

***Instructions for the Preparation of  
Application for the Use of Sealed  
Sources in Industrial Radiography***

*Washington State Department of Health  
Office of Radiation Protection*

## Aid in Completing Application RHF-1 IR

The application is self-explanatory: fill in the blanks, check the appropriate boxes, and attach any additional information.

A number of attachments are specified. These should be numbered according to the corresponding item number in the application.

**Please Note:** Submitting incomplete or incorrect information will cause a delay in the issuance of your license. We stress that you use this checklist to avoid inadvertent errors in your license application.

Please submit **original** of the entire application and attachments, except you need not return the instructions or Exhibits 1-3, these are for your records only.

### Checking Your Work

- Have you included the street address of the use and/or storage location? Do you want to work at temporary job sites? If so, Item 1c must be checked.
- Did you include the name and phone number of the person to contact regarding this application?
- Are you sure the sealed sources match the exposure devices and the source changers according to manufacturer's data?
- Have you checked all the appropriate boxes and filled in all required blanks?
- Have you completed and included all the requested information?
  - Training and experience of Radiation Safety Officer (RSO) - see Appendix A
  - Appendix A - duties or equivalent RSO duties
  - Methods and procedures for calibrating survey instruments - see Exhibit 1
  - Methods and procedures for checking pocket dosimeters and alarming ratemeters - see Item 12
  - Facilities and storage diagrams - see Item 13
  - Leaking source procedure
  - Manufacturer's leak test procedures - see Item 14
  - In-house leak test procedures - see Item 14
  - Completed Appendix B
  - Copies of record forms identified in Appendix B
  - Organizational chart
  - Duties and responsibilities (other than RSO)
  - Checklist for quarterly internal audit
  - Procedure for reporting and recording deficiencies
  - Program to correct deficiencies
  - Information for in-house training - see Item 18
  - Individual users training and experience - see Item 18
- If this is a new application, have you enclosed the fee?
- Have you filled out and included the separate County/City Official Notification form? Please place it near the front of the application.
- Has "Item 20 – Certificate" of Form RHF-1 IR been signed by management? (The RSO may not sign this form unless management has filed with the department a statement authorizing the RSO to sign all applications and radiation safety program commitments. You may include the authorization with this application, if you desire.)

**Washington State Department of Health  
Office of Radiation Protection  
Regulatory Guide 10.6  
Guide for the Preparation of Applications for Use of Sealed  
Sources and Devices for Performing Industrial Radiography**

**INTRODUCTION**

**1.1 Purpose of Guide**

The purpose of this guide is to provide assistance in the preparation of an application for the possession and use of sealed sources and devices for performing industrial radiography.

This guide is intended only for general guidance, and the applicant must ensure that the application correctly and adequately describes the radiation safety measures and procedures to be followed to provide adequate protection for employees and the public.

**1.2 Applicable Regulations**

Washington State regulations that apply to radiography and that should be used in conjunction with this guide are WAC (Washington Administrative Code) Chapter 246-220 WAC, "Radiation Protection - General Provisions"; Chapter 246-221 WAC, "Radiation Protection Standards", Chapter 246-222 WAC, "Radiation Protection - Worker Rights"; Chapter 246-235 WAC, "Radioactive Material – Specific Licenses"; and Chapter 246-243 WAC, "Radiation Protection - Industrial Radiography". In addition, the following federal regulation is enforced by license condition, 10 CFR Part 71 and 49 CFR Part 170, Parts 172 - 178, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions."

**1.3 As Low As Reasonably Achievable (ALARA)**

WAC 246-220-007 states, in part, "...persons engaged in activities under licenses issued by the Washington State Department of Health pursuant to the Atomic Energy Act of 1954, as amended, shall, in addition to complying with the requirements set forth in Chapter 246-221 WAC, make every reasonable effort to maintain radiation exposures, and releases of radioactive materials in effluents to unrestricted areas, as low as is reasonably achievable." Washington State Department of Health, Office of Radiation Protection Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," provides the Washington State Office of Radiation Protection staff position on this important subject. License applicants should give consideration to the ALARA philosophy, as described in Regulatory Guide 8.10, in the development of plans for work with licensed radioactive materials. ALARA programs conforming to U.S. NRC Regulatory Guide 8.10 are considered to be compatible with the Washington position.

Some of the items that should be considered to help maintain radiation exposures as low as reasonably achievable are discussed below. The discussion is not intended to be all inclusive but should be used as a guide in establishing an operating philosophy for maintaining occupational radiation exposures as low as reasonably achievable.

The most important single item for industrial radiography is the use of survey meters to ensure that radioactive sources have been returned to the shielded position after each exposure. The necessity for performing adequate surveys must be continually emphasized during initial classroom training, on-the-job training, and annual refresher training of radiographers and assistants.

The use of collimators whenever possible and the habit of taking advantage of available shielding at temporary jobsites are also items that contribute to maintaining low occupational exposures. Again, these items must be addressed during initial training, on-the-job training, and refresher training.

In addition to the items mentioned above, the use of remote controls with "pipe-liner" type exposure devices, taking advantage of the full length of the crank-out assembly, and using as long a crank-out assembly as possible, will contribute to maintaining occupational exposures ALARA.

Management must also contribute to maintaining low occupational exposures by impressing upon the radiographers and assistants the importance of radiation safety, and by distributing the workload among personnel so that the same person does not always receive the assignment that involves the highest exposure(s). Management must review personnel monitoring records quarterly to identify those individuals who have exposures higher than the average and to try to establish and correct the cause. Management's role **in radiation safety cannot be overemphasized**. It must be repeatedly stressed by management that radiation safety takes precedence over work production.

## License Fees

An annual license fee is required for a radioactive materials license. Refer to the supplemental license fee information to determine the amount of fee that must accompany the original application. Checks should be made payable to Department of Health. Review of a new license application will not begin until the proper fee is received.

## Filing an Application

An application for a license for use of radioactive materials for Industrial Radiography must be filed on Form RHF-1IR, "Application for Radioactive Material License - Industrial Radiography", and must contain all the information specified and requested in the application form. The information submitted must be sufficient to allow the department to determine that the proposed equipment, facilities, procedures, and controls are adequate to protect health and minimize danger to life and property. Information submitted should pertain to the specific activities for which authorization is sought and should be complete. Submission of incomplete information will result in delays because of the correspondence necessary to obtain supplemental information.

Since licensees are required to comply with department rules and regulations, license conditions, and the content of the submitted application, at least one copy of all information submitted to the Department must be retained by the applicant for reference.

The Application Form RHF-1IR should be completed following the instructions provided in this guide. Original is to be filed with this Office and one copy kept by the applicant. Since the space provided on the form is limited, additional sheets should be appended as necessary. Supplemental information should be labeled to identify the applicant and reference the items for which information is being given.

To apply for a new radioactive materials license for industrial radiography devices, enclose a check or money order, payable to Department of Health (no cash) for the amount of fee, and mail fee with completed RHF-1IR form and attachments to the address given in the supplemental licensing fee information. However, if this is a renewal application, your annual fee will be billed separately and only the RHF-1IR and attachments should be sent to:

State of Washington  
Department of Health  
Office of Radiation Protection  
PO Box 47827  
Olympia, Washington 98504-7827

## Contents of an Application

The following deal with specific items on the application form. Some items are self-explanatory. Only those items requiring comment will be discussed.

### Item 1a. Address

The place of authorized use/storage of radioactive materials cannot be a P.O. Box address. An actual street address will be listed in a license condition. However, some companies do not receive mail at their street address. For that reason give your preferred mailing address in Item 1a, and the actual street address of the building or buildings where your radioactive materials will be stored and/or used in Item 1b. If you wish to be authorized to work at temporary jobsites in the State of Washington, off-shore, or out of state, check the box in Item 1c. A licensee must have an in-state permanent address where all required records are kept.

### Item 1d. Field Site Radiography Notification

Licensees will be periodically required to contact the Office's 1-800 number and provide notification of intent to do field site industrial radiography. This number is available 24 hours a day. Notification information will be supplied by the Office about one week prior to the notification period.

### Item 2. Person to be Contacted About Application

You should name the individual who knows your proposed program and can answer questions about the application. Also, please note the telephone number at which the individual may be contacted. If the contact changes, please notify the Office of Radiation Protection. Notification of a contact change is for information only.

### Item 4. Name of RSO

The licensee must name a qualified Radiation Safety Officer (RSO) who shall be responsible for the company's radiation safety program, act as the licensee's liaison with Washington State Department of Health, Office of Radiation Protection personnel on license matters, and take charge in case of company radiation emergencies. Out-of-state licensees must have an in-state RSO. (For full explanation of duties and qualifications of the RSO, consult RHF-1IR, Appendix A, "Qualifications and Duties of a Radiation Safety Officer".)

### **Item 5. RSO Qualifications and Duties**

Attach the radiation safety training (radiography and formal training in the establishment and maintenance of a radiation protection program) and experience of the RSO to the application. Signify that RSO duties as in RHF-11R Appendix A, or equivalent are attached for review.

### **Items 6, 7, and 8. Radioactive Material(s) Description**

- Identify the radionuclide that will be used in the radiographic device.
- Identify the manufacturer and model number of the sealed source that will be used in the radiographic device.
- Specify the maximum amount of radioactive material that will be in each named source.

Identify other sealed sources (i.e., any source that will not be used for performing radiography) which you may wish to possess by radionuclide, manufacturer, model number, and maximum amount (activity) of radioactive material in the source. For example, identify a sealed source and device that will be used for instrument calibration.

Because of the large area that requires surveillance, sources that exceed 100 curies of Iridium 192 or 200 curies of Cobalt 60 will not be routinely approved for temporary jobsite use. Sources that exceed these amounts should be used only in shielded permanent facilities. If you wish to use sources in excess of 100 curies of Iridium 192 or 200 curies of Cobalt 60 at temporary jobsites, you should provide specific information concerning where the sources will be used, the conditions of use, transportation and storage, and how you will conduct surveillance to prevent entry into the restricted area. Your operating and emergency procedures should provide special instructions governing the use of such sources with particular emphasis on area surveillance.

### **Item 9. Device Description**

Radiographic exposure devices must be designated by the current manufacturer and model number and should be keyed alphabetically to the sources listed in Items 6, 7, and 8 with which they will be used. In the columns on the far right in Item 9, specify manufacturer and model number of the source changers to be used with each exposure device.

Make certain that the sources, devices, and changers match according to manufacturer specifications, as a mismatch could result in a disconnect and a severe overexposure. If necessary, the suppliers of equipment should be contacted concerning the model numbers of source, devices, and source changers to ensure that the information contained in the application is accurate. Improperly identified equipment will usually require additional correspondence between you and this department.

### **Item 10. Radiation Detection Instruments**

List radiation detection instruments (survey instruments) by manufacturer, model number, and exposure range. Instruments to be used for surveys are required by WAC 246-243-080 to measure from a minimum of 0.02m Sv (two milliroentgen) per hour through at least 10m Sv (one roentgen) per hour.

### **Item 11. Calibration of Survey Instruments**

WAC 246-243-080 requires that a licensee maintain sufficient calibrated and operable survey meters to make physical radiation surveys, and that the instruments be calibrated at intervals not to exceed six months and after each instrument repair.

State that you will have operable and calibrated survey meters with a range of 0.02m Sv (two milliroentgen) per hour through at least 10m Sv (one roentgen) per hour. Include a statement that meters will (1) be calibrated so that the readings are  $\pm 20$  percent of the actual values of the calibration dose rate; (2) have a calibration chart or graph showing the results of the calibration, the date of the last calibration, and the due date of the next calibration affixed to the survey meter; and (3) be calibrated at least every six months and after each servicing. Also state that calibration records will be kept for a minimum of three years after each calibration, and identify by whom the instruments will be calibrated.

If instrument calibration will be performed by an organization (vendor) other than the applicant, the application should include the name, address, and license number of the organization.

If an applicant wishes to calibrate survey instruments in-house, the following information must be submitted:

- A. The radionuclide, manufacturer, 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. A certificate indicating that the source is traceable to the National Institute of Standards and Technology (NIST) must be submitted.

- C. Specific procedures to be used for calibration, including radiation safety procedures to be followed for use of the source. Exhibit 1 contains a description of an acceptable procedure for calibrating survey instruments.
- D. The name and experience of each individual who will perform instrument calibration.
- E. Diagrams of area which will be utilized when performing instrument calibrations.

**Item 12. Personnel Monitoring**

WAC 246-243-150 requires that radiographers and radiographers' assistants wear direct-reading pocket dosimeters, alarming ratemeters and either film badges or thermoluminescent dosimeters (TLDs) during radiographic operations. Film badge and TLD suppliers must be NVLAP certified for the type of dosimetry service provided. The pocket dosimeters must have a range from zero to 2m Sv (0 to at least 200 milliroentgen). Additional dosimeters with higher ranges are desirable for immediately determining dose in case of an accidental overexposure, but this is not required.

There are five mandatory commitment statements following the listing of direct reading pocket dosimeters in Item 12 which must be followed.

Applicant must state whether pocket dosimeters and alarming rate meters will be checked for accuracy by applicant or by approved service agency. If applicant will do own calibration checks, applicant must describe procedures for checking device exposure and energy response as required by WAC 246-243-150. If annual calibration checks will be performed by an outside service agency, list the approved service agency and their license number.

**Item 13. Facilities**

Describe the permanent storage facility for radioactive material and if applicable, the permanent radiographic installation. This description should include the following:

A permanent radiographic facility is at a fixed location, is shielded so that the area outside the facility is an unrestricted area, and, due to its construction may not need continuous surveillance. If the facility is used only occasionally for performance of radiography, it still is considered a permanent facility because it is the nature of the facility, rather than the frequency of use, that determines if the facility is permanent.

If you intend to perform radiography in a permanent radiography facility (or facilities), provide the following information for each facility:

- A. An annotated sketch or drawing of the facility and its surroundings that show:
  - The scale to which the sketch or drawing is made (the same scale should be used for all sketches and drawings).  
The recommended scale is 1/4 inch = 1 foot;
  - The type, thickness, and density of shielding materials on all sides, including the floor and roof;
  - The location of all entrance(s) and exits, and other points of access into the facility;
  - A description of the nature of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility;
  - The location of the visible/audible alarm system; and
  - The storage area for radiography devices.
- B. A description of the visible-audible signal system and how it meets the requirements of WAC 246-243-220. The visible signal must be activated only by radiation whenever the source is exposed and must be clearly visible, day or night, at the boundary of the restricted area. The audible signal must be activated only when an attempt is made to enter the facility when the source is exposed and must be, in the 2,000-5,000 hertz range, be a minimum of 5-10 decibels greater than normal ambient work noise. The requirement for the visible-audible signal system is in addition to other measures which may be taken to prevent access into the facility, such as locked doors.

WAC 246-221-120(e)(ii)(A) provides an alternative to the visible-audible alarm system required by WAC 246-243-220. It is acceptable to use a system that will reduce the radiation level to unrestricted area levels if the entrance to a high radiation area is opened while a source is out of its safe storage condition. The system must be automatic and may not depend on action by radiography personnel. If you intend to use this alternative, provide a complete description of your system.

- C. The results of actual radiation level measurements adjacent to, above, and below the facility. The radiation level in all directions around the facility, including the roof, must not exceed 0.02m Sv (two milliroentgen) per hour. Clearly identify the type of source (nuclide), the amount of radioactive material in the source, use, composition, weight, and orientation of collimator(s) and the position of the source within the facility for the measurements.

Variances will be considered if construction requirements preclude shielding the roof to meet the 0.02m Sv (two-milliroentgen) per hour radiation level requirement. Provide the following information to obtain approval for a variance:

- Means of access to the roof;
- Procedures for ensuring that no individual is on the roof or could gain access to the roof during the performance of radiography; and
- The steps taken to minimize radiation on the roof.

A radiation level that exceeds 1m Sv (100 milliroentgen) per hour will not be considered acceptable. This radiation constitutes a High Radiation Area and requires special precautions such as the visible-audible signal system required by WAC 246-243-220.

- D. Limitations (if needed) on positioning of sources or type (nuclide) and amount(s) of radioactive material that may be used in the facility to ensure that areas adjacent to, above, and below the facility will be unrestricted areas during the performance of radiography.

#### **Item 14. Leak Test Program**

Submit the procedure that will be followed in the event a leaking source is discovered.

The analyses of sealed source leak tests may be performed only by persons who are specifically trained and authorized by the department to do so. In establishing a program for leak testing, you may choose one of three approaches:

- A. You may utilize the services of a consultant or a commercial organization licensed by the department, the Nuclear Regulatory Commission, or any Agreement State to perform leak tests. Submit the name, address, and license number of the consultant or service agency.
- B. You may be licensed by the department to use a commercially available leak test kit to obtain leak test samples. The application must specify the name and address of the manufacturer of the leak test kit (and analyzer of the leak test samples). The manufacturer's leak test kit procedures, or the leak test procedures as adapted to your operation, must be attached. You must identify who will use the kits to perform leak tests. If radiographic personnel will perform leak tests, specific instructions must be included in the operating and emergency procedures for personnel.
- C. You may be licensed by the department to perform leak tests, including the taking and evaluation of wipes. WAC 246-235-080 (5) (e) requires the applicant to describe the procedures to be used. The following information must be included:
- A description of the instrumentation (including its sensitivity and accuracy) to be used in evaluating the samples;
  - 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;
  - A description of the material to be used in taking the smears, the points on the equipment that will be smeared (smears should not be taken directly from the surface of a source); see WAC 246-243-090;
  - National Institute of Standards and Technology (NIST) certificates for leak test standards.
  - Sample leak test report form.
  - The radiation safety procedures to be followed during the smearing process, the method for handling and disposing of the smears; and
  - A description of the pertinent training and experience of each person who will take and/or evaluate the smears.

Distributors of sealed sources supply a certificate with each source, giving the results and date of the last leak test performed. If 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, has been received. Thereafter, the source must be tested for leakage and contamination at intervals not to exceed six months. Records of the testing, identifying each source tested, the date of the test, and the results of the test in units of becquerels must be maintained for department inspection for three years after the test is performed.

#### **Item 15. Operating and Emergency Procedures**

WAC 246-243-140 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 WAC 246-243-140 and other duties and responsibilities that radiography personnel may have. Other duties could include instrument calibration, leak testing, quarterly inspection 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.

The operating and emergency procedures manual must be as concise as possible, containing clear and specific instructions in the duties of the radiography personnel and tailored to fit the program proposed in the application. Information contained in equipment manuals and other publications should be extracted and inserted into the operating and emergency procedures manual. The instructions contained in the operating and emergency procedures should be in language that can be easily understood by radiography personnel. (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.)

The operating and emergency procedures should be a sequential set of instructions that cover radiography operations from the beginning of the workday to the end of the workday. Topics that must be included in the operating and emergency procedures are:

A. Handling and Use of Licensed Sealed Sources, Radiographic Exposure Devices, Source Exchangers, and Instrument Calibration Equipment

- Step-by-step instructions of the “cookbook” type for the use and handling of radiographic exposure devices and related equipment must be provided. When appropriate, the procedures must include instructions for the use of radiation collimators or other auxiliary shielding material;
- If source exchange will be performed by radiography personnel, step-by-step instructions must be in the procedures. The
- Instructions should include surveys to be performed during the source exchange, and for shipment, and acceptable radiation levels for these surveys. Such instructions must also state the steps to be taken if the survey levels exceed acceptable levels;
- If radiography personnel will perform instrument calibration, step-by-step instructions must be in the procedures; and
- If radiography personnel will perform leak testing of sealed sources, specific instructions for performing the leak test must be in the procedures. If the applicant will use commercially available leak test kits, the instructions and procedures provided by the kit suppliers should be modified to fit 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 should indicate that management will be informed, since dealing with suppliers is usually a management function.

B. Methods and Occasions for Conducting Radiation Surveys

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

- Determination of the boundaries of the restricted area;
- Determination after each exposure that the source has returned to the safe storage position. The entire circumference of the radiographic exposure device must be surveyed. If the radiographic exposure device has a source guide tube, the survey must include the entire guide tube. The radiographic exposure device must be locked between exposures and the key removed;
- Determination by physical survey that the source is in a safe storage position prior to securing a radiographic exposure device or storage container in storage;
- Determination of radiation levels at external surfaces of storage facilities, periodically, to ensure that exposure rates in unrestricted areas do not exceed the limits specified in WAC 246-221-060. Specify the frequency at which surveys will be made (at the time of the quarterly inventory is recommended);
- Determination of radiation levels in and around vehicles used for transporting or storing sources and devices; and
- Determination that containers prepared for shipment comply with U. S. Department of Transportation regulations.

The acceptable radiation levels for survey must be expressed in m Sv (milliroentgen) per hour.

WAC 246-221-110, WAC 246-221-230, and WAC 246-243-190 require that records of specific surveys be maintained. Judgment by industrial radiography licensees 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 department does not expect radiographers to record each and every reading taken during a survey. However, records should be complete enough to show clearly that proper surveys have been made.

C. Methods for Controlling Access to Radiographic Areas

WAC 246-221-120 (d) and WAC 246-221-120 (e) (i) require posting of Radiation Areas and High Radiation Areas, respectively.

For temporary jobsite radiography, instruct personnel to post “Caution - Radiation Area” signs at the distance calculated for a 0.02m Sv (two milliroentgen) per hour radiation level and to make a confirming survey after the source has been exposed for the first time.

For permanent radiographic installations, provide instructions to personnel about posting the entrance to the facility with “Caution (or Danger) High Radiation Area” signs and provide procedures to ensure that the visible-audible signal system is operable and used.

WAC 246-243-170 requires direct surveillance to protect against unauthorized entry into a high radiation area except where the high radiation area is equipped with a control device or alarm system or where the high radiation area is locked to protect against unauthorized or accidental entry.

For radiography in nonpermanent facilities, instruct personnel to keep the perimeter of the restricted area under constant surveillance. Specify steps to take in the event that unauthorized personnel enter the restricted area; for example, immediate termination of the radiographic exposure. Surveillance of the perimeter of the restricted area will protect against entry into the high radiation area and prevent unnecessary exposure of individuals.

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

WAC 246-243-070 requires that radiographic exposure devices and storage containers be physically secured to prevent tampering or removal by unauthorized personnel. It is not acceptable to merely chain or secure a device containing a source to a fence or post. Unless a radiographer or radiographer's assistant is physically present to maintain surveillance, a device containing a source should be placed in storage so it is not accessible to unauthorized persons.

There may be situations in which radiography is performed in such a location that it would take extraordinary effort to gain access to the device, e.g., at the top of a building under construction. In anticipation of such situations, provide specific procedures for an alternative method of securing the device, and the circumstances for the alternative method. Keep in mind that merely roping an area and posting signs does not constitute an acceptable alternative.

A storage location should be such that the area around it is an unrestricted area; the location should be posted with "Caution - Radioactive Material" signs. A physical survey must be performed to confirm that the area around the storage facility is an unrestricted area.

WAC 246-243-060 requires that devices be secured in the shielded position each time the source is returned to that position. The procedures for using the devices must require locking the devices at the end of each exposure and removing the key. A radiation survey must be performed to confirm that the source is in the safe shielded position. For crankout devices, the survey must include the guide tube and the device itself.

E. Personnel Monitoring and the Use of Personnel Monitoring Equipment

WAC 246-243-150 states that no individual may act as a radiographer or radiographer's assistant unless, during radiographic operations, that person wears a direct-reading pocket dosimeter, an alarming rate meter and either a film badge or thermoluminescent dosimeter (TLD) at all times. Personnel should be instructed that they are required to wear direct-reading pocket dosimeters, an alarming rate meter and film badges or TLDs when they are engaged in radiographic operations. Personnel should be instructed to charge their pocket dosimeters at the start of each shift so that the dosimeters are capable of reading full scale. The dosimeter readings must be recorded at the beginning and end of each shift.

Include instructions about how and where dosimetry devices are to be stored when not in use. The storage place should be dry, radiation free, and cool so that the devices will not be affected by adverse environmental conditions.

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

Transport of radiography sources in exposure devices or storage containers via public roads is subject to the regulations of the United States Department of Transportation (49 CFR Parts 170 and 172-178) by WAC 246-232-090, regulations of the Nuclear Regulatory Commission (10 CFR Part 34), and to appropriate license condition(s). These regulations cover, among other things, permissible radiation levels around and within a vehicle and placarding of the vehicle during transport. Information should be extracted and placed into the instructions so that personnel know exactly what they are expected to do. The following items must be covered in instructions to personnel:

- Labeling containers with the appropriate level as specified in 172.400 of 49 CFR of the Department of Transportation's regulations. Instruction on how to determine which label (Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III) must be used;
- Securing the exposure device or storage container within the transportation vehicle. The instructions should specify how the package is to be secured in the vehicle so that it cannot move during transport;
- Placarding both sides, the front, and back of the vehicle with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. Sections 172.500 through 527 of 49 CFR of the Department of Transportation's regulations contain the requirements for the placards. Such placarding should not be used when not required;
- The vehicle transporting the sealed source MUST contain a copy of the required shipping papers. The shipping papers MUST contain all the necessary information as prescribed by 49 CFR 172.200 through 172.600. 49 CFR 172.600 requires emergency response information and an emergency response telephone number; and
- A vehicle used for transport could also be used for storage at a temporary jobsite. If the vehicle will be used for storage, instructions to personnel should indicate that all transport requirements remain in place during storage. The vehicle should, of course, be locked when it is used for storage or transport.

#### G. Minimizing Exposure of Persons in the Event of an Accident - Emergency Procedures

An emergency situation is considered to exist whenever an abnormal event occurs, e.g., failure of source to return to the safe storage position. Since it is not possible to list or specify all potential situations that would constitute an emergency, a general instruction is acceptable.

Radiography personnel should not attempt to perform operations involving retrieval or recovery of a source not in the shielded position unless they have had specific instruction and actual practice in retrieval operations with a dummy source. If you intend that radiographic personnel perform source retrieval or recovery, include in your training program a description of the instruction they will receive, including practice with a dummy source and what special equipment, available for emergencies, will be used. In addition, include specific instructions for source retrieval in your operating and emergency procedures.

Unless personnel have had instruction and training in source retrieval or recovery, include the following instructions to personnel:

- Establish and post the restricted area at the 0.02m Sv (two milliroentgen) per hour radiation level;
- Maintain continuous surveillance of the restricted area until the situation is corrected;
- Notify management or other appropriate persons; and
- Describe the action to be taken by management.

#### H. Notification of Proper Persons in the Event of an Accident

In the emergency procedures, clearly identify the names and telephone numbers of management or supervisory personnel to be notified in the event of an accident as required by paragraph WAC 246-243-140 (8). The individuals to be notified should be those persons who are in a position to take appropriate action in an emergency or accident. Such persons could also include those in police and fire departments, depending on the emergency.

#### I. Maintenance of Records

When you are granted a license, you must generate and maintain the following records:

- Utilization logs as required by WAC 246-243-110. The instructions to personnel should clearly specify the need for the utilization log. The elements required are:
  - The make, model number, and serial number of the device and sealed source used;
  - Identification of the radiographer and assistants;
  - Where the device is used, the date used and the date returned to storage; and
  - The make, model and serial number(s) of the survey meter(s) used.
- Records of daily inspection of equipment as required by WAC 246-243-120. Instructions to personnel should specify that a record be made of the daily inspection.
- Pocket dosimeter (serial number(s)) readings as required by WAC 246-243-150. These readings should be made at the beginning and end of the work shift. Instructions to personnel must specify that the readings be recorded.
- Results of the physical survey following the final exposure of the day or operations as required by WAC 246-243-190 (3). Instructions to personnel should specify that a record of the final survey be made.

There are other operations performed by radiography personnel for which records must be generated. These operations may include quarterly inspection and maintenance, instrument calibration, shipment of packages, etc. If management requires radiographers to perform management operations associated with the performance of radiography, the instructions dealing with these operations should specify the need for an appropriate record of the performance of the operation.

Do not include instructions about records that are solely the responsibility of management.

#### J. Daily Inspection and Maintenance of Exposure Devices, Related Equipment and Storage Containers

WAC 246-243-120 (2) requires that exposure devices, storage containers, and source changers be checked for obvious defects prior to use, each day the equipment is used.

The instructions to personnel must clearly reflect the regulatory requirement that the daily inspection be performed each day before the equipment is used. If equipment is used on more than one shift during a day, the equipment must be checked at the start of each shift.

Specify in the instructions to personnel the items that must be checked and the steps to be taken if any defects are found in the equipment. Manufacturers of the equipment can provide a list of items that should be checked in the daily inspection. A record of the performance of the daily inspection must be made.

Exhibit 2 provides examples of instructions for daily inspection of radiographic devices. Your instructions should be tailored to your program and to the devices you are authorized to possess and use.

#### K. Off-Scale Pocket Dosimeter Readings

WAC 246-243-150 (2) requires that an individual's film badge or TLD be immediately sent for processing if the self-reading pocket dosimeter is found to be off-scale. There are no exceptions to this requirement. Regardless of the circumstances, the film badge or TLD must be sent for processing if the pocket dosimeter is found to be off-scale during or at the end of a work shift.

Instructions to personnel for action to be taken if a dosimeter is found to be off-scale should, as a minimum, include the following:

- Stop work immediately and place the source in a safe storage position in the exposure device;
- Have the individual(s) film badge or TLD processed immediately; and
- Notify the individual specified in the emergency procedures.

#### L. Product Malfunctions and Defects

If the radiographer discovers any malfunction or defect in the equipment, the radiographer must immediately notify the Radiation Safety Officer.

#### **Item 16. Waste Disposal**

Waste disposal can usually be accomplished by returning all waste to the manufacturer. If it is desired to use another firm or individual other than the manufacturer of sealed sources for waste disposal, then this firm or individual must hold a specific radioactive materials license to perform such services. Sealed sources may only be transferred to a person or firm holding a specific license for receipt or disposal of the specific type and amount of radioactive material involved.

Specify on the application whether radioactive waste will be returned to the manufacturer or whether some other arrangement will be followed. If other, attach an explanation to the application.

#### **Item 17. Management Controls**

WAC 246-235-084 (5) requires that the license applicant submit a description of the overall organizational structure of the radiography program, including specific delegation of authority and responsibility for the program. The applicant should describe how active control over the radiography program is exercised by management personnel in positions of authority. Each individual in the line of authority should be identified by name and title. If the Radiation Safety Officer delegates duties and responsibilities to persons of lesser authority, the application must identify those persons and specify how management will ensure that their duties are properly performed.

WAC 246-243-050 requires an internal inspection system adequate to ensure that state regulations, license provisions, and your operating and emergency procedures are followed by radiographers and radiographers' assistants. You should submit a description of your internal inspection program that includes the specific matters to be considered in an inspection and a discussion of management action to be taken to correct any deficiencies. Your internal inspection program must cover field audits of each radiographer and radiographer's assistant, while actually performing radiography, at intervals not to exceed six months. Include such a commitment in your application.

Inspections must be made on-the-job and should be unannounced. If a radiographer or radiographer's assistant does not perform radiography for a period that exceeds six months since the last inspection, the radiographer must demonstrate knowledge of the requirements and the radiographer's assistant must demonstrate knowledge by a practical examination before these individuals can next participate in a radiographic operation.

Specify the name, training, and experience of each individual who will conduct internal inspections. An individual who conducts internal inspections must have a minimum of one year of actual experience as a radiographer.

Exhibit 3, Internal Inspection Checklist, provides an example of an acceptable, generic, internal inspection. Your internal inspection checklist should be tailored to your program.

#### **Item 18. Training for Radiographers and Radiographer's Assistants**

Radiographers and radiographer's assistants must have adequate training and experience as outlined in WAC 246-243-130. Because WAC 246-243-130 contains different requirements for radiographers and radiographer's assistants, include the sequence of events from the time of hiring through the designations of individuals as radiographers or radiographer assistants. Experienced radiographers who have worked for another licensee should receive formal instruction similar to that given to prospective radiographer's assistants. This instruction must include training in your operating and emergency procedures, in the use of your exposure devices and associated equipment, and in the use of survey meters and other radiation monitoring devices.

Instructors who provide classroom training to individuals in the principles of radiation and radiation safety should have knowledge and understanding of these principles beyond those obtainable in a course similar to the one given to prospective radiographers. Individuals who provide instruction in the hands-on use of radiography equipment should be qualified radiographers with at least one year of experience in performing radiography, or should possess a thorough understanding of the operation of radiographic equipment.

Submit an outline of the training to be given to prospective radiographers and radiographer's assistants. Submit your procedures for experienced radiographers who have worked for another licensee. Provide a copy of a typical examination and the correct answers to the examination questions. Indicate the passing grade. Specify the qualifications of your instructors in radiation safety principles and describe their experience with radiography. Describe the practical examination that will be given to prospective radiographers and radiographer's assistants. Describe the annual refresher training program, including topics to be covered and how the training will be conducted. Submit your procedures for verifying that their certification remains valid. As a minimum your procedures for newly hired, previously certified individuals should require documentation of your contracting the certifying entity and confirming the certification.

X-ray training by itself will not be considered adequate experience for performing gamma radiography.

**Item 19. License Fee**

The license fee must accompany the application. The applicant must refer to supplemental license fee information to determine the amount due. Fees are due at time of submission of a new license application. Thereafter, the licensee will be billed annually. State in the space provided the amount of fee submitted with the application.

**Item 20. Certificate**

Each application for a radioactive materials license must be signed and dated by the appropriate corporate or company official. The application must be signed by corporation management or a company owner. The application may not be signed by the Radiation Safety Officer, unless the Department has on file an authorization from corporate management or a company owner that the Radiation Safety Officer is authorized to make commitments for the company.

**Amendments to Licenses**

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

Applications for license amendments may be filed in letter form. The application should identify the license by company name and radioactive materials license number. It should clearly describe the exact nature of the requested changes, additions, or deletions.

References to previously submitted information and documents must be clear and specific and must identify the pertinent information by date, page, and paragraph. Currently there is no fee for a license amendment.

**Renewal of a License**

Industrial radiography radioactive materials licenses are issued for a period not to exceed five years.

An application for renewal of a license must be filed at least 30 days prior to the expiration date as provided for in WAC 246-235-050, to ensure that the license does not expire until final action on the application has been taken by the department.

Renewal applications must be filed on Form RHF-11R, "Application for Radioactive Material License - Industrial Radiography," appropriately supplemented in accordance with the instructions in the application and these instructions. The application must contain only complete and up-to-date information about the applicant's current program.

To facilitate the review process, the application for renewal should be submitted without reference to previously submitted documents and information. If such references cannot be avoided, they must be clear and specific and must identify the pertinent information by date, page, and paragraph.

## Exhibit 1

### Calibration of Instruments

1. Calibration of survey meters should be performed with radionuclide sources\* that approximate point sources.
  - The source activities should be traceable within 5% accuracy to the U.S. National Institute of Standards and Technology (NIST) calibrations.
  - WAC 246-243-080 requires that survey instruments be calibrated at intervals not to exceed six (6) months and after every A. servicing or repair.
  - Each scale in the range from 0.02m Sv (two milliroentgen) per hour through 10m Sv (one roentgen) per hour is required to be calibrated at two widely separated (i.e., 1/4 & 3/4, or 1/3 & 2/3) points on each scale other than zero. Other points should be checked.
  - The highest and lowest points used to calibrate each scale of the instrument should be separated by at least 50% of the scale.
  - The exposure rate measured by the instrument should be within plus or minus 20% of the true exposure rate.
  - A calibration chart or graph containing the calibration factor, the date of last calibration, and due date of next calibration must be affixed to the survey meter.
2. The use of the small check source that is incorporated into some survey meters is not appropriate or acceptable for calibration purposes.
3. WAC 246-243-080(3) requires that records of the calibrations discussed in Item 1 be maintained for three years.
4. The inverse square law and radioactive decay law may be used for calibration. A calibrated source will have a calibration certificate giving its output at a given distance measured on a specified date by the manufacturer. The inverse square law may be used with any point source to calculate the exposure rate at other distances. The radioactive decay law may be used to calculate the output at any time after the specified date.

#### A. 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

$$R_a D_a^2 = R_b D_b^2$$

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  $R_a D_a^2$  and  $D_b$  are known,  $R_b$  can be calculated from  $R_b = \frac{D_a^2}{D_b^2} \times R_a$

#### B. Radioactive Decay Law

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

$$R_t = R_0 \times e^{-\left(\frac{0.693}{T_{1/2}}\right) \times t}$$

Where

$R_t$	is the exposure rate at a time "t" after the source calibration date
$R_0$	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  $R_0$  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.).

\* Sources of Cesium-137, Radium-226, or Cobalt-60 are appropriate for use in calibrations. The activity of the calibration standard should be sufficient to calibrate the survey meters on all ranges up to 10m Sv (one roentgen) per hour. If there are higher ranges, they should at least be checked for operation and approximately correct response to radiation.

## Exhibit 2

### Daily Maintenance Check of Radiographic Device and Related Equipment

The radiographer will perform a daily maintenance check of the exposure device and related radiographic equipment. This inspection will be conducted prior to the use of the equipment on each day that radiographic work is to be performed. Report defective equipment to the RSO immediately. Do not attempt to use defective equipment. After determining that the equipment is operative, record the condition of the radiographic equipment.

#### 1. Inspect remote-control radiographic equipment as follows:

- Inspect the cables for cuts, breaks, and broken fittings;
- Inspect the crank for damage and loose hardware;
- Check operation of controls for freedom of drive cable movement;
- Survey for radiation levels and record readings. The radiation levels should be about the same as those in previous daily inspections;
- Check that all safety plugs are in place;
- Inspect the exposure device for damage to fittings, lock, fasteners, and labels;
- Check for any impairment of the locking mechanism; and
- Record the results of the daily inspection in the log.

#### 2. Inspect a typical pipeliner device as follows:

- Source Shield Assembly:
  - Make a radiation survey of exterior surfaces of the source shield assembly. With the center of the survey meter six inches (15 cm) from the surface, the radiation levels should not exceed 0.25 milliroentgen per hour per curie. Example: 80 curies x 0.25 mR/hr = 20 mR/hr.
  - Visually inspect for signs of damage. Check the fastenings on the actuator. Look for missing or loose fasteners. Check to ensure the safety wiring on the fasteners is intact. Check the nameplate bearing the radiation symbol and any other required labels for presence and legibility. Check that the lock is operable.
- Control Assembly:
  - Visually check for damage. Test for leaks by turning the control valve to OFF. Pump a vacuum of approximately 15 inches and observe the gauge. (The gauge should remain steady. A falling gauge indicates a leak. A leaking control assembly must be repaired by an authorized vendor prior to any further use of the assembly.)
- System Check:
  - Conduct the check in an area where the source may be exposed. Position the source shield assembly so that the beam is directed away from you, preferably into a shielding wall or floor. Place a survey meter turned "ON" adjacent to the device so you can observe it.
  - Connect the tube to the source shield assembly.
  - Lock the device.
  - Connect the tube to the control assembly.
  - Set the control valve to OFF.
  - Pump vacuum to approximately 15 inches.
  - Turn the control to ON. Observe your survey meter. The radiation level should not change. If the radiation level increases, the lock is faulty and must be repaired.
  - Observe the vacuum gauge. A falling gauge indicates a leak in the control hose or source actuator.
  - Turn the control to OFF.
  - Remove the hose from the source shield assembly.
  - Important: Be sure the control valve is turned to OFF. Be sure the hose is removed from the source shield assembly before unlocking.
  - Unlock the device.
  - Replace the hose in the source shield assembly.
  - Turn the pump control valve to ON. Observe your survey meter. The radiation level should increase. Turn the control valve to OFF. The radiation level should decrease to initial level.
  - Record results of the daily inspection in the log.

Exhibit 3  
**Field Radiography  
 Internal Inspection Checklist**

Radiography Location \_\_\_\_\_ Date \_\_\_\_\_ Time \_\_\_\_\_

Radiographer \_\_\_\_\_ Inspector \_\_\_\_\_

Radionuclide \_\_\_\_\_ Curies \_\_\_\_\_ Serial# \_\_\_\_\_

Camera Serial # \_\_\_\_\_ Camera Make & Model# \_\_\_\_\_

Survey Meter Model # \_\_\_\_\_ Serial # \_\_\_\_\_ Calib Due Date \_\_\_\_\_

- |  | Yes                      | No                       |
|--|--------------------------|--------------------------|
| 1. Was the radiographer/assistant wearing his/her film badge, alarming ratemeter and calibrated dosimeter?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 2. Were other individuals working within the restricted area wearing film badges and dosimeters?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. Was the restricted area posted with sufficient "Caution Radiation Area" signs?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. Was the restricted area properly controlled to prevent unauthorized entry?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 5. Was the high radiation area posted with sufficient "Caution (or Danger) High Radiation Area" signs?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. Did the radiographer/assistant have and use a calibrated and properly operating survey meter?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 7. Were the utilization log and daily pocket dosimeter log properly filled out?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Did the radiographer/assistant have sufficient knowledge of safety rules? (Ascertained by oral questions.)  | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Was the radiographer/assistant working with defective equipment?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 10. Did the radiographer/assistant properly survey the camera and source tube and take a radiation reading one foot (0.3m) in front of the source following the radiographic exposure? | <input type="checkbox"/> | <input type="checkbox"/> |
| 11. Were radionuclides stored properly and kept locked to prevent unauthorized removal?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 12. Was the storage area posted with "Caution - Radioactive Material" signs?   | <input type="checkbox"/> | <input type="checkbox"/> |
| 13. Did the radiographer/assistant possess a copy of the applicant's operating and emergency procedures and the state of Washington Statutes and Rules for Radiation Protection?       | <input type="checkbox"/> | <input type="checkbox"/> |
| 14. Did the radiographer/assistant properly combine the survey meter reading and meter scale used to accurately determine dose rate(s)?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 15. Was proper visual surveillance of the restricted area maintained?  | <input type="checkbox"/> | <input type="checkbox"/> |
| 16. Were there any items of noncompliance other than those listed on this form? (If any, explain in remarks.)  | <input type="checkbox"/> | <input type="checkbox"/> |

Remarks \_\_\_\_\_  
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