading indicated with the instrument in the “battery check” mode, if available.
  - F. Angle between the radiation flux field and the detector (parallel, perpendicular).

**Note:** Internal detectors shall specify angle between radiation flux field and a specified surface of the instrument.

- G. For detectors with removable shielding, note whether the shielding was in place or removed during the calibration procedure.

- H. Include person's name who performed the calibration and the date on which the calibration was performed.
- 4. A single point on a survey meter scale can be considered satisfactorily calibrated if the indicated exposure rate differs from the calculated exposure rate by less than 10%.

**Note:** Three kinds of scales are frequently used on radiation survey meters:

- A. Linear Scale: Meters on which the user selects a linear scale must be calibrated at no less than two points on each scale. The points should be at approximately  $\frac{1}{3}$  and  $\frac{2}{3}$  of the decade.
  - B. Multidecade Logarithmic Scale: Meters that have a multidecade logarithmic scale must be calibrated at no less than one point on each decade and no less than two points on one of the decades. These points should be approximately  $\frac{1}{3}$  and  $\frac{2}{3}$  of the decade.
  - C. Automatically Ranging Digital Display: Meters that have a device for indicating rates must be calibrated at no less than one point on each decade and no less than two points on one of the decades. These points should be approximately  $\frac{1}{3}$  and  $\frac{2}{3}$  of the decade.
- 5. Scales in excess of 10 mSv/hr (1,000 mrem/hr) need not be calibrated. However, such scales shall be checked for operation and approximately correct response.
  - 6. The following information shall be attached to the instrument as a calibration sticker or tag:
    - A. Source that was used to calibrate the instrument
    - B. A calibration chart or graph for each scale or decade of a survey meter that is greater than  $\pm 20\%$  of the actual values identifying the average correction factor, or a note indicating that scale was checked only for function or is inoperative.
    - C. Date of calibration
    - D. Date survey instrument is due calibration
    - E. Name or initials of individual calibrating instrument

### Inverse Square Law

If  $R_a$  is the exposure rate at a distance  $D_a$  from a point source and  $R_b$  is the exposure rate at a distance  $D_b$  from the same point source, then

$$R_a D^2_a = R_b D^2_b$$

Note:  $R_a$  and  $R_b$  must be in the same units of exposure rate (e.g., mR/hour, R/hour, etc.) and  $D_a$  and  $D_b$  must be in the same units of distance (e.g., centimeters, meters, etc.).

If  $R_a$ ,  $D_a$ , and  $D_b$  are known,  $R_b$  can be calculated from

$$R_b = \frac{D^2_a}{D^2_b} \times R_a$$

### Radioactive Decay Law

The exposure rate of a standard source at a time after a specified calibration date is given by

$$R_t = R_o \times e^{-(0.693 t / T_{1/2})}$$

where

$R_t$  is the exposure rate at a time  $t$  after the source calibration date

$R_o$  is the exposure rate on the day of calibration

$t$  is the time elapsed since the calibration date

$T_{1/2}$  is the radionuclide half-life

Note:  $R_t$  and  $R_o$  must be in the same units of exposure rate (e.g., mR/hour, R/hour, etc.) and  $t$  and  $T_{1/2}$  must be in the same units of time (e.g., seconds, days, years, etc.).

## **APPENDIX B** **OPERATING AND EMERGENCY PROCEDURES**

SRPAR 0400-20-08-.05(2) requires each licensee to provide radiography personnel with operating and emergency procedures. The purpose of this requirement is to provide radiography personnel with clear and specific instructions in the topics listed in SRPAR 0400-20-08-.07 and in other duties and responsibilities that radiography personnel may have. Other duties could include instrument calibration, leak testing, quarterly inspections, and preventive maintenance of equipment, and shipment of sources and devices. The operating and emergency procedures for personnel should not contain information that does not apply specifically to the duties of radiography personnel; for example, neither the training program nor the management control program should be included in the operating and emergency procedures.

The operating and emergency procedures should be tailored to fit the program proposed in the application. The procedures and instructions should be complete and self-contained in a single document or in a clearly designated part of a broader scope document that includes related material such as a description of the management control program. Information contained in equipment manuals and other publications should be extracted and inserted into the operating and emergency procedures so that the instructions to personnel are clear, specific, and appropriate for the proposed program. Where applicable, instructions for use and handling of devices incorporated into permanent radiographic installations should be separate and distinct from those for mobile or portable devices.

There is no specific format for operating and emergency procedures. Topics that shall be included in the operating and emergency procedures are:

1. Handling and Use of Licensed Sealed Sources, Radiographic Exposure Devices, Source Exchangers, and Instrument Calibration Equipment
  - A. Step-by-step instructions for the use and handling of radiographic exposure devices and related equipment should be provided. When appropriate, the procedures should include instructions for use of radiation collimating cones or other auxiliary shielding material.
  - B. If source exchange will be performed by radiography personnel, step-by-step instructions for source exchange, including surveys to be performed during the source exchange and for shipment and acceptable radiation levels for these surveys, shall be in the procedures. Such instruction shall, also, state the steps to be taken if the survey levels exceed acceptable limits.
  - C. If radiography personnel will perform instrument calibration, step-by-step instructions should be in the procedures and in Item 6.c.

- D. If radiography personnel will perform leak testing of sealed sources, specific instructions for performing the leak test shall be in the procedures and in Item 6.i. If the applicant will use commercially available leak test kits, the instructions and procedures provided by the kit suppliers should be modified to the applicant's program. For example, many kit procedures indicate that the manufacturer of the source should be notified if a survey of the leak test sample indicates a potentially leaking source. Instructions shall indicate that management will be informed since dealing with suppliers is usually a management function.

2. Methods and Occasions for Conducting Radiation Surveys

The procedures shall identify when-surveys shall be made, specifically what shall be surveyed, acceptable radiation levels for the surveys, the steps to be taken if acceptable levels are exceeded, and records of survey results to be made. In general, a survey should be performed each time a source is manipulated or moved. Surveys that need to be performed include:

- A. Determination after each exposure that the source has returned to the safe storage position. The entire circumference of the radiographic device must be surveyed. If the radiographic exposure device has a source guide tube, the survey shall include the guide tube.
- B. Determination of the boundary of the restricted area.
- C. Determination of radiation levels at external surfaces of storage facilities.
- D. Determination of radiation levels in and around vehicles used for transporting or storing sources and devices.
- E. Determination that the source is in a safe storage position prior to securing a radiographic exposure or storage container.
- F. Determination of the number of radiographic exposures and the duration of each.
- G. Determination that containers prepared for shipment comply with the requirements in Department of Transportation regulations (10 mR/hr at 1 meter from any surface and 200 mR/hr at the surface of the container).

The acceptable radiation levels for surveys should be expressed in milliroentgens per hour.

SRPAR 0400-20-08-.06(3)(c) and (d) require that records be maintained of specific surveys. Judgment is required for maintaining records of other surveys required by the regulations in which maintenance of the records is not specified in the regulations. The State does not expect radiographers to record each and every reading taken during a survey. However, records shall be complete enough to show clearly that proper surveys have been done.

## Methods for Controlling Access to Radiographic Areas

Instructions for controlling access to radiographic areas shall be specifically stated in the procedures. The instructions for control of access to permanent radiographic installations shall be separate and distinct from the instructions for temporary site operations.

The boundaries of restricted areas and high radiation areas are required to be posted. "Caution<sup>1</sup> Radiation Area" signs shall be posted at the boundary of the restricted area, and "Caution<sup>1</sup> High Radiation Area" signs shall be posted at the boundary of the high radiation area. High radiation area signs shall not be used at the boundary of a restricted area; these signs shall be used only at the boundary of a high radiation area.

Signs, by themselves, do not provide an adequate means of access control. In these situations, barricade tape or rope will be used when the radiation area cannot be controlled against unauthorized entry with posting alone. For radiographic operations performed outside a permanent radiographic installation, instructions on maintaining continuous direct visual surveillance of operations to prevent unauthorized persons from entering the high radiation area during radiographic operations are necessary. For permanent radiographic installations, specific instructions concerning use of interlocking devices and systems, locking of the facility, security of keys, use of warning lights and alarms, etc., shall be included in the procedures.

A specification of a radiation level of 2 millirem per hour for the boundary of the restricted area and 100 millirem per hour for the boundary of the high radiation area is acceptable. A physical survey with a survey meter shall be performed to confirm the 2 millirem per hour radiation level for the restricted area boundary after the source has been exposed. It is neither necessary nor desirable for a physical survey to be made to confirm the radiation level at the boundary of the high radiation area since such a survey could lead to unnecessary exposure of personnel.

### 3. Methods and Occasions for Locking and Securing Radiographic Exposure Devices, Storage Containers, and Sealed Sources

Instructions requiring securing of the exposure device after completion of the survey to determine that the source has returned to the safe storage position shall be written and available. Instructions shall further specify that surveys to determine that the sealed source has returned to the shielded position after an exposure are required pursuant to SRPAR 0400-20-08-.06(3)(b) and, in the case of a radiographer's assistant, they must be made under the personal supervision of a radiographer, SRPAR 0400-20-08-.03(17). SRPAR 0400-20-08-.06(3)(c) requires that a record of the last survey made prior to locking the radiographic exposure device and ending direct surveillance be maintained.

<sup>1</sup> Or Danger

Instructions and procedures for storage of sources and devices at both permanent and temporary job sites, including locking of devices, posting of storage area, and surveys around the storage areas, shall be in the procedures.

4. Personnel Monitoring and the Use of Personnel Monitoring Equipment

The instructions shall contain requirements for radiography personnel to wear their personnel monitoring devices so that any exposure received will be accurately reflected by the devices. The instructions shall be specific. See SRPAR 0400-20-08-.05(3) for personnel monitoring control requirements.

Frequent reading of pocket dosimeters shall be required so that personnel may be aware of exposure that they may have received. An instruction concerning steps that must be taken immediately by radiography personnel in the event a dosimeter is found to be off scale shall be included in the procedures. This instruction shall include the requirement stated in paragraph SRPAR 0400-20-08-.05(3)(d) that an individual's personnel dosimeter be processed immediately if that individual's pocket dosimeter is discharged beyond its range. It shall be required that the individual cannot return to work with radioactive material until a determination of his radiation exposure has been made. Instructions for storage of personnel monitoring devices shall be included in the procedures.

5. Transporting Sealed Sources to Field Locations, Packaging of Exposure Devices and Storage Containers in the Vehicles, Posting of Vehicles, and Control of Sealed Sources During Transportation

Most transport of radiography sources in exposure devices or storage containers over public roads is subject to the regulations of the Department of Transportation. These regulations cover, among other things, permissible radiation levels around and within a vehicle and placarding of the vehicle during transport. Even in those cases in which the Department of Transportation regulations are not applicable (such as intrastate transportation), SRPAR 0400-20-10-.30 requires conformance to the standards and requirements of the Department of Transportation. This includes shipping papers for everyday transport.

The procedures shall contain instructions on how exposure devices or storage containers will be secured within the transporting vehicle to prevent shifting within the vehicle. There shall be instructions for placarding of the vehicle during transport. The Department of Transportation regulations require "RADIOACTIVE" placards on all four sides of the vehicle for Type Yellow III packages. There shall be instructions for surveys in and around the vehicle. The radiation level in the passenger compartment shall not exceed 2 millirem per hour. Although it is not specifically required for transport, there are occasions when the vehicle should be considered an unrestricted area so that a specification of a radiation level of 2 milliroentgens per hour at a distance of 12 inches from any external surface of the vehicle should be provided.

When a vehicle is used for storage, i.e., when the sources are not being transported, the posting requirements in SRPAR 0400-20-05-.111 are applicable, and that vehicle shall therefore be posted with "Caution-Radioactive Material" signs. As noted above, the area outside a parked vehicle used for storage is an unrestricted area, and the radiation level at 12 inches from the surface of the vehicle shall not exceed 2 millirem per hour.

#### 6. Minimizing Exposure of Persons in the Event of an Accident

Instructions to personnel shall include procedures for minimizing the exposure of persons in the event of an accident or other unusual occurrence. Possible malfunctions of equipment should be considered, and steps to follow in each case of malfunction shall be specifically set forth.

The procedures shall contain clear and specific instructions concerning emergency situations. The steps to be taken by radiography personnel should, in general, be limited to (1) surveying the area, (2) establishing a restricted area, (3) notifying appropriate persons, and (4) maintaining direct surveillance and control over the area until the situation is corrected. Limitations on action that may be taken by radiography personnel shall be clearly specified.

The attempted recovery of a source that has become detached from an exposure device, an operation that may result in exposure to high levels of radiation, shall not be attempted by radiography personnel unless specifically trained. Confirm that you will follow the specific procedures listed below if you wish to be authorized for source retrieval, or confirm that source retrievals will only be performed by a person specifically licensed by the NRC or an Agreement State to perform such services.

The Division will review the applicant's procedures for source retrieval with respect to keeping exposures ALARA and controlling exposures to radiation. Since it is not possible to specify all potential exposure situations, a general procedure is acceptable. A retrieval procedure shall contain the following elements:

- Warnings that only specifically authorized individuals, or personnel supervised by such authorized individuals and working in their presence are allowed to perform retrievals.
- A clear statement that no source or suspected source containing items such as a stuck source in a guide tube will be handled directly.
- Expedient methods of reducing unintended exposure to staff and the public, such as using lead shot bags, sandbags, steel plates, remote handling devices, and culverts cut lengthwise.
- Additional dosimetry should be used during source retrievals, for example, pocket dosimeters with a range greater than 2 mSv (200 mrems) or finger badges.

- Methods of restricting access to the area, including establishing a restricted area and obtaining outside help in controlling access.
- Appropriate use of survey instruments. The procedure should prohibit using alarming dosimeters or electronic dosimeters as survey instrument substitutes.
- Criteria for requesting outside assistance.
- Instructions for reducing the exposure to other personnel and members of the public during recovery operations.
- Notification of the RSO, RSO-designee, and management.
- Specific training including practice with special tools, shielding, and additional dosimetry with a dummy source.
- Notification of the NRC or Agreement State.

7. Procedure for Notifying Proper Persons in the Event of an Accident

The names and telephone numbers of the persons to be contacted shall be made available to all radiographic personnel.

8. Recordkeeping

The instructions to personnel shall specify those records that must be maintained by them during the course of their work. Among the records that are normally made by radiography personnel are dosimeter readings, surveys, and daily inspection of equipment. Other records shall be included if they are the responsibility of radiography personnel. Records for which management and supervisory personnel have responsibility shall not be included in the operating and emergency procedures.

9. Inspection and Maintenance of Radiography Exposure Devices, Storage Containers, and Source Changers

SRPAR 0400-20-08-04(8) requires a check for obvious defects in radiographic exposure devices, storage containers, and source changers. This shall be done prior to use each day the equipment is used. The procedures shall contain specific instructions for inspection of equipment and the actions to be taken if any defects are found. A checklist shall be contained in the procedures, listing the items that shall be covered in the daily inspection. Equipment manufacturers may be helpful in providing information concerning daily inspections.

Inspection and preventive maintenance of equipment shall be done prior to the first use and at intervals not to exceed three months thereafter. If radiography personnel will conduct these inspections, the procedures shall contain clear and specific instructions for

inspection and maintenance. As part of the inspection and preventive maintenance program, all connectors, drive cable, source guide tubes, on-off indicator mechanisms, and moving parts shall be checked for defects and excessive wear. Cables should be cleaned and lubricated, and all defective and excessively worn components repaired or replaced if components essential to the safe operation of the device are found to be defective or in poor operating condition, the device shall be immediately removed from service until repairs can be made. An instruction to be followed in this event shall be written. Records of quarterly inspections and maintenance must be kept for three years.

The alarm system shall be tested for proper operation with a radiation source each day before the installation is used for radiographic operations. The test shall include a check of both the visible and audible signals. Entrance control devices that reduce the radiation level upon entry shall be tested monthly. If an entrance control device or an alarm is operating improperly, it shall be immediately labeled as defective and repaired within seven (7) calendar days. The facility may continue to be used during this seven-day period, provided the licensee implements the continuous surveillance requirements of SRPAR 0400-20-08-.06(1) and uses an alarming rate-meter. The licensee shall retain records of these tests for three (3) years for inspection by the Division.

**10. Off-Scale Pocket Dosimeter Readings**

Procedures to be taken immediately by radiography personnel in the event a pocket dosimeter is found to be off scale shall include the following instructions:

- A. Stop work immediately;
- B. Initiate emergency procedures if the source is exposed and cannot be retracted; otherwise, retract the source safely;
- C. Notify the radiation safety officer immediately. In this regard the name of the radiation safety officer and the manner in which this individual can be reached shall be included.

**11. Product Malfunctions and Defects**

If the radiographer discovers any malfunction or defect in the equipment, the radiographer shall notify the radiation safety officer. Procedures to be followed in such an event shall tell the radiographer what to report, when to report the problem, and the individual to whom it shall be reported.

## **APPENDIX C** **TRAINING PROGRAM**

An applicant for a radiography license is required to have an adequate program for the training of radiographers and radiographer's assistants. With respect to radiography personnel, two important points should be understood: (1) the duties and responsibilities of the radiographer may not be delegated to the radiographer's assistant. A radiographer must be physically present at the location where radiography is being performed. A radiographer's assistant may perform source manipulation, surveys of the radiographic device to determine source locations etc., only in the physical presence of a radiographer, and (2) any individual who assists a radiographer by manipulating radiographic exposure devices, sealed sources, related handling tools, or survey instruments is acting in the capacity of a radiographer's assistant and must meet the requirements of SRPAR 0400-20-08-.05(l)(b). Below is an outline of the training program required by the regulations (SRPAR).

### **- Radiographers -**

Below are the subjects to be covered as referenced in SRPAR 0400-20-08-.07. This should contain approximately 40 classroom hours at least 4 of which should be on equipment.

1. Fundamentals of radiation safety, including:
  - A. Characteristics of gamma radiation
  - B. Units of radiation dose and quantity of radioactivity
  - C. Hazards of radiation dose and quantity of radioactivity
  - D. Levels of radiation from sources to be used
  - E. Methods of controlling radiation dose (time, distance and shielding)
2. Radiation detection instrumentation to be used, including:
  - A. Use, operation, calibration and limitations of radiation safety instruments
  - B. Survey techniques
  - C. Use of personnel monitoring equipment
3. Radiographic equipment to be used:
  - A. Operation and control of radiographic exposure equipment, remote handling equipment and storage containers, including pictures or models of source assemblies (pigtails)
  - B. Storage, control, and disposal of licensed material
  - C. Inspection and maintenance of equipment

4. The requirements of pertinent state regulations
5. Case history of radiography accidents

The radiographer shall successfully complete a written test and a field examination in the above subjects. The written test should include at least 50 questions that cover all areas of instruction. A passing grade shall be 80%. The field exam shall examine the demonstration of competence to use sources of radiation, related handling tools, and survey instruments.

**Minimum of two months of on-the-job training:** (Under supervision of a certified radiographer)

**Instruction in:** (Approximately 8 hours)

- Chapters 0400-20-05, 0400-20-08, and 0400-20-10 of SRPAR
- Applicable U.S. DOT regulations as referenced in 10 CFR Part 71
- License conditions
- Operating and Emergency Procedures

**Periodic training:** Shall be conducted at least annually and include the following subjects:

- New procedures or equipment
- New or revised regulations
- Opportunities for employees to ask safety questions and receive answers to their safety questions
- The results of internal inspections
- Accidents or errors that have been observed

### - Radiographer's Assistants -

**Radiographer's Assistants shall have instructions in the following:** (Approximately 8 hours for operating and emergency procedures; approximately 4 hours for devices, sources, equipment, and survey instruments)

- Operating and Emergency Procedures
- The use of radiographic exposure devices, sealed sources, associated equipment, and radiation survey instruments

A written or oral test with 20-50 questions and a passing grade of 80% is expected and a means to demonstrate competence in the use of devices, sources, equipment, and survey instruments.

**Periodic training** (Shall be at least annual; submit to DRH)

- Same as outlined above for radiographer

## **APPENDIX D** **PROGRAM RESPONSIBILITIES AND MANAGER QUALIFICATIONS**

The individual assigned the duties of maintaining active management control of the program must be a qualified radiographer and have one year of full time hands-on experience as a qualified radiographer, and have training in establishing and maintaining a radiation protection program. They shall have training in the use of the types of equipment proposed in the application and shall bear the title of Radiation Safety Officer. Thorough knowledge of management policies, company administrative and operating procedures, and safety procedures related to protection against radiation exposure should be prerequisites for the position. Alternates who are approved radiographers should be designated to assume these functions when necessary.

A list of the duties that may be performed by the licensee's management personnel is presented below. It is not intended to be all-inclusive nor should it be interpreted as a requirement that any one person assume all of the listed duties. Some duties may be delegated to persons of lesser authority.

1. Serving as the licensee's liaison officer with the Division of Radiological Health on license matters.
2. Maintaining control of procurement, security, and disposal of licensed material.
3. Developing and maintaining up-to-date operating and emergency procedures.
4. Establishing and maintaining a personnel monitoring program.
5. Procuring and maintaining radiation survey instruments.
6. Establishing and conducting the training program for radiographers and radiographer's assistants.
7. Examining and determining competence of radiographic personnel.
8. Establishing and maintaining storage facilities.
9. Maintaining exposure devices, radiography facilities, and associated equipment.
10. Establishing and maintaining a leak-testing program.
11. Establishing and maintaining the internal inspection system.
12. Performing source replacement and source tagging operations.
13. Conducting quarterly inventories and maintaining utilization logs.
14. Establishing and conducting a survey instrument calibration program.
15. Establishing and maintaining the licensee's recordkeeping system.
16. Reviewing and ensuring maintenance of those records kept by others.
17. Assuming control and instituting corrective action in emergency situations.
18. Investigating the cause of incidents and determining necessary preventive action.
19. Acting in an advisory capacity to the licensee's management and radiography personnel.
20. Establishing a procedure for evaluating and reporting defects and noncompliance.
21. Stopping unsafe licensed activities.