

# **LICENSING GUIDE**

**INSTRUCTIONS FOR PREPARING AN APPLICATION  
FOR A RADIOACTIVE MATERIALS LICENSE AUTHORIZING  
THE  
USE OF SEALED RADIOACTIVE SOURCES  
IN  
INDUSTRIAL RADIOGRAPHY DEVICES**

**December 31, 2005**

## TABLE OF CONTENTS

I.	<u>INTRODUCTION</u> .....	4
	A. PURPOSE OF LICENSING GUIDE .....	4
	B. AGREEMENT STATE .....	4
	C. MANAGEMENT RESPONSIBILITY .....	5
	D. APPLICABLE REGULATIONS .....	5
	E. PURPOSE OF APPENDICES, EXHIBITS AND SUPPLEMENTS .....	6
II.	<u>FILING AN APPLICATION</u> .....	7
	A. GENERAL .....	7
	B. LICENSE FEES .....	8
III.	<u>CONTENTS OF AN APPLICATION</u>	
	Item 1. NAME AND MAILING ADDRESS OF APPLICANT .....	9
	Item 2. STREET ADDRESS(ES) .....	9
	Item 3. PERSON TO CONTACT REGARDING APPLICATION .....	9
	Item 4. TELEPHONE NUMBER .....	9
	Item 5. LICENSE FEE .....	10
	Item 6. TYPE APPLICATION .....	10
	Item 7. INDIVIDUAL USERS .....	10
	Item 8. TRAINING AND EXPERIENCE USERS .....	10
	Item 9. RADIATION SAFETY OFFICER .....	11
	Item 10. TRAINING PROGRAM .....	12
	Item 11. RADIOACTIVE MATERIAL .....	12
	Item 12. LEAK TESTS .....	13
	Item 13. RADIATION DETECTION INSTRUMENTS .....	13
	Item 14. CALIBRATION OF INSTRUMENTS .....	14
	Item 15. PERSONNEL MONITORING PROGRAM .....	14
	Item 16. FACILITIES AND EQUIPMENT .....	15
	Item 17. RADIATION SURVEY PROGRAM .....	16
	Item 18. ORDERING, RECEIVING AND SHIPPING .....	16
	Item 19. WASTE DISPOSAL .....	17
	Item 20. CONTROL AND SECURITY OF RADIOACTIVE MATERIAL .....	17
	Item 21. TRANSPORTATION .....	18
	Item 22. OPERATING PROCEDURES .....	19
	Item 23. EMERGENCY PROCEDURES .....	19
	Item 24. ADMINISTRATIVE PROCEDURES .....	20
	Item 25. MANAGEMENT CONTROL .....	20
	Item 26. CERTIFICATE .....	21

IV. LICENSE AMENDMENTS.....	21
V. LICENSE RENEWAL.....	22
VI. LICENSE TERMINATION.....	22
VII. LIST OF ATTACHMENTS.....	23

#### APPENDICES

App. A	ALARA Program
App. B	Duties and Responsibilities of the Radiation Safety Officer
App. C	Radiation Safety Training Program
App. D	Leak Tests of Sealed Radioactive Sources
App. E	Calibration of Radiation Survey Instruments
App. F-1	Personnel Monitoring
App. F-2	Dose Limit for Members of the Public
App. G	Facilities and Equipment
App. H	Increased Controls
App. I	Radiation Surveys
App. J	Ordering, Receiving and Shipping Packages Containing Radioactive Material
App. K	Disposal or Transfer of Radioactive Material
App. L	Access Control and Security of Temporary Job Sites
App. M	Transportation of Radiographic Devices
App. N	Operating Procedures
App. O	Emergency Procedures
App. P	Administrative Requirements
App. Q	Radiation Safety Program Annual Review

#### EXHIBITS

Ex. A	Model Shipping Paper – Common Carrier Shipments
Ex. B	Model Shipping Paper – Exclusive Use Shipments
Ex. C	Radiography Equipment Inspection and Maintenance
Ex. D	Performance Review Checklist
Ex. E	Information to Consider for Procedures
Ex. F	Daily Maintenance Check of Radiography Equipment
Ex. G	Model Emergency Response Information

## **INTRODUCTION**

### **A. PURPOSE OF GUIDE**

This Licensing Guide provides instructions to an applicant for preparing an application for a specific license authorizing the possession and use of radioactive material in the form of sealed sources contained in radiographic exposure devices (cameras) or other portable devices (for example, source changers) for industrial radiography. It also describes the Department of Health and Human Service's criteria for evaluating an industrial radiography license application. The phrases "industrial radiography device", "radiographic device" or "exposure device", or "camera" may be used interchangeably in this Licensing Guide. The Guide addresses a variety of the many radiation safety issues associated with the possession and use of radiographic exposure devices.

The information submitted in the application must be sufficient to demonstrate that proposed equipment, facilities, personnel, and procedures are adequate to protect the public health and safety of the citizens of Arkansas. Submission of incomplete or inadequate information will result in delays in the approval process for the license. Additional information will be requested when necessary to ensure that an adequate radiation safety program will be established and implemented. Such requests for additional information will delay completion of the application's review and may be avoided by a thorough study of the regulations and these instructions prior to submitting the application.

<b>NOTE:</b> <b>The Licensing Guide for Industrial Radiography Devices is not a regulation. It serves only as guidance to assist the Applicant in completing an Application for Radioactive Material License.</b>
---

### **B. AGREEMENT STATE**

Arkansas is an Agreement State with the U.S. Nuclear Regulatory Commission (NRC). This Agreement authorizes the State of Arkansas to assume regulatory authority over most activities involving radioactive material within the state. The exceptions are nuclear power plants and federally controlled facilities, which remain under NRC jurisdiction. The Arkansas Department of Health and Human Services (Department), Radiation Control Section, Radioactive Materials Program, regulates the possession and use of radioactive material within Arkansas. Under authority of the Arkansas State Board of Health's, Rules and Regulations for Control of Sources of Ionizing Radiation, the Department issues licenses to users of radioactive material and performs inspections to ensure compliance with the regulations.

### C. MANAGEMENT RESPONSIBILITY

The Department recognizes that effective implementation and management of the radiation safety program is mandatory for achieving a safe program that complies with the Rules and Regulations for Control of Sources of Ionizing Radiation.

To help insure effective management involvement in all aspects of the radiation safety program, the Department requires that a management representative sign the license application acknowledging management's overall commitment to and responsibility for the following:

1. Radiation safety, security, and control of radioactive material.
2. Completeness and accuracy of the radiation safety program records and all information provided to the Department.
3. Knowledge about the contents of the application and license.
4. Committing adequate resources (including personnel, time, facilities and equipment) to the radiation safety program to help insure the general public and workers are protected against radiation hazards.
5. Compliance with the Rules and Regulations for Control of Sources of Ionizing Radiation
6. Selecting and assigning a qualified Radiation Safety Officer (RSO).

### D. APPLICABLE REGULATIONS

The following portions of the Rules and Regulations for Control of Sources of Ionizing Radiation are applicable to the use of radioactive material in the form of sealed sources in portable devices and should be used in conjunction with these instructions:

- ◆ Section 2 “Licensing of Radioactive Materials”
- ◆ Section 3 “Standards for Protection Against Radiation”
- ◆ Section 4 “Transportation of Radioactive Materials”

The Department periodically amends the regulations. Notification of proposed changes will be provided as they occur in accordance with the Administrative Procedures Act of the State of Arkansas.

Industrial Radiography Device licensees are also subject to U.S. Department of Transportation (DOT) regulations, which are found in Title 49, Code of Federal Regulations (49 CFR), Parts 170 through 189. Copies of 49 CFR can be ordered by writing the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 371954, Pittsburg, PA 15250-1954. The web site for U.S. Department of Transportation is [www.dot.gov](http://www.dot.gov).

## **E. PURPOSE OF APPENDICES AND EXHIBITS**

The regulations require applicants to acquire equipment, train workers, and implement procedures that will ensure compliance. In addition to the “Application for Radioactive Material License”, a set of appendices, exhibits and supplements are enclosed to assist the Applicant in the development of a portable gauge radiation protection program. Appendices contain information that must be submitted for review (for example, Appendix D, Leak Test of Sealed Radioactive Sources) and model procedures that may be used to meet regulatory requirements. Equivalent procedures are also acceptable but must be submitted for approval by the Department. The Applicant must decide which Procedure to use, either the Appendix or Equivalent, and must commit to that decision. Exhibits are examples of the types of documents or forms that must be submitted as part of the application, and in several cases, are model forms that may be used by applicants to satisfy regulatory requirements.

Carefully read the applicable regulations, model procedures and forms before deciding if the models are appropriate for the activities being requested. Model procedures and forms may be adopted by submitting them as part of the license application, or may be used as guides for developing equivalent procedures. Item VII, “List of Attachments” (Page 23 of the Licensing Guide) provides a table to indicate which model or equivalent procedures have been attached to the submitted application

**NOTE: Some of the information contained in this Licensing Guide was taken from the following documents:**

- **U.S. Nuclear Regulatory Commission (NRC) document, NUREG-1556, Volume 2, “Consolidated Guidance About Materials Licenses, Program-Specific Guidance About Industrial Radiography Licenses”,**
- **State of Florida, Department of Health, Bureau of Radiation Control, Regulatory Guide 1.40, “Instructions for Preparing Applications for Radioactive Material Licenses Authorizing Industrial Radiography” (Draft),**
- **State of Texas; Department of Health, Bureau of Radiation Control, Regulatory Guide 2.1, “Guide for Radioactive Material-Industrial Radiography”**

**The information is used with permission of the NRC and the States of Florida and Texas.**

## **FILING AN APPLICATION**

### **A. GENERAL**

An application for a specific license to use radioactive material in the form of sealed sources in industrial radiography devices should be submitted on the "Application For Radioactive Material License". Space provided on the application form is limited, so separate 8.5 x 11 inch sheets of paper should be attached. Each additional sheet submitted with the application should be identified and keyed to the item number on the Application form to which it refers.

The application must be completed in triplicate. Send two (2) copies of the completed application to:

Arkansas Department of Health and Human Services  
P.O. Box 1437, Slot H-30  
Little Rock, Arkansas 72203-1437

Retain at least one copy of the submitted application form, with all attachments. When issued, the license will require that radioactive material be possessed and used in accordance with statements, representations and procedures provided in the application and the supporting documentation. Regulatory requirements specified in the Rules and Regulations for Control of Sources of Ionizing Radiation shall govern unless the statements, representations and procedures set forth in the license application and correspondence are more restrictive than the regulations.

All license applications will be available for review by the general public in the Department. If it is necessary to submit proprietary information, follow the procedure in the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-4040, "Public Record-Exceptions". Failure to follow this procedure could result in disclosure of the proprietary information to the public or substantial delays in processing the application. Employee personal information, (for example, home address, home telephone number, social security number, date of birth, radiation dose information), should not be submitted unless specifically requested by the Department.

## **B. LICENSE FEES**

The following fees are assessed:

<u>License Application fee</u>	A non-refundable administrative fee for processing a new license application is \$1,000.  <u>Review of the application will not begin until the proper fee is received by the Department.</u>
<u>License Amendment Fee</u>	A non-refundable administrative fee for processing an application to amend an existing license. The amount of license amendment fee is \$50.00 per amendment.  <u>Review of the amendment request will not begin until the proper fee is received by the Department.</u>
<u>Annual fee</u>	An annual fee covers the Department costs for administering the radioactive materials licensing program. The annual fee for an Industrial Radiography license is \$1000.  The Annual Fees are due January 1 of each year.

## **CONTENTS OF AN APPLICATION**

### **1. NAME AND MAILING ADDRESS**

List the legal name of the applicant's corporation or company, including the designation "doing business as", or other legal entity with direct control and responsibility for the use of the radioactive material and to whom the license will be issued. A division or department within the corporate organization may not be the licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity.

Provide the mailing address where correspondence should be sent.

Provide the telephone number of the corporation or company.



<b>NOTE:</b> <b>The Department must receive prior notification in the event of change of ownership or control or any bankruptcy proceedings.</b>
--

**2. STREET ADDRESS AT WHICH RADIOACTIVE MATERIAL WILL BE USED AND/OR STORED (IF DIFFERENT FROM ITEM 1.)**

List the physical street address, city, state, and Zip Code for each permanent facility or place where radioactive material will be used and/or stored, if other than described in Item 1. Do not list an address as a Post Office Box.

The use of temporary job sites should be requested by adding the statement “at temporary job sites throughout the State of Arkansas.” The use of licensed radioactive material at temporary job sites will become part of the license conditions. Each separate location of temporary use does not need to be specified so long as the job sites are used only for a single job lasting less than 180 days.

**3. PERSON TO CONTACT REGARDING THIS APPLICATION**

Identify the person who can answer questions about the application. This is typically the proposed Radiation Safety Officer, unless the Applicant has named a different person as the contact. The Department will contact this individual if there are questions about the application.

**4. TELEPHONE NUMBER FOR CONTACT PERSON**

Provide the telephone number of the contact person, if different than the telephone number provided in Item 1.

**5. LICENSE FEE ENCLOSED**

Mark the appropriate choice. Provide an explanation if the License Fee is not enclosed. Review of the application will not begin until the proper fee is received by the Department.

Make all checks payable to the “Arkansas Department of Health and Human Services”.

**6. TYPE APPLICATION**

Mark the appropriate choice. If the application is for a renewal, identify the applicable Radioactive Materials License Number.

## 7. **INDIVIDUAL USERS**

List each individual to be designated as a **Radiographer, Radiographer Instructor, and Radiographer's Assistant**. A radiography license does not typically list the names of radiographic personnel. Instead, Condition 12 of the license states that "licensed materials shall only be used by radiographic personnel that have successfully completed the licensee's training program described in their license application..." It should, however, be noted that at its discretion, the Department may include the names of radiographic personnel on the radioactive material license. Maintaining documentation of training for each user on file for inspection purposes is required to demonstrate that personnel are adequately trained.

## 8. **TRAINING AND EXPERIENCE OF RADIOGRAPHIC PERSONNEL IN RADIATION SAFETY**

### a. **FORMAL TRAINING IN RADIATION SAFETY**

1. The State of Arkansas requires that before an individual serves as a Radiographer or Radiographer Instructor the individual must be certified through by a radiographer certification program through a certifying entity.
2. Submit documentation of radiographer certification and the radiation safety training for each person listed in Item 7 of the application. Restrict training documentation to relevant information; i.e., demonstrating that the individual has the radiation safety training and experience specific to the requested activities to be conducted. Appropriate training certificates are acceptable, but must be supplemented with documentation of completion of training in company operating and emergency (O&E) procedures if third parties were used to provide training.
3. Appendix C, "Radiation Safety Training Requirements" of this guide provides detailed descriptions of the radiographic personnel training and qualification requirements. The required documentation that is to be submitted for each radiographer classification is also described.
4. Maintaining documentation of training (including valid training certificates) on file for inspection purposes for all radiographic personnel is required by the Department to demonstrate that radiography personnel are adequately trained.

b. **EXPERIENCE**

Describe any additional relevant work experience with radiation and include where the experience was obtained. Descriptions of experience are typically unnecessary unless seeking approval for an individual to act as a Radiographic Instructor for in-house radiation safety training.

**Note:** To prevent the potential for identity theft, never submit documentation that lists individuals' social security numbers or birth dates.

9. **RADIATION SAFETY OFFICER (RSO)**

- a. Provide the name of the individual assigned the position of RSO. This person is designated by, and responsible to, management for the for implementing the Radiation Safety Program and the As Low As Reasonably Achievable (ALARA) Program, and for ensuring compliance with the applicable regulations and license provisions. The ALARA Program is discussed in Appendix A, "ALARA Program.

The RSO must have independent authority to stop operations that are considered unsafe. It must be committed to and confirmed by management that the individual serving as the RSO will have the sufficient time to and commitment from management to implement the radiation safety program to insure that the radioactive material is used in a safe manner. Management involvement in and support of the radiation protection program is discussed in Item 25, Management Control.

- b. The RSO must be based in the immediate area and able to provide direct oversight of the licensee's daily operations. The RSO may delegate certain day-to-day tasks of the radiation protection program to other responsible individuals (potential designees). For example, a large testing company with multiple field stations may appoint individuals designated as "site RSOs" who assist the RSO and are responsible for the day-to-day activities at the field stations. Licensees may also appoint other individuals who may "step-in" as an emergency contact when the RSO is unavailable. The potential designees do not need to meet the required RSO qualifications; however, these individuals should be qualified, experienced radiographers who are adequately knowledgeable of the activities to which they are assigned. Applicants do not have to identify other responsible individuals if day-to-day tasks, etc. will not be delegated.

- c. As a minimum, the RSO must complete radiographer training, and must have a minimum of 2,000 hours (one year full-time field experience) of hands-on experience as a qualified radiographer, and must have formal training in establishing and maintaining a radiation protection program. Documentation of the RSO's training and experience must be included in Item 8, above.

#### **HOLD FOR APPENDIX**

To be considered eligible for the RSO position, an individual must be a qualified radiographer. This should be a course specifically designed to provide training in running a radiation safety program, a basic radiation safety course is not acceptable. While a course particular to industrial radiography would be highly encouraged, this is not required. Acceptable training programs would be a classroom course typical of those provided through universities or commercial training facilities. Hands-on experience means experience in all areas considered to be directly involved in the radiography process. This includes taking radiographs, surveying device and radiation areas, transporting the radiography equipment to temporary jobsites, posting, work sites, radiation area surveillance, completing and maintaining records, etc. Excessive time spent in only one or two of these operations (film development and/or area surveillance) should not be counted toward the 2,000 hours. Experience with radiography using x-rays can be included; however, the majority of experience should be in isotope radiography.

#### **10. TRAINING PROGRAM**

Describe the training program for Radiographic Personnel and for Ancillary Personnel. The training must be adequate to insure that individuals working with radioactive material, or who may be in the general vicinity where the radioactive material is used or stored, are aware of possible hazards, safety precautions, and emergency procedures that are associated with the use of the material.

Appendix C, "Radiation Safety Training Program", describes the types of training programs that are required and prescribes the frequency at which each program is conducted. Appendix C may be used as the description of the Applicant's training program provided it is included with the application along with a statement of commitment to the program by the Applicant.

## 11. RADIOACTIVE MATERIAL

a. **ELEMENT AND MASS NUMBER**

Specify each isotope of radioactive material requested, for example, "Iridium-192". Also, identify any depleted uranium (DU) that is used as shielding material.

b. **CHEMICAL AND/OR PHYSICAL FORM**

Identify each form of radioactive material requested, for example, "Sealed Source, Source Assembly, etc.". State the name of the source manufacturer and the sealed source model number.

c. **MAXIMUM AMOUNT TO BE POSSESSED AT ANY ONE TIME**

Indicate the total amount of radioactive material requested and the maximum activity per source. The following is an example of the information to be submitted and the proper format to provide the information.

(a) ELEMENT AND MASS NUMBER	(b) CHEMICAL AND/OR PHYSICAL FORM	(c) MAXIMUM AMOUNT TO BE POSSESSED AT ANY ONE TIME
1. Iridium-192	1. Sealed source (XYZ, Inc. Model 123 )	1. 3 sources; no single source to exceed 120 Curies
2. Cobalt-60	2. Sealed source (XYZ, Inc. Model 456 )	2. 2 sources; no single source to exceed 110 Curies

d. **PURPOSE FOR WHICH RADIOACTIVE MATERIALS LISTED IN ITEM 11.a. WILL BE USED**

Specify the use for each source of radioactive material requested. Include the name of the manufacturer of the exposure device and/or source changer in which each sealed source will used or stored. The following is an example of the information to be submitted and the proper format to provide the information.

1. and 2. For use in XYZ Corporation Model 2000 exposure device for industrial radiography.
---

e. **Additional information to be provided**

1. Confirm that each sealed source, device, and source/device combination possessed is registered in the Sealed Source and Device Catalogue as an approved sealed source or device by the U.S. Nuclear Regulatory Commission or an Agreement State and will be possessed and used in accordance with the conditions specified in the registration certificate.
2. Confirm that all radiographic exposure devices, source assemblies or sealed sources, and all associated equipment which meet the requirements specified in Paragraph RH-1801, "Equipment Control" of the Rules and Regulations will be used in radiographic operations
3. Confirm that associated equipment is compatible with the exposure devices, source changers, and sealed sources containing radioactive material.

**12. LEAK TESTS**

Each sealed radioactive source shall be periodically tested to determine if radioactive material is leaking from the sealed source in the exposure device. Additionally, leak testing of devices containing depleted uranium (DU) shielding to determine whether there is any radioactive leakage from the device is also required. Sealed sources containing byproduct material must be leak tested at intervals not to exceed 6 months and DU devices tested at intervals not to exceed 12 months.

Appendix D, "Leak Test Procedures", describes the requirement for leak testing and provides instructions for performing and documenting the tests.

Form D, entitled "**Leak Tests for Sealed Sources**", requests specific information on the proposed leak test program and how it will be performed. Complete Form D and submit it with the application.

**13. RADIATION DETECTION INSTRUMENTS**

The possession and use of appropriate radiation survey instruments is required for all licensees who will conduct industrial radiography operations. The survey instrument shall be capable of accurately measuring the radiation fields produced by the sealed source currently in use, and be visually checked for damage and for proper operation with a radiation source at the beginning of each day of use and at the beginning of each work shift to insure proper operation.

Licensee shall keep sufficient calibrated and operable radiation survey instruments at each location where radioactive material is present to make the required radiation surveys. The instruments shall be capable of measuring a range from 2 mrem (0.02 mSv) per hour through 1 rem (10 mSv) per hour.

Radiation survey instruments shall be calibrated at intervals not to exceed 3 months and after each servicing, (except for battery changes).

#### **14. CALIBRATION OF INSTRUMENTS**

Radiation survey instruments must be periodically calibrated (**not to exceed 3 months and after each servicing**) to insure the instrument accurately detects and measures radiation from the sealed source. The calibration service must be performed by a Service Vendor who is licensed or registered to perform the service by the Arkansas Department of Health and Human Services, the U.S. Nuclear Regulatory Commission, or an Agreement State. However, the licensee may be authorized to calibrate instruments “in-house” provided certain requirements are met. Additional guidance for performing instrument calibration is provided in Appendix E. Complete Form E marking the appropriate spaces to describe how the calibration will be performed.

If an applicant elects to perform radiation survey instrument calibration “in-house”, detailed, step-by-step procedures are required to be submitted for each instrument that will be calibrated. Also, the radiation source(s) that will be used for calibration must be included in Item 11, Radioactive Material.

#### **15. PERSONNEL MONITORING PROGRAM**

- a. The Licensee may not permit any individual to act as a Radiographer or a Radiographer’s Assistant unless, at all times during radiographic operations, each individual wears, on the trunk of the body, a combination of a direct reading pocket dosimeter, an operable alarm ratemeter, and either a firm badge , a thermoluminescent dosimeter (TLDs) and optically stimulated luminescent dosimeter (OSLD. These Personnel Monitoring Devices are described in Appendix F, “Personnel Monitoring”.

At permanent radiography installations where other appropriate alarming and warning devices are routinely used, the wearing of an alarming ratemeter is not required.

Describe the proposed personnel monitoring program by completing Appendix F-1, Form F-1, “Personnel Monitoring Program” and submit the completed Form with the application.

- b. Radioactive Material Licensees are required to insure that no member of the public receives a radiation dose from sources under the control of the Licensee that exceeds the dose amounts referenced in the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1208, “Dose Limits for Individual Members of the Public”. These limits are not to exceed:

- (1.) **Total Effective Dose Equivalent: 100 millirem per year**
- (2.) **Dose in any unrestricted area: 2 millirem in any one hour**

Paragraph RH-1209, “Compliance with Dose Limits for Individual Members of the Public” requires that the Licensee show compliance with the annual dose limit.

Appendix F-2, “Dose Limit for Members of the Public”, provides additional information on the annual dose limits for members of the public and provides a methodology for determining and documenting the dose. Complete Appendix F-2 by marking the appropriate boxes and providing the requested information.

Submit the completed Appendix F-2 with the application.

## 16. FACILITIES AND EQUIPMENT

Radioactive material licenses are written to authorize the performance of industrial radiography at either permanent radiographic installations or at temporary job sites inside a facility (e.g., manufacturing plant), or throughout the State of Arkansas (remote pipeline), or some combination thereof.

Appendix G, “Facilities and Equipment” contains the information that must be submitted in the application thoroughly describing the physical facilities and equipment associated with the storage and use of radiographic devices at the proposed “use locations”. The facilities and equipment used in the transportation of radiographic devices to temporary job sites, including the vehicular storage and security of the device in transport, must also be described and submitted.

<b>Note:</b>	<b>Storage of radiographic devices or radioactive material in a private residence or motel/hotel room overnight on a temporary basis is not authorized or approved.</b>
--------------	---

The Department, in cooperation with the U.S. Nuclear Regulatory Commission and other Agreement States, has implemented increased controls (ICs) for Radioactive Material Licensees that possess radioactive material in quantities of concern. These IC requirements for Industrial Radiography licensees are



contained in Appendix H, “Increased Controls for Licensees that Possess Sources Containing Radioactive Material Quantities of Concern”. The ICs must be implemented in addition to the currently mandated requirements of the Rules and Regulations, Paragraph RH-1306.a “Storage of Sources of Radiation”.

**Applicants shall review Appendix H and provide a statement in the Application confirming that all requirements described in the Appendix H have been implemented.** However, as appropriate, the statement may also contain the following information:

a Department Notification

- (1.) If the Licensee is unable to comply with any of the requirements in Appendix H
- (2.) If compliance with any of the requirements is unnecessary because of specific circumstances of the Licensee, or
- (3.) If implementation of any of the requirements would cause the Licensee to be in violation of the provisions of any regulation or the license.

The notification shall provide detailed justification for seeking relief from or variation of any specific requirement.

b. Adverse Impact

If it is considered that implementation of any of the requirements detailed in Appendix H would adversely impact the safe operation of the facility, the Application must contain notification of Department of the following:

- (1.) Specific description of the adverse safety impact,
- (2.) Technical basis for the determination that the requirement would have an adverse safety impact, and
- (3.) Either a proposal for achieving the same objectives specified in the Appendix H requirement in question, or a schedule for modifying the facility to address the adverse safety condition.

If neither approach is appropriate, the response must referenced/supplemented to paragraph 1, above, to identify the condition as a requirement with which you cannot comply, with attendant justifications as required in paragraph 1, above.

c. Schedule

If the ICs are not implemented and operational at the time of submitting the Application, provide a schedule and a commitment to follow the schedule for completion of each requirement detailed in Appendix H. **The implementation of the ICs will be inspected immediately following the issuance of the Radioactive Material License.**

- d **This portion of the Application shall be marked as "Withhold from Public Disclosure Under RH-4040."**

## 17. **RADIATION SURVEY PROGRAM**

Radiation surveys are required to be performed by the Radioactive Material Licensee during the use, movement, and storage of radiographic devices to help insure that the radioactive material is used in a safe manner in accordance with regulatory requirements. Radiation surveys must be made whenever a radiographic device is manipulated or moved.

Appendix I, "Radiation Surveys", provides an example list of radiation surveys that are required to be performed during radiographic operations, including transportation. The requirement to perform radiation surveys, along with the survey methodology and documentation, must be incorporated into the Radiation Safety Program and the Operating and Emergency Procedures, addressed in Items 23 and 24 of this Application.

Complete Item 17 of the Application by including the specific Operating and Emergency Procedure Number in the Procedure Reference column in Appendix I and submitting the Appendix with the Application. Additional surveys that will be performed by the Licensee may also be included in Appendix I.

## 18. **ORDERING, RECEIVING, AND SHIPPING RADIOACTIVE MATERIAL**

Radioactive material may only be possessed and used in accordance with a Radioactive Material License issued the Department, the U.S. NRC, or other Agreement State. The types and quantities of radioactive material that are allowed are specified in the license and no other licensable type or quantity of radioactive material may be possessed and used.

Identify the Name and Title of the individual who will order radioactive material and will maintain possession within the limits contained in the Radioactive Material License.

The receipt and opening of packages containing radioactive material must be performed in accordance with the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1307, "Procedures for Picking Up, Receiving and Opening Packages".

Appendix J, "Ordering, Receiving and Opening and Shipping Packages Containing Radioactive Material", provides additional information on each of these topics. Appendix J contains adequate procedures that may be used to comply with these requirements; however, procedures that are equivalent to Appendix J may also be submitted.

Complete Item 18 of the Application by providing the name and title of the individual in Appendix J and submit Appendix J with the Application as the procedures that will be used. If the Appendix J procedures will not be used, submit equivalent procedures describing ordering radioactive material, and the receiving and opening of packages containing radioactive material.

## **19. WASTE DISPOSAL**

Radioactive material contained in radiographic devices, including depleted uranium shielding, must be disposed of in accordance with the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1400 a., "General Requirements" for Waste Disposal.

The preferred method of disposing of radiographic devices containing radioactive material is to return (transfer) the radioactive source to the manufacturer (an Authorized Recipient). However, it is also acceptable to transfer the gauge to a licensed, commercial radioactive waste disposal company (an Authorized Recipient). Provide the Name, Address and Radioactive Material License Number (issued by the U.S. NRC or an Agreement State) of the Service Vendor who will provide the waste disposal services in the appropriate spaces in Appendix K

Complete Item 19 of the application by completing and submitting Appendix K, "Disposal or Transfer of Radioactive Material" with the application.

## **20. CONTROL AND SECURITY OF RADIOACTIVE MATERIAL**

Radioactive material at temporary job sites must be controlled and secured to prevent individuals from entering radiation areas when the gauge is being used, and to prevent the unauthorized removal of the radioactive material from the site.

Procedures must be developed and implemented to establish and control access to restricted areas at temporary job sites. The procedures must also address the requirement that the gauge and restricted area must be kept under constant surveillance when the gauge is in use at the job site. Procedures must also be used to insure the gauge is secured to prevent unauthorized removal from temporary job site storage.

Appendix L, "Access Control and Security of Temporary Job Sites", contains procedures that may be used to comply with the requirement to control and secure temporary job sites.

Appendix G, “Security of Portable Gauges” describes the security requirements that must be implemented at temporary job sites to help insure the gauges are not removed from the job site or temporary storage by unauthorized individuals.

Complete Item 20 of the Application by describing the control and security methods that will be used. If Appendix L and Appendix G procedures will be used, submit each Appendix with the application. If the Appendix L and Appendix G procedures will not be used, submit equivalent procedures describing how restricted areas will be established and controlled and how the gauge will be secured while in use.

## 21. **TRANSPORTATION**

Radiographic devices and/or source changers containing radioactive material must be transported in accordance with U.S. Department of Transportation (DOT) regulations, regardless if the device is being transported by a common carrier on public highways or by the Licensee under an Arkansas Radioactive Material License to a temporary job site. Section 4 of the Rules and Regulations for Control of Sources of Ionizing Radiation also establishes the requirement for compliance with U.S. DOT regulations. Licensees are responsible for ensuring that the radiographic devices or source changers are properly packaged, marked, labeled, secured, blocked and braced, and that proper documentation accompanies the shipment.

U.S. DOT regulations, 49 CFR 172, Subpart H requires every hazardous material employer (Licensee) to provide all Authorized Users who package and transport radioactive materials receive initial and refresher (every three years) hazardous material safety training in accordance with U.S. DOT, 49 CFR 172, Subpart H. The Licensee is responsible for training, testing, documenting, certifying, and maintaining records of this training for all Authorized Users.

Appendix M, “Transportation of Radiographic Devices”, provides some general guidelines for transporting radioactive material. However, applicants are urged to obtain current U.S. Department of Transportation regulations (49CFR) from the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 371954, Pittsburg, PA 15250-1954. The web site for the U.S. Department of Transportation is **[www.dot.gov](http://www.dot.gov)**.

Complete Item 21 of the Application by confirming in writing that the appropriate U.S. DOT regulations will be followed when transporting or preparing a package containing radioactive material for shipment. Also, confirm that all Authorized Users will be provided training as required by U.S. DOT, 49 CFR 172, Subpart H.

## 22. **OPERATING PROCEDURES**

### **Radiation Safety Program**

Industrial Radiography Licensees are required to develop, implement, and maintain a comprehensive radiation safety program. The program must be commensurate with the scope and extent of activities proposed for the use of radioactive materials in industrial radiography, and must describe how safe operations, ALARA radiation dose, and regulatory compliance will be achieved through training, procedures, and equipment. A written description of the Radiation Safety Program must be submitted to the Department. Appendix N contains topics that must be included in the Radiation Safety Program.

### **Operating procedures**

Radiographic devices must be used and maintained in accordance with the manufacturer's instructions for use, the Radioactive Material License and the Rules and Regulations for Control of Sources of Ionizing Radiation. In order to minimize radiation doses to the radiographic personnel and to members of the public, the Applicant must adopt operating procedures and practices that comply with and reflect the As Low As is Reasonably Achievable (ALARA) philosophy in all phases of radiographic device use and operation.

The RSO is responsible for assuring that the radiographic devices are used as required by the Operating Procedures and in a manner that is ALARA. The RSO is also responsible for completing certain radiation protection administrative functions that are required by the Rules and Regulations, such as periodic job performance inspections of radiographic personnel or periodically leak testing the radioactive sources. These functions must also be addressed in the operating or equivalent procedures.

Appendix N includes a listing of operating procedure topics that, as a minimum, must be addressed in the Operating Procedures.

Complete Item 22 of the Application by submitting a copy of the Radiation Safety Program and all Industrial Radiography Operating Procedures that will be implemented and used.

## 23. **EMERGENCY PROCEDURES**

Emergency procedures must be developed and implemented to manage an emergency, or abnormal event, involving radiographic devices containing radioactive material. An example of an emergency is the radioactive source has failed to return to the safe position in the radiographic device. Since it is not possible to specify all possible situations that would constitute an emergency, a general emergency procedure is acceptable. The procedure must describe the

licensee's actions to minimize radiation dose during and after an event. Additional procedures and instructions such as posting the restricted area, maintaining surveillance of the area, and notifying the Radiation Safety Officer must also be included.

Appendix O, "Emergency Procedures" contains emergency procedures that may be used by the Applicant to guide the emergency response to various emergencies or events involving radiographic devices. However, the Applicant may submit equivalent emergency procedures with the Application for review by the Department.

Complete Item 23 of the Application by submitting a copy of all emergency procedures that will be followed when responding to an event.

#### **24. ADMINISTRATIVE PROCEDURES**

The RSO is responsible for documenting, recording, and maintaining records of radiation safety activities, as well as informing/notifying employees of matters pertaining to radiation safety, as specified in the Rules and Regulations for Control of Sources of Ionizing Radiation.

Appendix P, "Administrative Requirements" provides a summary listing of requirements in the Rules and Regulations which must be included in the Radiation Safety Program.

Complete Appendix P by marking the appropriate boxes indicating that the requirements have been read, and are understood, and will be complied with by the Radiation Safety Program. Submit the completed Appendix P with the application.

#### **25. MANAGEMENT CONTROL**

**Licensee management is responsible for insuring that the Radiation Safety Program and the ALARA Program, as discussed in Appendix A, are implemented and maintained.** Management involvement in and support of the Radiation Safety Program is critical to the success of the program. Senior management must give the Radiation Safety Officer the necessary authority and responsibility and must provide the necessary resources to implement the Radiation Safety Program and must appropriately support his actions. The Radiation Safety Officer must be afforded the necessary time in the work period to perform the assigned duties of the Radiation Safety Officer.

Submit a corporate organizational chart showing to whom the Radiation Safety Officer reports radiation safety issues. Confirm that Senior Management has granted the Radiation Safety Officer the necessary authority and responsibility by for implementing the Radiation Safety Program, including the authority to stop potentially unsafe work involving the radiation sources.

Confirm that the annual review of the Radiation Safety Program, as required by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1004, “Radiation Protection Programs” will be performed and documented. Appendix Q, “Radiation Safety Program Audit” contains an example annual program audit that is specific to industrial radiography. The example audit in Appendix Q is acceptable to the Department. It should be noted that not all areas included in the example audit may be applicable to every industrial radiography licensee. Also, please confirm that the report of the findings of the audit will be reviewed and approved by Senior Management.

## 26. CERTIFICATE

The Application for a Radioactive Material License and the Radioactive Material License are legal documents. License applications and all correspondence must be signed and dated by an individual(s) who are authorized to make legally binding statements or act on behalf of the Applicant. This individual is the Certifying Official.

<b>NOTE:</b>	<b>Each item of this application to which you commit will be reviewed during your program compliance inspections. You should be able to provide documentation to demonstrate compliance with the rules and regulations and the license.</b>
--------------	---

<b>NOTE:</b>	<b>Please identify all other individuals in the Applicant’s organization who may be authorized to sign documents for the Applicant/Licensee.</b>
--------------	--

## IV. LICENSE AMENDMENTS

Licensees are required to conduct operations in accordance with applicable regulations and the statements, representations and procedures contained in the license application and supporting documents. The license must be amended if any changes are planned. **Submittal of an amendment request does not allow immediate implementation of proposed changes.** Until the license has been amended to reflect approval of the change(s), the licensee must comply with the original terms and conditions of the license. Applications for license amendments may be filed in letter form. The request must be dated and signed by a certifying official, must identify the license by name and number, must be submitted in

duplicate, and must clearly describe the nature of the changes, additions or deletions requested. References to previously submitted documents must be specific and identify the applicable information by date, page and paragraph. The Licensee must maintain a copy of the submitted and referenced documentation on file for inspection.

<b>Note:</b>	<b>To prevent the potential for identity theft, never submit documentation that lists individuals' social security numbers or birth dates.</b>
--------------	--

## V. LICENSE RENEWAL

A Radioactive Material License remains in effect for a specific period of time, typically five to seven years, unless some other action has been taken by the Department or the licensee. The expiration date is stated on the cover page of the Radioactive Material License or by subsequent license amendment. The Licensee is responsible for completing and sending an Application For Radioactive Material License to the Department prior to the expiration date of the license.

An application for license renewal must be received by the Department at least 30 days prior to the expiration date. This filing will ensure that the license does not expire until final action has been taken on the application, as addressed in the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-411, "Renewal of Licenses". If the application is received less than 30 days before the expiration date, the facility or individual may be without a valid license when the license expires. Renewal applications must be filed using the Department's Application For Radioactive Material License.

Renewals require submittal of an entirely new application, completed as if it were an application for a new license, with complete and up-to-date information about the Applicant's radiation protection program, demonstrating compliance with all licensing and regulatory requirements in effect at the time of renewal. Renewal applications should be submitted without reference to documentation and information submitted previously.

<b>Note:</b>	<b>To prevent the potential for identity theft, never submit documentation that lists individuals' social security numbers or birth dates.</b>
--------------	--



## **VI. LICENSE TERMINATION**

Prior to license termination, the Licensee must properly dispose of all licensed radioactive material. A request to terminate the Radioactive Material License may be filed in letter form to the Department prior to the expiration date of the license.

## **VII. LIST OF ATTACHMENTS**

**TABLE 1. MODEL PROCEDURES**

<b>Appendix</b>	<b>Title</b>	<b>Attached</b>	<b>Equivalent</b>	<b>N/A</b>
App. A	ALARA Program			
App. B	Duties and Responsibilities of the Radiation Safety Officer			
App. C	Radiation Safety Training Program			
App. D	Leak Tests of Sealed Radioactive Sources			
App. E	Calibration of Radiation Survey Instruments			
App. F-1	Personnel Monitoring			
App. F-2	Dose Limits for Members of the Public			
App. G	Facilities and Equipment			
App. H	Increased Controls			
App. I	Radiation Surveys			
App. J	Ordering, Receiving, Opening and Shipping Packages Containing Radioactive Material			
App. K	Disposal or Transfer of Radioactive Material			
App. L	Access Control and Security of Temporary Job Sites			
App. M	Transportation of Radiographic Devices			
App. N	Operating Procedures			
App. O	Emergency Procedures			
App. P	Administrative Requirements			
App. Q	Radiation Safety Program Annual Review			

**TABLE 2. EXHIBITS**

<b>Exhibit</b>	<b>Title</b>	<b>Attached</b>	<b>Equivalent</b>	<b>N/A</b>
Ex. A	Model Shipping Paper – Common Carrier Shipments			
Ex. B	Model Shipping Paper – Exclusive Use Shipments			
Ex. C	Radiography Equipment Inspection and Maintenance			
Ex. D	Performance Review Checklist			
Ex. E	Information to Consider for Procedures			
Ex. F	Daily Maintenance Check of Radiography Equipment			
Ex G	Model Emergency Response Information			



## **APPENDIX A**

### **ALARA PROGRAM**

#### **I. THE ALARA PHILOSOPHY**

The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1004, “Radiation Protection Programs” requires the use, to the extent practical, of procedures and engineering controls based upon sound radiation protection principles to achieve occupational and public doses that are As Low As Reasonably Achievable (ALARA). The primary concept of the ALARA philosophy is that unnecessary exposure to radiation should be avoided, even though current occupational dose limits provide a very low risk of injury.

The objective is to reduce occupational radiation dose (both individual and collective) as far below regulatory limits as is reasonably achievable by means of good radiation protection planning and practice, as well as by a management commitment to policies that deter departures from good practices.

The three primary methods of minimizing exposure to radiation are: TIME, DISTANCE and SHIELDING. When working with sources of radiation, always minimize the TIME, maximize the DISTANCE, and make use of available SHIELDING to keep dose ALARA.

#### **II. MANAGEMENT COMMITMENT**

Management is committed to the ALARA philosophy of maintaining occupational and public radiation doses as low as reasonably achievable.

- A. All personnel using radioactive material will be made aware of our commitment to the ALARA philosophy and they will be instructed in the procedures necessary to keep their radiation dose as low as possible.
- B. The RSO will be delegated authority to ensure adherence to ALARA principles. Management will support the RSO in instances where this authority must be asserted.
- C. All reasonable modifications will be made to procedures, equipment and facilities to reduce radiation dose, unless the cost is considered to be unjustified. Management will be prepared to describe the reasons for not implementing modifications that have been recommended.

#### **III. RADIATION SAFETY OFFICER RESPONSIBILITIES**

- A. The RSO will emphasize the ALARA philosophy to workers, instruct personnel on current procedures and provide guidance on relevant changes to reduce radiation dose.
- B. The RSO will review dosimetry reports for all monitored personnel to determine if unnecessary dose is being received. The RSO will investigate within 30 days the cause of any personnel radiation dose greater than 100 millirem. If warranted, the RSO will take corrective actions to ensure that unnecessary exposures are halted and recurrence is prevented. A report of each investigation and the actions taken, if any, will be recorded and maintained for inspection purposes.

- C.** At least annually, the RSO will insure that a formal review of the radiation protection program's content and implementation, as required by Paragraph RH-1004, "Radiation Protection Programs" is performed. The review will include an evaluation of equipment, procedures, dosimetry records, inspection findings, and incidents. The RSO will assess trends in occupational exposures as an index of the program's success and determine if any modifications to the program are needed. A summary of the results of each annual review, including a description of actions proposed and taken (if any) will be documented by the RSO, discussed with management, and signed and dated by both. A report on each audit will be maintained on file for 3 years from the date of the review.
- D.** The RSO will provide written notifications of annual radiation dose to all monitored personnel as required by Paragraph RH-2804, "Notifications and Reports to Individuals", and will be available to respond to any questions regarding the dose reports.
- E.** Other typical duties of the RSO are described in [Appendix B-2](#).

## **APPENDIX B**

### **Typical Duties and Responsibilities of the Radiation Safety Officer (RSO)**

---

The RSO's duties and responsibilities include ensuring radiological safety and compliance with Arkansas Department of Health and Human Services' and DOT regulations, and with the conditions of the license. Typically, these duties and responsibilities include ensuring the following:

- RSO stops licensed activities which the RSO considers unsafe
- Possession, use, storage, and maintenance of approved radiographic devices are consistent with the limitations in the license and the manufacturer's recommendations and instructions
- Training programs are reviewed and approved and management oversight of training is performed to insure effective radiation safety practices are taught
- Radiographic devices are only used by properly trained and certified personnel
- Radiographic devices are only used in accordance with current operating and emergency procedures
- Personnel monitoring devices are calibrated, used, and exchanged at the proper intervals; records of the results of personnel monitoring are maintained and timely notifications are made
- Radiation survey instruments are properly calibrated and maintained
- Radiation surveys are properly performed and documented
- Radiographic devices are properly stored and secured against unauthorized removal
- Sealed radioactive sources are leak tested as required by the license
- Proper authorities are notified in case of accident, damage to radiographic devices, failure of the source to return to proper shielding, fire, or theft
- Unusual occurrences involving the radiographic device (e.g., accident, damage) are investigated, cause(s) and appropriate corrective action are identified, and corrective action is taken

- Audits are performed as required, documented, and corrective actions taken
- Radioactive material is transported in accordance with all applicable DOT requirements
- Radioactive material is disposed of properly
- Appropriate records are maintained
- Up-to-date license is maintained, and amendment and renewal requests are submitted in a timely manner

## APPENDIX C

### RADIATION SAFETY TRAINING PROGRAM

#### I. Introduction

##### A. General

Industrial radiography using radioactive material shall only be performed by or under the personal supervision of trained, certified, and licensed radiographic personnel. Personnel training in radiation safety, along with strict adherence to approved operating and emergency procedures are the principal means of insuring safe radiographic operations. Radiographic personnel include the following defined positions:

##### 1. Radiographer:

Any individual who performs or who, in attendance at the site where sources of radioactive material are being used, personally supervises industrial radiographic operations and who is responsible to the licensee for assuring compliance with the requirements of the regulations and the conditions of the license. **Only personnel who have been certified through a radiographer certification program may serve as a Radiographer in the State of Arkansas.**

##### 2. Radiographer Instructor:

Any radiographer who has been listed on a specific license from the Department and meeting specific requirements or the Rules and Regulations.

##### 3. Radiographer's Assistant:

Any individual who, under the direct supervision of a radiographer, uses radiographic exposure devices, sealed sources or related handling tools, or radiation survey instrumentation in industrial radiography.

There are three training requirements associated with industrial radiography. Radiographic Personnel Training will be provided to the above-defined workers who will be using the radiographic devices. Hazardous Materials (Hazmat) Employee Training will be provided to any worker associated with the packaging and transportation of radioactive material. Ancillary Personnel Radiation Awareness Training will be provided to all personnel who may be in the vicinity of the radiographic devices (for example, vicinity of device permanent storage area) during their routine work activities. The training will be conducted at the frequency specified in the following table:



<u>Training Requirement</u>	<u>Frequency of Training</u>
Radiographic Personnel Training	Initial; Annual Refresher
Hazardous Materials (Hazmat) Training	Initial; Refresher every 3 years
Ancillary Personnel Radiation Awareness Training	Initial; Annual Refresher

## **B. Radiographic Personnel**

1. The Rules and Regulations establish requirements for the Radiographer's and Radiographer's Assistant's training program. The training programs for each of these positions must be described in the application. The description must include training procedures, as well as a detailed training outline and a sequence of events (timeline) from the time of hiring an individual through the designation of the individual as a Radiographer's Assistant and, finally, as a certified Radiographer. Similarly, a program description, including procedures, for training experienced radiographic personnel must also be submitted. Experienced Radiographers who have worked for another licensee **must** receive formal training by the new employer similar to that given to Radiographer's Assistant's candidates.
2. The training program for Radiographers and Radiographer's Assistant shall include the following components:
  - a. Initial training.
  - b. On-the-job training
  - c. Periodic (refresher) training.
  - d. Assessment of the Radiographer's and Radiographer's Assistant's knowledge of and ability to comply with regulatory requirements, and the operating and emergency procedures.
  - e. Period internal inspection of the Radiographer's and Radiographer's Assistant's job performance during actual industrial radiography operations.
3. The radiographic personnel training program has four requirements:
  - a. "Instructions to Radiation Workers", includes general radiation awareness training for all personnel.
  - b. Training in operating and emergency procedures and equipment to qualify as a Radiographer' Assistants
  - c. On-the-job training.
  - d. Radiation safety training (minimum 40 hours), combined with two (2) months of on-the-job training, to qualify as a radiographer.

4. Three of the training requirements (Items a, b, and c) must be addressed during the initial training to qualify as a Radiographer's Assistant. The radiation safety training and on-the-job training must be accomplished to qualify as a Radiographer and the radiographer certification examination. The Hazardous Materials Training, required by the U.S. Department of Transportation, must also be provided during the initial training program.
5. This Appendix describes the overall training and qualification program that is required by the Department.

## **II. Generic Training Program Components**

### **A. Radiographer Instructor**

Individuals serving as Radiographer Instructors for radiation safety training of radiographic personnel shall have the following minimum qualifications:

1. One year of documented industrial radiography experience as a Radiographer; and,
2. At least 16 hours of formal instruction in the establishment and maintenance of a radiation protection program, including training to perform internal inspections and mitigation of radiological accidents.

### **B. Training and Testing Format**

Training is conducted in a formal classroom setting, except for practical training/testing on equipment use, which is conducted during special training sessions, not during production radiography.

Examinations on radiography training topics shall be closed book. Written tests shall be taken without assistance, under the Radiographer Instructor's supervision. The minimum passing score is 80% on all examinations. Individuals who fail to obtain a passing score shall be provided additional training. The duration of the training and the time interval before the individual is allowed to re-take the examination is left to the discretion of the Radiographer Instructor. New examinations with different questions covering the same topics are used for re-testing. A copy of a typical examination and the correct answers to the examination questions shall be provided to the Department.

Practical examination questions shall be written and the examination shall be administered by the Radiographer Instructor. The practical examination shall be taken without assistance. The minimum passing score is 80% on all examinations. Attachment C-1 contains a checklist that may be used as a source of potential examination questions and areas of evaluation for the practical examination. A copy of a typical practical examination and the correct responses to the examination questions shall be provided to the Department.

### III. Radiation Workers Awareness Training

- A. Prior to handling, transporting, or operating radiographic devices, all radiographic personnel will receive the general radiation safety training as required by Paragraph RH-2803, "Instructions to Workers", of the Rules and Regulations for Control of Sources of Ionizing Radiation. The following instructions will be provided:
1. Information on the storage, security, transfer, or use of radiographic devices at permanent facilities and temporary job sites
  2. The health effects associated with exposure to radiation or radioactive material
  3. Precautions and procedures used to minimize exposures
  4. Applicable provisions of Arkansas' radiation control regulations and the company's Radioactive Materials License
  5. Workers' responsibility to report any unsafe conditions in the workplace
  6. Appropriate responses to warnings made in the event of incidents having the potential to involve radiation exposure
  7. Reporting requirements for occupational radiation exposures described in Paragraph RH-2804, "Notifications and Reports to Individuals".
- B. Radiation awareness training is usually provided concurrently with other radiation safety training as part of the Radiographer's Assistant training program. When this radiation awareness portion of the training is offered on a stand-alone format, it will typically last 2 - 4 hours. The duration may vary based on attendees' comprehension of the topics covered. A question and answer session will be held at the end of the training period, and attendees will be encouraged to request clarification as necessary during the presentation.

### IV. Hazmat Employee Training

- A. Radioactive material contained in radiographic devices is classified as hazardous material by the U.S. Department of Transportation (DOT). In accordance with DOT regulations (49 CFR Part 172, Subpart H) workers must complete hazmat training prior to performing work that directly affects hazardous material transportation safety. (Exception: New driver employees can transport for 90 days without the training, provided a hazmat-trained employee directly supervises them.) Refresher training must be provided at least once every 3 years.
- B. Hazmat training will include the following: general awareness/familiarization, function specific, and safety training. It will be provided either in-house or by qualified third party trainers. **Completion of the radiographic personnel training can satisfy the hazmat training requirement; however, additional documentation is required (see below).**
- C. Documentation of hazmat training will be maintained for the duration of each worker's employment, plus 90 days, and will include the following information:
1. The employee's name and date of most recent training completed;
  2. Description, copy or location of training materials used;
  3. Name and address of the person providing the training; and

4. Certification that the employee has been trained and tested as required.
- D.** Driver training meeting the requirements of 49 CFR 177.816 must be provided to all personnel driving vehicles containing radiographic devices, and may be provided concurrently with hazmat employee training.

#### **IV. Radiographer's Assistant Training**

- A.** In order to qualify as a Radiographer's Assistant, an individual must satisfactorily complete a training and qualification program. The training shall consist of at least 16 hours of initial formal classroom training which must include the following subjects:

1. Radiation awareness (2-4 hours)
2. Hazmat employee (2-4 hours)
3. Licensee's operating and emergency procedures (4-6 hours)
4. Regulatory requirements of the Rules and Regulations and the Radioactive Material License. (1-2 hours)

The Radiographer's Assistant training involves overlapping training requirements (specifically, radiation awareness and hazmat) and this training may be provided concurrently.

- B.** The individual must also receive training (4-6 hours) and develop competence in using the radiographic devices and associated equipment, and radiation survey instruments that will be used during industrial radiography. This "hands-on" training and equipment use must be under the direct personal supervision of a Radiographer or Radiographer Instructor.

- C.** As the final qualification for Radiographer's Assistant, the individual must
1. Demonstrate an understanding of the instructions described in Paragraph IV.A, above, by successfully completing ( 80%) a written examination (minimum 25 questions) on the subjects, and,
  2. Demonstrate competence in the use of radiographic devices and radiation survey instruments by successfully completing(80%) a practical examination using the equipment.

The examinations shall be administered by a Radiographer Instructor.

#### **V. Radiographer Training**

- A.** In order to qualify as a Radiographer, an individual must satisfactorily complete a training and qualification program. The training shall consist of at least 40 hours of training and must include topics listed in the Rules and Regulations, Paragraph RH-1804, "Subjects to be Covered During the Instruction of Radiographers", specifically, the following:

1. Fundamentals of Radiation Safety
2. Radiation Detection Instruments

3. Radiographic Equipment to be Used
4. Regulatory Requirements of the Rules and Regulations and the Radioactive Material License
5. Licensee's Written Operating and Emergency Procedures
6. Case Histories of Accidents in Radiography

**B.** Following the training, the individual must

1. Demonstrate an understanding of the instructions described in Paragraph V.A, above, by successfully completing ( $\geq 80\%$ ) a written examination (minimum 50 questions) on the subjects, and,
2. Demonstrate competence in the use of radiographic devices and radiation survey instruments by successfully completing ( $\geq 80\%$ ) a practical examination using the equipment.

The examinations shall be administered by a Radiographer Instructor.

**C.** Additionally, the individual must document a minimum of two months (320 hours) of on-the-job training (OJT) as a Radiographer's Assistant.

**D.** The Licensee shall furnish the following documents to the individual prior to the beginning of the Radiographer's training program:

1. Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation
2. Arkansas Radioactive Material License
3. Operating and Emergency Procedures

## **VI. Radiographer Certification**

### **A. General Information**

1. The Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1802.b.1.A, "Training" requires that an individual be "...certified through a radiographer certification program by a certifying entity..." before acting as a Radiographer performing industrial radiography. The American Society for Nondestructive Testing (ASNT) and some state radiation control agencies are approved certifying entities.
2. Certification requires the individual to submit documentation demonstrating completion of OJT hours, completion of a practical exam, and obtaining a passing score on a certification exam. Certification is valid for 5 years, unless suspended or revoked prior to expiration, and re-testing is required for renewal.

### **B. ASNT Radiographer Certification** **DOES NOT ADDRESS X-RAY**

1. The ASNT is recognized by both the U.S. Nuclear Regulatory Commission and the Conference of Radiation Control Program Directors, Inc. (CRCPD) as an independent certifying organization, approved for radiographer certification through its Industrial Radiographer Radiation Safety Personnel (IRRSP) program.

2. The examination consists of 125 questions and must be completed within 3 hours. Examination schedules may be accessed at [www.asnt.org](http://www.asnt.org) and special examination dates can be arranged. Certification program documents, including the application, outline of exam subjects, and a list of reference materials are available on the ASNT website. Examination results are mailed within 2-4 weeks after the test, and a certification wallet card is mailed to successful candidates. The ASNT uses 10 CFR for its questions on generic regulatory requirements and radiography rules.

**C. State Certification**

Radiographer certification programs operated by state radiation control agencies are modeled after the Texas program (states contract with Texas to format the TX exam to fit each state's regulations). Information on state certification programs is available from the Department and the NRC.

**D. Certification Records**

Radiographer certification records and documentation are maintained on file with radiography training and examination records until termination of the company's license. Radiographers keep evidence of their certification (e.g., wallet card) available for inspection at temporary job sites.

**VIII. Training Requirements for Experienced Personnel**

If individuals with prior radiography experience are employed, these individuals shall be trained as described below.

**A. Personnel with Prior Experience as a Radiographer's Assistant**

Individuals with experience as a Radiographer's Assistant shall complete the same training and testing provided to individuals with no radiography experience. If an individual has documentation of radiography OJT from previous employment, the hours may be applied to the OJT requirements, provided the Radiation Safety Officer independently verifies and documents the number and quality of the hours.

The individual shall also receive radiation awareness and hazmat employee training, as described in Paragraphs III and IV, above.

**B. Personnel with Prior Experience as a Radiographer**

Individuals with documented experience as a radiographer will receive a minimum of 4 hours of training and examinations (written and practical exams) in Operating and Emergency Procedures and radiography equipment use to re-qualify as a Radiographer. Written examinations (~25 questions) on operating and emergency procedures will be similar to those used to test Radiographer's Assistant. Additional training may be provided if deemed necessary by the Radiation Safety Officer. If lacking documentation of radiation awareness or hazmat employee training, the individual will receive the training in accordance with this program. If documentation of radiation awareness and hazmat employee training is available and its validity has

been verified, “scaled-down” versions of the training will be provided to address company-specific subjects.

**C. Verification of Prior Radiography Experience**

Prior radiography experience is accepted only if the Radiation Safety Officer is able to independently verify the information. Previous employers shall be contacted and asked to provide statements (verbally or written) confirming the validity of documentation supplied by the Radiographer.

**IX. Annual Refresher Training**

At least 8 hours of radiation safety refresher training shall be provided to all radiographic personnel at least every 12 months. The training may be conducted in multiple sessions and may be in the form of lectures, guided discussions, demonstrations, or individualized instruction. One or more topics may be covered, such as radiation safety basics, procedures, regulatory requirements, inspection findings, equipment issues and emergency response. Examinations shall consist of written, oral or practical exams. Radiographic Instructors receive the same credit for the training as the attendees

**X. Ancillary Personnel Radiation Awareness Training**

- A.** Ancillary personnel (office personnel, janitorial personnel, non-radiation workers, etc.) who may work in the general vicinity of the radiographic devices (for example, the radiographic device permanent and temporary storage areas) shall receive radiation awareness training to insure that these individuals understand the possible hazards, safety precautions, and emergency procedures related to the use and storage of radioactive material. This training is required by the U.S. Department of Labor, Occupational Safety and Health Administration.
- B.** The training shall be conducted by the Radiation Safety Officer for ancillary personnel at the time of employment. Refresher training for all ancillary personnel shall be conducted at least annually thereafter.
- C.** The training shall last about one hour and personnel shall be encouraged to ask questions or request additional discussion of any topic covered in the training.
- D.** Documentation of radiation awareness training for ancillary personnel shall be maintained on file for inspection purposes.

**XI. Training Records**

**A. Radiation Workers Awareness Training Records**

Although the Arkansas Rules and Regulations do not require documentation of Radiation Workers Awareness Training, the training must be documented to demonstrate compliance.

**B. Hazmat Employee Training Records**

Documentation of hazmat training shall be maintained for the duration of each individual's employment, plus 90 days, and will include the following information:

1. The employee's name and date of most recent training completed;
2. Description, copy or location of training materials used;
3. Name and address of the person providing the training; and
4. Certification that the employee has been trained and tested as required by 49 CFR Part 172, Subpart H.

**C. Radiation Safety Training Records**

Records of initial and refresher radiation safety training and the results of qualification examinations for radiographic personnel shall be maintained on file until license termination. On-the-job training records are documented. Records of annual refresher radiation safety training are documented and maintained until license termination.

**D. Records of Verification of Previous Training and Experience**

Documentation of verification of previous radiography training and experience shall be retained with the rest of the worker's training, testing and certification documentation, and shall be maintained until termination of the company's license.

**E. Radiographer Certification Records**

Documentation of radiographer certification shall be retained in the individual's training files and maintained until termination of the company's license.

**XII. Internal Performance Inspection**

**A. General Information**

The Arkansas Rules and Regulations require the Radiation Safety Officer to inspect the job performance of each Radiographer and Radiographer's Assistant at intervals not to exceed 6 months to ensure that regulations, license requirements, and procedures are being followed. This procedure describes how the audit requirement is met.

**B. Internal Inspection Procedure**

Internal inspections must include observation of the performance of each Radiographer and Radiographer's Assistant during a radiographic operation. Individuals not participating in a radiographic operation for more than 6 months since the last inspection must demonstrate knowledge of Licensee's Operating and



Emergency Procedures and the safe use of radiographic and related equipment by a practical examination before participating in a radiographic operation. Inspections of the Radiation Safety Officer are not required.

The Performance Evaluation Form is used to evaluate job performance and document inspections. The Inspector must describe any deficiencies noted in the "Remarks" section.

If an inspection is performed by a designee, the Radiation Safety Officer will evaluate the designee's inspection findings within 30 days of the inspection to determine if individual's job performance exhibit diligent application of ALARA principles. The Radiation Safety Officer will sign (or initial) and date each inspection form following the review. As warranted, the Radiation Safety Officer shall take corrective action (e.g., additional training, repeat audits) to ensure that all deficiencies noted during the inspection that could result in unnecessary radiation dose are stopped and recurrence is prevented. The Radiation Safety Officer will describe on the inspection form any corrective actions taken.

**C. Audit Records**

Inspection records (completed Performance Evaluation Forms) shall be retained on file for a minimum 3 years beyond the date of the inspection.

## APPENDIX D

### LEAK TESTS OF SEALED RADIOACTIVE SOURCES and RADIOGRAPHIC DEVICES USING DEPLETED URANIUM SHIELDING

Each sealed source contained in a radiographic device and each radiographic device using depleted uranium shielding must be tested at regular intervals to ensure that the radioactive material is secure and is not leaking contamination. Leak test requirements are specified in the Rules and Regulation for Control of Sources of Ionizing Radiation, Paragraph RH-1212, “Leak Tests”, and Paragraph RH-1801, f.3 “Leak Testing and Replacement of Sealed Sources”.

**A. Leak Test Frequency.**

Sealed sources contained in radiographic devices shall be leak tested at least every 6 months, unless otherwise specified in the Radioactive Material License. Radiographic devices using depleted uranium shielding shall be tested for leakage at intervals not to exceed 12 months.

**B. Leak Test Kit**

Only leak test kits provided by licensed vendors will be used to sample (smear) sealed sources and depleted uranium shielding.

**C. Taking the Leak Test Sample**

Leak test samples shall be taken only by Radiographers or Radiographer’s Assistant’s, wearing their assigned personnel monitoring dosimeters. Leak test samples shall be taken in accordance with the written instructions provided by the supplier of the leak test kit and the device manufacturer.

**D. Leak Test Sample Analysis**

Leak test sample analysis will be performed only by vendors specifically licensed to provide the service by the Department, the U. S. Nuclear Regulatory Commission, or other Agreement State.

**E. Leak Test Records**

If a test indicates a radiographic device’s sealed source or the device is leaking, the radiographic device will be removed from service and the Department will be notified by a written report on the leaking source within 5 days. The report will be submitted to Arkansas Department of Health and Human Services, P.O. Box 1437, Slot H-30, Little Rock, Arkansas, 72203-1437. The report will describe the equipment involved, the test results, and the corrective actions taken (i.e., device removed from

service until repaired; radiation surveys conducted to determine presence of contamination; decontamination as necessary).

Leak test records shall be maintained on file for inspection purposes and shall be retained for at least 3 years following the date the record was created. The records will include the following information:

- ◆ Each source's manufacturer name, model, and serial number
- ◆ The identity of each sealed source radionuclide and its estimated activity, expressed in millicuries
- ◆ Each radiographic device using depleted uranium shielding manufacturer's name, model number, and serial number
- ◆ The measured activity of each leak test sample, in microcuries
- ◆ The date the sample was collected.

## Appendix D

### Form D

#### LEAK TESTS FOR SEALED SOURCES

Please provide the requested information by checking the appropriate items. The completed Form D is a commitment by the Applicant to perform the leak test as indicated. This information will be incorporated into the Radioactive Material License as a Special License Condition.

#### SEALED RADIOACTIVE SOURCES WILL BE LEAK TESTED AS INDICATED:

\_\_\_\_\_ 1. Leak tests will be performed by a consultant or a commercial firm:

- a. Frequency of leak test \_\_\_\_\_
- b. Name of Company \_\_\_\_\_
- c. Address \_\_\_\_\_
- d. License Number \_\_\_\_\_
- e. Arkansas Vendor Registration Number \_\_\_\_\_

\_\_\_\_\_ 2. Leak tests will be performed by the applicant using a commercial leak test kit:

- a. Frequency of leak test \_\_\_\_\_
- b. Manufacturer of kit \_\_\_\_\_
- c. Model number of kit \_\_\_\_\_
- d. Name of company to perform assay of leak test samples \_\_\_\_\_
- e. Arkansas Vendor Registration Number \_\_\_\_\_
- f. Manufacturer's instruction will be followed in the use of the leak test kit \_\_\_\_\_

**RADIOGRAPHIC DEVICES USING DEPLETED URANIUM SHIELDING  
WILL BE LEAK TESTED AS INDICATED**

\_\_\_\_\_ **1. Leak tests will be performed by a consultant or a commercial firm:**

- a. Frequency of leak test \_\_\_\_\_
- b. Name of Company \_\_\_\_\_
- c. Address \_\_\_\_\_
- d. License Number \_\_\_\_\_
- e. Arkansas Vendor Registration Number \_\_\_\_\_

\_\_\_\_\_ **2. Leak tests will be performed by the applicant using a commercial leak test kit:**

- a. Frequency of leak test \_\_\_\_\_
- b. Manufacturer of kit \_\_\_\_\_
- c. Model number of kit \_\_\_\_\_
- d. Name of company to perform assay of leak test samples \_\_\_\_\_
- e. Arkansas Vendor Registration Number \_\_\_\_\_
- f. Manufacturer's instruction will be followed in the use of the leak test kit \_\_\_\_\_

## APPENDIX E

### CALIBRATION OF RADIATION SURVEY INSTRUMENTS

Radiation survey instruments must be calibrated at intervals not to exceed three months and after each maintenance or servicing of the instrument, except for battery changes. The calibration must be sensitive enough to insure the instrument detects radiation emitted from the radiographic device sealed sources and must meet all survey requirements identified in the Rules and Regulation for Control of Sources of Ionizing Radiation, Paragraph RH-1300.c, "Surveys", and the requirements of Paragraph RH-1801.e "Radiation Survey Instruments". The survey instrument must be capable of measuring 2 millirem per hour through 1 rem per hour.

- A. Calibration of survey instruments shall be performed using radioactive material (electronic calibration is not acceptable):
1. The calibration source activity or dose rates at specified distances shall be traceable to a standard certified to within  $\pm 5$  percent accuracy to a primary radiation standard such as those maintained by the U.S. National Institute for Standards and Technology (NIST).
  2. The calibration source shall approximate a point source.
  3. For linear scale instruments, each scale of the instrument shall be calibrated on at least two points located at approximately  $1/3$  and  $2/3$  of full scale; for logarithmic scale instruments, each scale shall be calibrated at midrange for each decade and at two points on at least one decade; and for digital instruments at three points between 2 and 1000 millirem per hour.
  4. The instrument shall be calibrated so that an accuracy within plus or minus 20 percent of the calibration source can be demonstrated at each point.
- B. Records of radiation survey instrument calibration shall be maintained on file for inspection purposes and shall be retained for at least 3 years following the date the record was created.
- C. Radiation survey instruments shall be checked for operability to verify the instrument is working properly. The radiation survey instrument shall be checked with a radiation source at the beginning of each day of use and at the beginning of each work shift to ensure it is operating properly. The readings shall be taken with the reference source placed in specific repeatable geometry relative to the instrument. If any reading with the same geometry is not within 20 percent of the reading obtained immediately after calibration, the instrument should be recalibrated.

## Appendix E

### Form E

#### CALIBRATION OF RADIATION SURVEY INSTRUMENTS

Please provide the requested information by checking the appropriate items or completing the information in the space provided. The completed Form E is a commitment by the Applicant to perform the radiation survey instrument calibration as indicated.

#### RADIATION SURVEY INSTRUMENTS WILL BE CALIBRATED AS INDICATED

- \_\_\_\_\_ 1. Survey instruments will be calibrated at intervals not to exceed three months and following each maintenance and repair activity, except battery change.
- \_\_\_\_\_ 2. Calibration will be performed as follows:
- a. For linear scale instruments, each scale of the instrument shall be calibrated on at least two points located at approximately 1/3 and 2/3 of full scale
  - b. For logarithmic scale instruments, each scale shall be calibrated at midrange for each decade and at two points on at least one decade
  - c. For digital instruments at three points between 2 and 1000 millirem per hour.
3. Radiation survey instrument calibration will be performed by:

- \_\_\_\_\_ a. SERVICE VENDOR OR INSTRUMENT MANUFACTURER

Name of Company \_\_\_\_\_

Address of Company \_\_\_\_\_

Arkansas Vendor Registration Number \_\_\_\_\_

\_\_\_\_\_ **b. CONSULTANT**

Name of Company\_\_\_\_\_

Address of Company\_\_\_\_\_

Arkansas Vendor Registration Number\_\_\_\_\_

\_\_\_\_\_ **c. LICENSEE (Applicant)**

**(1.) Calibration Source**

Radioactive Material\_\_\_\_\_

Activity (millicuries)\_\_\_\_\_

Manufacturer's Name\_\_\_\_\_

Source Model Number\_\_\_\_\_

Traceability to Primary Standard\_\_\_\_\_

Accuracy\_\_\_\_\_

**(2.) Calibration procedures, including radiation safety procedures are attached.**

YES\_\_\_\_\_

NO \_\_\_\_\_(Explain)\_\_\_\_\_



## Appendix F-1

### PERSONNEL MONITORING

#### I. PERSONNEL MONITORING

Individuals serving as Radiographers and Radiographer's Assistants are required to wear a combination of Personnel Monitoring Devices, including

- A Direct Reading Pocket Dosimeter, and
- An operable Alarm Ratemeter, and
- A Personnel Monitoring Badge, either a film badge, thermoluminescent dosimeter (TLD), or an Optically Stimulated Luminescent Dosimeter (OSLD).

These devices must be worn on the front of the torso at, or above the waist and below the shoulder, at all times during radiographic operations. **Radiography shall not be performed if one of the required dosimeters is missing or is inoperable.**

Complete Form F, Personnel Monitoring Program, describing the proposed radiation dose monitoring program and submit the completed form with the application.

#### II. DESCRIPTION OF PERSONNEL MONITORING DEVICES

##### A. Personnel Monitoring Badges

##### 1. General

Personnel monitoring badges must detect beta, gamma and neutron radiation, therefore, the capabilities of available badges must be verified before making a selection. Dosimetry processors must hold accreditation from the National Voluntary Laboratory Accreditation Program (NVLAP) of the National Institute of Standards and Technology. A list of NVLAP accredited dosimetry vendors is available on the Internet at [www.nist.gov](http://www.nist.gov).

Each order of badges includes a control badge for measuring the amount of background radiation the badges receive each monitoring period. This enables the background to be subtracted from the total reading to provide an accurate record of each individual's occupational radiation dose. When not in use the badges should be stored with the control badge to ensure accurate dosimetry records. The control badge must be stored in a low background radiation location and must be returned with the other badges each monitoring period.

**2. Film Badges**

Film badges are small pieces of x-ray film contained in a plastic holder. The film darkens in proportion to the amount of radiation it has been exposed to, so measurements of the film density provide a measurement of the wearer's radiation dose. Film badges should be protected from extreme environmental conditions which may affect their ability to accurately record radiation. Film badges must be exchanged on a MONTHLY basis.

**3. Thermoluminescent Dosimeters (TLD)**

TLDs are personnel monitoring badges that contain small crystals capable of storing some of the energy from radiation. If the crystals are then heated to a specific temperature, they release the stored energy as light. The amount of light released is proportional to the amount of radiation the TLD badge received, which can be measured to determine the wearer's dose. TLDs should be protected from extreme environmental conditions which may affect their ability to accurately record radiation. They must be exchanged on a MONTHLY basis.

**4. Optically Stimulated Luminescent Dosimeters (OSLDs)**

OSLDs measure radiation through a thin layer of aluminum oxide. A laser light stimulates the aluminum oxide after use, causing it to become luminescent in proportion to the amount of radiation exposure. OSLDs must be exchanged on a MONTHLY basis

**B. Personnel Monitoring Direct Reading Devices**

**1. Direct Reading Pocket Dosimeters**

Pocket Dosimeters provide an immediate measurement of the total radiation dose the wearer received in the time period while wearing the dosimeter. Pocket dosimeters shall have a range of 0 to at least 200 millirem. The dosimeters must be recharged at least daily or at the beginning of the shift. If an individual's pocket dosimeter discharges beyond its range (off-scale), the individual shall STOP all radiographic operations and the individual's film badge, TLD, or OSLD shall be collected and processed immediately. The individual shall not resume radiography until a final determination of the radiation exposure has been determined. Pocket dosimeters shall be checked for correct response to radiation at periods not to exceed one year. Acceptable dosimeters shall be read within plus or minus twenty percent of the true radiation dose. NOTE: Electronic personal dosimeters may only be used in place of ion chamber pocket dosimeters.

## 2. **Alarm Ratemeters**

An Alarm Ratemeter detects and measures the radiation dose rate and alarms at a preselected alarm setpoint. Each Alarm Ratemeter shall

- a. Be checked to ensure the alarm functions properly before using (at the start of each shift)
- b. Be set to alarm at a preset dose rate of 500 millirem per hour, with an accuracy rate of plus or minus 20 percent of the true dose rate
- c. Require special means to change the preset alarm function, and
- d. Be calibrated at periods not to exceed 12 months for correct response to radiation.

### III. **INSTRUCTIONS FOR USING PERSONNEL MONITORING DEVICES**

#### A. **General Instructions**

Personnel Monitoring Devices, as described in Paragraph I, above, shall be worn at all times when handling, using, or transporting a radiographic device. Radiographic personnel will be assigned a Personnel Monitoring Badge which can only be worn by the individual to whom it has been assigned. Badges must be promptly returned to the Radiation Safety Officer (RSO) at the end of each monitoring period to ensure rapid processing.

All Personnel Monitoring Devices shall be worn on the front of the torso, at or above the waist and below the shoulder.

#### **Recommended Work Practices for Personnel Monitoring**

- ◆ Never leave Personnel Monitoring Devices in close proximity to a radiographic device or other radiation source
- ◆ Protect Personnel Monitoring Badge from moisture, intense heat or light and chemicals
- ◆ When not in use, store Personnel Monitoring Badge with their control badge in a low background radiation area

#### B. **Special Instructions for New Hires and Lost/Damaged Dosimeters**

To ensure accurate monitoring of occupational dose, an assigned personnel monitoring badge will be ordered immediately for new radiographic personnel. A spare/visitor badge may be provided to new workers until the assigned dosimeter arrives.

If a Personnel Monitoring Device is lost or damaged the individual shall cease work immediately until a replacement device is provided and the dose is determined for the

time period from issuance to loss or damage of the dosimeter. The Radiation Safety Officer must request approval from the Department to revise the individual's dosimetry record.

Spare Personnel Monitoring Badges may be used to replace a Personnel Monitoring Badge that has been lost or damaged before the end of the monitoring period, provided the spare badge is imprinted with the individual's name or another form of identification. Radiographic personnel assigned a spare badge will have the dose recorded by the dosimeter added to their occupational dose record.

#### IV. **PERSONNEL MONITORING RECORDS REQUIREMENTS**

##### A. **Records of Prior Occupational Dose**

Prior to assigning a dosimeter to radiographic personnel the individual's occupational radiation dose received during the current year will be determined. In addition, every reasonable effort must be made to obtain the individual's records indicating the individual's cumulative occupational radiation dose. If an individual is unable to provide the information, records from their previous employer will be obtained. Prior occupational dose records shall include all of the information required by the Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-2826, "Cumulative Occupational Exposure History", Department Form Z, or an equivalent form.

##### B. **Records of Individual Monitoring Results**

Records of doses received by each monitored individual will be maintained as long as the company's license remains in effect. Dosimetry records will be kept in accordance with the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-2804, "Notifications and Reports to Individuals" on Department Form Y, "Occupational Exposure Record for a Monitoring Period", Paragraph RH-2825, or an equivalent form, and will contain all of the information required by Paragraph RH-2804. These records will be updated annually.

##### C. **Annual Reports to Monitored Individuals**

Radiographic personnel assigned a Personnel Monitoring Badge will receive a written annual dose report describing the past year's monitoring results, as required by the Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-2804, "Notifications and Reports to Individuals". Records documenting that the reports have been furnished to monitored workers will be maintained for at least 3 years.

##### D. **Termination Reports to Monitored Individuals**

Within 30 days of termination of employment, or within 30 days after the individual's exposure has been determined, whichever is later, each monitored individual will receive a written report summarizing the individual's occupational radiation dose, as required by Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-2804, "Notifications and Reports to Individuals". Records

documenting that the reports have been furnished to monitored workers will be maintained for at least 3 years.

**E. Records for Declared Pregnancies**

The fetal dose will be closely monitored so as not to exceed 500 millirem. Female radiographic personnel that have declared themselves pregnant will be instructed to always wear their assigned dosimeters at waist level to estimate the embryo/fetus dose. Recordkeeping requirements specified in the Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-1207, "Dose to an Embryo/Fetus" and RH-1500.f.5., "Records of Individual Monitoring Results", will be met.

**F. Occupational Dose Limits for Minors**

Minors will not exceed an annual occupational dose of 500 millirem. Recordkeeping requirements specified in Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-1206, "Occupational Dose Limits for Minors" and Paragraph RH-2804, "Notifications and Reports to Individuals", will be met.

**G. Worker Overexposure Reports**

When a report of an individual's exposure is sent to the Department as required by Rules and Regulations for Control of sources of Ionizing Radiation, Paragraph RH-1505, "Notifications and Reports to Individuals", the exposed individual will also be notified no later than when the report is sent out.

# Appendix F-1

## Form F-1

### PERSONNEL MONITORING PROGRAM

**Describe the proposed personnel radiation dose monitoring program by marking the appropriate boxes. Submit the completed Form with the Application**

---

**1. Personnel Monitoring Badge Service---Vendor Supplied**

**a. Type Badge to be Used:**

**Film**                       **OSLD**                       **TLD**

**b. Radiation Detected:**

**Beta**                       **Gamma**                       **Neutron**

**c. Type Monitoring:**

**Whole body**                       **Extremity**

**d. Frequency of exchange:**

**Monthly**

**e. Supplier of Personnel Monitoring Badge Service:\_\_\_\_\_**

**Vendor Registration Number:\_\_\_\_\_**

**2. Pocket Dosimeter or Electronic Personal Dosimeter**

**Manufacturer :\_\_\_\_\_**

**Model Number:\_\_\_\_\_**

**3. Alarming Ratemeter**

**Manufacturer :\_\_\_\_\_**

**Model Number:\_\_\_\_\_**

## APPENDIX F-2

### DOSE LIMIT FOR MEMBERS OF THE PUBLIC ANNUAL DOSE DETERMINATION COMPLIANCE STUDY

#### Introduction

The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1208, requires that portable gauge operations be conducted so that the following limits are met:

- Radiation doses in unrestricted areas do not exceed **2 millirem in any one hour**
- Doses to members of the public do not exceed **100 millirem in a year**

Paragraph RH-1209 requires that appropriate surveys, calculations and/or environmental monitoring be used to demonstrate compliance with the dose limits. Satisfactory completion of this dose study provides the necessary documentation of compliance with both regulatory limits.

The below marked box indicates how this procedure is being utilized:

- New license applicant:** the procedure describes the methodology that will be used to conduct the dose study after licensed activities begin.
- Renewal application:** the procedure describes the methodology and results of the completed dose study of existing operations.

Radioactive Material Licensees must insure that:

- The radiation dose received by individual members of the public resulting from the licensees possession and/or use of licensed materials does not exceed 100 mrem (1 mSv) in one calendar year.

**NOTE: Members of the public include persons who live work, or may be near locations where industrial radiography devices are used or stored and employees whose assigned duties do not include the use of radioactive material and who work in the vicinity where radiographic devices are stored.**

- The radiation dose in unrestricted areas does not exceed 2 mrem (0.02 mSv) in any one hour.
- Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, and nonradioactive equipment storage areas. The licensee does

not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons such as security.

- Licensees must show compliance with both portions of the regulation. Radiographic operations at temporary jobsites must be demonstrated to have doses to the public in unrestricted areas that do not exceed 2 mrem (0.02 mSv) in any one hour. For storage areas and permanent radiographic facilities, calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance with levels of 2 mrem (0.02 mSv) in any one hour and 100 mrem (1 mSv) in a calendar year.

## **Calculational Method**

For ease of use by most industrial radiography licensees, the examples in this Appendix use conventional units. The conversions to SI units are as follows: 1 foot (ft) = 0.305 meter (m); 1 mrem = 0.01 mSv.

The calculational method takes a tiered approach, going through a three-part process starting with a “worst-case” situation and moving toward more realistic situations. It makes the following simplifications:

1. Each device is a point source,
2. Typical radiation levels encountered when the source is in the shielded position are taken from either the Sealed Source & Device (SSD) Registration Sheet, the maximum dose levels allowed for a transport package (exposure device) labeled YELLOW III, or the manufacturer's literature, and
3. No credit is taken for any shielding found between the devices and the unrestricted areas.

Part 1 of the calculational method is simple but conservative. It assumes that a member of the public is present 24 hours a day, and it uses only the inverse square law to determine if the distance between the device and the affected member of the public is sufficient to show compliance with the public dose limits.

Part 2 considers not only distance, but also the time that a member of the public is actually in the area under consideration.

Part 3 considers distance and the portion of time that both the device and the affected member of the public are present.

Part 4 considers the distance, the portion of time that both the device and the affected member of the public are present and the shielding provided by the structural materials or shielding materials specifically added by the licensee.

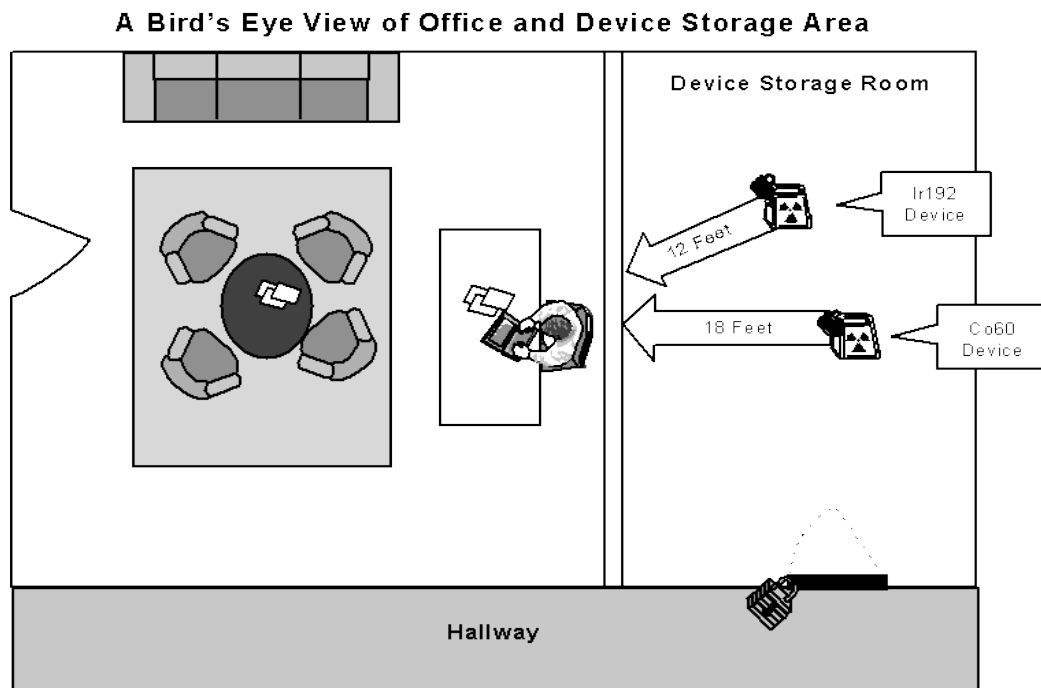


Using this approach, licensees make only those calculations that are needed to demonstrate compliance. In many cases, licensees will need to use the calculational method through Part 1 or Part 2. These calculations typically result in higher radiation levels than would exist at typical facilities, but provide a method for estimating conservative doses which could be received.

### **Example 1**

To better understand the calculational method, Mo-Rad, Inc., a hypothetical radiography licensee, is demonstrated. Yesterday, the company's president noted that the new device storage area is close to his secretary's desk and he asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with Department's regulations.

The secretary's desk is near the wall separating the reception area from the designated, locked device storage area, where the company is storing its two devices. Joe measures the distances from each device to the wall and assumes that each device would have the maximum dose rate allowed under Department or DOT regulations: 200 mrem/hr (2 mSv/hr) on the surface and 10 mrem/hr (0.1 mSv/hr) at one meter. Figure F-2.1 is Joe's sketch of the areas in question, and Table F-2.1 summarizes the information Joe has on each device.



rad0007 d.ppt  
072398

**Figure F-2.1. Diagram of Office and Radiographic Device Storage Area**

**Table F-2.1 Information Known About Each Radiographic Device**

Description of Known Information	Device 1	Device 2
How device is stored	Ir-192 exposure device (Type B container)	Co-60 exposure device (Type B container)
Dose rate in mrem/hr encountered at specified distance from the device	10 millirem/hr at 1 meter (3.3 ft)	10 millirem/hr at 1 meter (3.3 ft)
Distance in ft to secretary's chair	12 ft	18 ft

**Example 1: Part 1**

Joe's first thought is that the distance between the devices and the secretary's chair may be sufficient to show compliance with the regulation in RH-1208. So, taking a worst-case approach, he assumes: 1) the devices are constantly present (i.e., 24 hr/d), 2) both devices remain in storage with no other use, and 3) the secretary is constantly sitting in the desk chair (i.e., 24 hr/d). Joe proceeds to calculate the dose she might receive hourly and yearly from each device, as shown in Tables F-2.2 and F-2...3, below.

**Table F-2.2 Calculational Method, Part 1: Hourly and Annual Dose Received from Device 1**

Step No.	Description	Device 1 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in millirem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(12) <sup>2</sup>	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 10.9 = 109	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk, <b>HOURLY DOSE RECEIVED FROM DEVICE 1</b> , in millirem in an hour.	109/144 = <b>0.76</b>	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 1</b> , in millirem in a year.	0.76 x 24 x 365 = 0.76 x 8760 = <b>6,630</b>	

**Table F-2.3 Calculational Method, Part 1: Hourly and Annual Dose Received from Device 2**

Step No.	Description	Device 2 Input Data	Results
1	Dose received in an hour at known distance from device (e.g., from manufacturers data), in millirem/hr	10	10
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup>	(3.3) <sup>2</sup>	10.9
3	Square of the distance (ft) from the device to the secretary's desk in an unrestricted area, in ft <sup>2</sup>	(18) <sup>2</sup>	324
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	10 x 10.9 = 109	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in an hour by an individual at the secretary's desk, <b>HOURLY DOSE RECEIVED FROM DEVICE 2</b> , in millirem in an hour	109/324 = <b>0.34</b>	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICE 2</b> , in millirem in a year	0.34 x 24 x 365 = 0.34 x 8760 = <b>2950</b>	

To determine the total hourly and total annual dose received, Joe adds the pertinent data from the preceding tables.

**Table F-2.4 Calculational Method, Part 1: Total Hourly and Annual Dose Received from Devices 1 and 2**

Step No.	Description	Device 1	Device 2	Sum
7	<b>TOTAL HOURLY DOSE RECEIVED</b> from Step 5 of Tables F-2.2, and F-2.3, in millirem in an hour	0.76	0.34	0.76 + 0.34 = <b>1.1</b>
8	<b>TOTAL ANNUAL DOSE RECEIVED</b> from Step 6 of Tables F-2.2, and F-2.3, in millirem in a year	6630	2950	6630 + 2950 = <b>9580</b>

The Sum in Step 7 demonstrates compliance with the limit of 2 mrem in any one hour. Reevaluate if assumptions change. If the Sum in Step 8 exceeds 100 mrem/yr, proceed to Part 2 of the calculational method.

At this point, Joe is pleased to see that the total dose that an individual could receive in any one hour is only 1.1 mrem in an hour, but notes that an individual could receive a dose of **9,580 millirem in a year, much higher than the 100 millirem limit.**

**Example 1: Part 2**

Joe reviews his assumptions and recognizes that the secretary is not at the desk 24 hr/d. He decides to make a realistic estimate of the number of hours the secretary sits in the chair at the desk, keeping his other assumptions constant (i.e., the devices are constantly present (i.e., 24 hr/d), both devices remain in storage with no other use). He then recalculates the annual dose received.

**Table F-2.5 Calculational Method, Part 2: Annual Dose Received from Devices 1 and 2**

Step No.	Description	Results	
9	A. Average number of hours per day that individual spends in area of concern (e.g., secretary sits at desk 5 hr/day; the remainder of the day the secretary is away from the desk area copying, filing, etc.)	5	
		B. Average number of days per week in area (e.g., secretary is part time and works 3 days/week)	3
		C. Average number of weeks per year in area (e.g., secretary works all year )	52
10	Multiply the results of Step 9.A. by the results of Step 9.B. by the results of Step 9.C. = <b>AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR</b>	$5 \times 3 \times 52 = 780$	
11	Multiply the sum in Step 7 by the results of Step 10 = <b>ANNUAL DOSE RECEIVED FROM DEVICES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN</b> , in millirem in a year	$1.1 \times 780 = 860$	

*Note:* If Step 11 exceeds 100 millirem in a year, proceed to Part 3 of the calculational method.

Although Joe is pleased to note that the calculated annual dose received is significantly lower, he realizes it still exceeds the 100 mrem in a year limit.

### Example 1, Part 3

Again, Joe reviews his assumptions and recognizes that the devices are not always in storage when the secretary is seated at the desk. As he examines the situation, he realizes he must consider each device individually.

**Table F-2.6 Calculational Method, Part 3: Summary of Information**

<b>Summary</b>	
<b>Information on When Devices Are Present in the Storage Area:</b>	
<b>Device 1:</b> An Ir-192 Radiographic Device located in the Storage Area overnight; it is used every day at temporary jobsites all year and returned to the storage location at the end of each day. The device is usually present during the Secretary's first and last hours of work each day.	
<b>Device 2:</b> A Co-60 Radiographic Device located in the Storage Area continuously (24 Hr/d) for 8 months of the year; for the remaining 4 months of the year, it is at temporary jobsites	
<b>Information from Example 1, Part 2 on When the Secretary Is Sitting at the Desk:</b>	
5 Days per Week	
3 Days per Week	
52 Weeks per Year	

**Table L.F-2.7 Calculational Method, Part 3: Annual Dose Received from Devices 1 and 2**

<b>Step No.</b>	<b>Description</b>	<b>Device 1</b>	<b>Device 2</b>
12	Average number of <b>hours per day</b> device is in storage while secretary is present	<b>2</b>	<b>5</b>
13	Average number of <b>days per week</b> device is in storage while secretary is present	<b>3</b>	<b>3</b>
14	Average number of <b>weeks per year</b> device is in storage while secretary is present	<b>52</b>	<b>32</b>
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = <b>TOTAL HOURS EACH DEVICE IS STORED PER YEAR WHILE SECRETARY IS PRESENT</b>	2 x 3 x 52 = <b>312</b>	5 x 3 x 32 = <b>480</b>
16	Multiply the results of Step 15 by the results of Step 7 = <b>ANNUAL DOSE RECEIVED FROM EACH DEVICE</b> , in millirem in a year	312 x 0.76 = <b>237</b>	480 x 0.34 = <b>163</b>

17	Sum the results of Step 16 for each device = <b>TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME DEVICE IS IN STORAGE</b> , in millirem in a year	237+ 163 = <b>400</b>	
----	--	-----------------------------	--

If the result in Step 17 is greater than 100 millirem/yr, the licensee must take corrective actions.

Joe notes that the result in Step 17 does not show compliance with the 100 mrem/yr limit. Since the result in Step 17 is higher than 100 millirem/yr, then Joe has to consider one or more of the following:

Consider whether the assumptions used to determine occupancy and the time each device is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions.

Calculate the effect of any shielding located between the device storage area and the secretarial workstation. Listed below are typical half-value layers (HVL) for Ir-192 and Co-60.

**Table F-2.8 Half Value Layers (HVL) for Typical Shielding Materials**

	Steel	HVL (inches) Lead	Concrete
Ir-192	0.5	0.25	1.7
Co-60	0.8	0.5	2.1

Take corrective action (e.g., move devices within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance

Designate the area outside the storage area as a restricted area and the secretary as an occupationally exposed individual. This would require controlling access to the area for purposes of radiation protection and training the secretary as required by the Rules and Regulations.

**Example 1, Part 4**

Joe decides to take into account the amount of shielding provided by the wall between the secretary's desk and the storage area where the two devices are located. The wall between the secretary's office and the storage area is a 4-inch thick concrete firewall.

**Table F-2.9 Calculational Method, Part 4: Annual Dose Received from Devices 1 and 2**

Step No.	Description	Device 1	Device 2
18	Annual dose received from each device from Step 15	<b>237</b>	<b>163</b>
19	Number of HVLs (Thickness of shielding material/Thickness for one HVL); If more than one shielding material, need to evaluate each shielding material separately by <i>type of radionuclide</i> .	<b>4.0/1.7 = 2.35</b>	<b>4.0/2.1 = 1.9</b>
20	Fraction of radiation dose transmitted through shield: 0.5 (Total Number of HVLs); If more than one shielding material, then sum the number results from Step 19 by <i>radionuclide</i> .	<b>0.5(2.35) = 0.2</b>	<b>0.5(1.9) = 0.27</b>
21	Multiply the results of Step 20 by the results of Step 18 = <b>ANNUAL DOSE RECEIVED FROM EACH DEVICE</b> , in millirem in a year	0.2 x 237 = <b>47</b>	0.27 x 163 = <b>44</b>
22	Sum the results of Step 21 for each device = <b>TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN, TIME DEVICE IS IN STORAGE AND SHIELDING OF STRUCTURAL MATERIALS</b> , in millirem in a year	47 + 44 = <b>91</b>	

**Note:** If the result in Step 22 is greater than 100 mrem/yr, the licensee must take corrective actions.

Joe is glad to see that the results in Step 22 show compliance with the **100 mrem in a calendar year limit**.

Note that in the example, Joe evaluated the unrestricted area outside only one wall of the device storage area. Licensees also need to make similar evaluations for other unrestricted areas and to keep in mind the ALARA principle, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the devices closer to the secretarial workstation, adding a device to the storage area, changing the secretary to a full-time worker, or changing the estimate of the portion of time spent at the desk) and to perform additional evaluations, as needed.

### **Combination Measurement - Calculational Method**

This method, which allows the licensee to take credit for shielding between the device and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each device. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. However, licensees must exercise caution when making measurements with currently calibrated radiation survey instruments. A maximum dose of 100 mrem (1 mSv) received by an individual over an interval of 2080 hours (i.e., a work year of 40 hr/wk for 52 wk/yr) is equal to less than 0.05 mrem (0.5 microsievert) per hour. **This dose rate is well below the minimum sensitivity of most commonly available G-M Survey instruments.**

Instruments used to make measurements for calculations must be sufficiently sensitive. An instrument equipped with a scintillation-type detector (e.g., NaI(Tl)) or a micro-R meter used in making very low gamma radiation measurements should be adequate.

Licensees may also choose to use environmental TLDs. TLDs used for personnel monitoring may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 10 millirem (0.1 mSv). Suppose a TLD monitors dose received and is changed once a month. If the measurements are at the minimum reportable level, the annual dose received could have been about 120 millirem (1.2 mSv), a value in excess of the 100 mrem/yr (1 mSv/yr) limit. If licensees use TLDs to evaluate compliance with the public dose limits, they should consult with their TLD supplier and choose more sensitive TLDs, such as those containing CaF<sub>2</sub> that are used for environmental monitoring. In unrestricted areas next to the device storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 100 mrem/yr (1 mSv/yr) limit.

## Example 2

As in Example 1, Joe is the RSO for Mo-Rad, Inc., a radiography licensee. The company has two devices stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial work station is located. See Figure F-2.1 and Table F-2.1 for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

During the winter while all the devices were in storage, Joe placed an environmental TLD badge in the secretarial work space for 30 days. Joe chose a winter month so he did not have to keep track of the number of hours that each device was in the storage area. The TLD processor sent Joe a report indicating the TLD received 100 mrem.

Parts 2 and 3 are the calculated the same as Example 1.

**Table F-2.10 Combination Measurement - Calculational Method**

Step No.	Description	Input Data and Results
<b>Part 1</b>		
1	Dose received by TLD, in millirem	<b>100</b>
2	Total hours TLD exposed	24 hr/d x 30 d/month = <b>720</b>
3	Divide the results of Step 1 by the results of Step 2 to determine <b>HOURLY DOSE RECEIVED</b> , in millirem in an hour	<b>0.14</b>
4	Multiply the results of Step 3 by 365 d/yr x 24 hr/d = 8760 hours in one year = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM DEVICES</b> , in millirem in a year	365 x 24 x 0.14 = 8760 x 0.14 = <b>1226</b>



Parts 2 and 3		
	Calculated Same as Example 1	

For conditions described above, Step 3 indicates that the dose received in any one hour is less than the 2 mrem in any one hour limit. However, if there are any changes, then the licensee would need to reevaluate the potential doses which could be received in any one hour. Step 4 indicates that the annual dose received would be much greater than the 100 millirem in a year allowed by the regulations.

In Step 2, Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 millirem, then he can make adjustments for realistic estimates of the time spent in the area of concern while the devices are actually in storage as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the devices were in storage -- i.e., 24 hr/d for the 30 days that the TLD was in place.)

## Appendix G

### FACILITIES AND EQUIPMENT

#### I. Introduction

Applicants must specifically identify and describe all radiographic installations at which industrial radiography will be conducted, including temporary job sites, permanent locations, field stations, and any other locations where radiographic devices may be used or stored.

#### II. Temporary Job Sites

##### A. License Requirement

A Radioactive Material License is required to perform industrial radiography at temporary work locations or fixed, permanent work locations, or a combination of both.

Industrial radiography is most commonly performed at temporary job sites throughout the State of Arkansas. During this process, the radiographic devices are stored at a permanent storage location and are transported to the job site in a specially equipped vehicle by radiographic personnel and then returned to the permanent storage location at the completion of the work. Temporary storage of the radiographic devices in the transport vehicle is typically authorized by the Radioactive Material License; however, temporary storage at the job site (outside the transport vehicle) is not permitted unless it is specifically authorized by the License. Radiographic equipment stored at temporary jobsites must be secured at a location that prevents access by unauthorized personnel. It is not acceptable for a device to be chained to a post and left unattended at the place of use during lunch, breaks, or after hours.

<p><b>NOTE: Radiographic devices, source changers, or transport containers that contain radioactive material may not be stored in residential locations.</b></p>
--

If the applicant plans to use vehicles for storage, there must be procedures and instructions to personnel about proper posting of the vehicle. Vehicles should be posted with a "Caution - Radioactive Material" sign on the entrance to the area of the vehicle where licensed material is stored. Appendix P, "Operating Procedures" addresses the specific requirements for the radiological posting of the vehicle.

In responding to the requirements of the Rules and Regulations and the Application, Item 16, the Applicant must provide a written description of the facilities and equipment and the transport vehicle, as well as provide drawings of

the facility site and storage area, and the vehicle, to support the written description.

**B. Response from Applicant:**

The Application must include the following information:

1. Permanent Storage Facility
  - a. Submit a description and an annotated diagram of the permanent storage facility that includes the following:
    - (1.) Site Plan showing the location of the permanent storage area on the facility site with appropriate labeling of buildings, security fences, access gates, all entrances and points of access, and distances to adjacent structures.
    - (2.) Description of the work areas inside the facility that are occupied by ancillary personnel, including the distances from the nearest work areas to the storage area and the time spent in each work area by personnel, etc.
    - (3.) Description of the storage vault materials, radiation shielding, and vault construction including the door, shielding thickness on all sides, and a general description of the security provisions (locks, alarms, etc.) for the storage area.
    - (4.) Radiological posting of the facility and storage vault.
  - b. If the facility is a multistory and/or multi-tenant building, identify floors above and below the storage area and their uses, including areas occupied by other tenants. Exhibit A provides a sample facility diagram.
  - c. Provide evidence that the permanent storage area is capable of storing at least the maximum number of devices to be authorized by the license.
  - d. Appendix H, "Security of Radiographic Devices" addresses the requirements for security measures that will be used to prevent unauthorized access to the radioactive devices and radioactive material.

- e. Describe the radiological posting of the permanent gauge storage facility and confirm that the facility will always be properly posted.
- f. Describe any remote handling equipment that will be available for use.

2. Transport Vehicle

- a. Submit a description and an annotated diagram of the radiographic device storage container inside the transport vehicle that includes the following:
  - (1.) Storage container materials, radiation shielding, and container construction, including shielding thickness on all sides, a general description of how the device will be secured to the container/vehicle, bracing the device to prevent load shifting during transport, and a general description of the physical security provisions (locks, etc) for the storage container.
  - (2.) Radiological posting of the vehicle when the vehicle is used as a temporary storage location. Confirm that the vehicle will always be properly posted.
  - (3.) Radiographic device overpacks used during transportation
- b. Appendix H, “Security of Radiographic Devices” addresses the requirements for security measures that will be used to prevent unauthorized access to the radioactive devices and radioactive material.
- c.. Describe any remote handling equipment that will be available for use.

<p><b>NOTE: The overnight storage of a radiographic device in a private residence or motel/hotel room or similar location, on a temporary basis is not authorized or approved.</b></p>
--

3. Temporary Storage Locations/Field Stations

- a. Identify the location(s) of the proposed temporary storage facility and submit the same information for the temporary location as

provided for the permanent storage location in Paragraph 2.b.1, above.

- b. Appendix H, "Security of Radiographic Devices" addresses the requirements for security measures that will be used to prevent unauthorized access to the radioactive devices and radioactive material.
- c. Describe the radiological posting of the permanent gauge storage facility and confirm that the facility will always be properly posted.
- d. Describe any remote handling equipment that will be available for use.

### **III. Permanent Radiographic Installation**

#### **A. Licensing requirement**

1. A permanent radiographic installation is an enclosed shielded room, cell, or vault in which radiography may be performed. A facility is considered "permanent" if it is intended to be used for radiography, even if radiography is rarely performed there. The nature of the facility, rather than the frequency of use, determines a permanent radiographic installation. All radiographic operations conducted at locations of use authorized on the license must be conducted in a permanent radiographic installation, unless specifically authorized by Department. If licensees need to perform radiography at their place of business outside of a permanent facility due to unique circumstances (the item to be radiographed is too large for the facility), then the Department must authorize this method of use. In this case, two individuals must be present whenever radiographic operations occur outside of a permanent installation.
2. The one primary (and perhaps the most important) reason licensees have for conducting radiography in a permanent radiographic installation is that they can limit access restrictions imposed at a work location. In order to ensure this control a permanent radiographic installation, if located on the ground, must be enclosed by a minimum of four shielded walls (otherwise, the floor must also be shielded). The use of materials that do not realistically provide shielding, do not qualify. Areas outside of the facility generally should qualify as unrestricted areas. While the area outside of an installation should qualify as an unrestricted area (i.e., not exceed 2mR/hr), the regulation did not specify radiation limits in order to allow for design

flexibility for moving equipment into and out of the installation, or other considerations. Radiation levels slightly exceeding these levels outside of the facility should only be considered or allowed when the higher levels are due to "sky shine" or the need for equipment movement. If the roof of the facility does not qualify as a restricted area, or if no roof exists, mechanical access restrictions (fence, etc.) must be utilized and additional administrative controls must be imposed to ensure that unwanted access can be gained only through extraordinary effort. All entrance ways into the facility must be interlocked with control devices, as required by the Rules and Regulations, Paragraph RH-1801.j, "Permanent Radiographic Installations". Unless all entrance ways are locked, at least one radiographer must be present at the facility whenever radiography is being conducted.

3. A field station is a facility where licensed material may be stored and/or used and from which equipment is dispatched. Radiographic operations may be conducted in a permanent radiographic installation or at the place of business in the same manner as described above.
4. A restricted area is an area that licensees limit access for the purpose of protecting individuals from undue risks from exposure to radiation and radioactive materials. A restricted area cannot include areas used as residential quarters.
5. Requirements for a permanent radiographic installation:
  - a. Audible-visible signals
    - (1.) Each entrance is equipped with a visible-audible signal system. The visible signal is activated by radiation whenever the source is exposed. The audible signal will sound if anyone tries to enter the installation while the source is exposed. The requirement for the visible-audible signal system is in addition to other measures that may be taken to prevent access to the installation, such as locked doors.
    - (2.) As an alternative to the visible-audible alarm system, it is acceptable to use a control system that will reduce the radiation level if the entrance to a high-radiation area is opened while the source is out. The system must be automatic and independent of radiography personnel action. If this alternative is planned, provide a description of the system.
  - b. Diagram depicting the shielding, layout, and audible-visual alarms

- (1.) A diagram of the installation must be submitted to assist in evaluating the shielding and determining compliance with regulations regarding restricted and unrestricted areas, location of access points, and locations of audible-visible signals. Figure G-1 shows an example installation diagram.

c. Calculations or survey results of radiation levels

- (1.) For a determination of installation adequacy, provide information showing that the radiation level in all directions around the installation, including the roof, will not exceed a dose of 2 mrem (0.02 mSv) in any one hour. Take into account the highest quantity of radioactive material that will be used in the installation and any limitations on source positioning in the installation. Radiation levels in all directions around the installation that are below 2 mrem (0.02 mSv) in any one hour are considered acceptable. If the radiation levels will exceed 2 mrem (0.02 mSv) in any one hour, then steps must be taken (use lower-activity source, use collimator, or move setup farther away) to reduce the radiation to the acceptable level.
- (2.) A radiation level on the roof that exceeds 100 mrem (1.0 mSv) in one hour at 30 cm from the surface is considered a "high radiation area" and requires special precautions to control access to the area. Licensees should make efforts to lower a radiation level exceeding 100 mrem (1.0 mSv) in any one hour by using additional shielding, collimators, or other engineering controls. The roof of a fixed radiography cell is a potentially occupied area, and applicants must demonstrate that no individual member of the public could receive effective doses in excess of 0.02 mSv (2 mrem) in any one hour or 100 mrem (1 mSv) in a year.

**B. Response from Applicant:**

The Application must include the following:

1. If radiography is planned in a permanent radiography installation or installations (including field stations with permanent exposure cells), provide the following information for each installation:
  - a. An annotated sketch or drawing of the facility and its surroundings.

- b. 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. Drawings to this scale that do not fit on 8 1/2 X 11 paper may be provided as sectional drawings.
  - c. The type, thickness and density of shielding materials on all sides, including the floor and the roof.
  - d. The locations of entrance ways and other points of access to the facility.
  - e. A description of the areas adjacent to the facility and the distance to these areas. Include information on areas adjacent to, above, and below the facility.
  - f. A description of the general location of each proposed permanent installation listed in Item 3 (e.g., located in an industrial park, an office complex, etc.) and its current use.
  - g. A general description of the visible-audible signal system or entrance control system and its location.
  - h. The results of radiation-level calculations or actual radiation measurements adjacent to, above, and below the installation. The radiation level in all directions around the installation, including the roof, should not exceed 2 mrem (0.02 mSv) in any one hour. Clearly identify the type and the amount of radioactive material in the source, and the position of the source within the installation for the calculations or measurements.
2. Variances will be considered if construction requirements preclude shielding the roof in order to meet the requirement not to exceed 2 mrem (0.02 mSv) in any one hour. Provide the following information to obtain approval for a variance:
- a. Procedures for ensuring that no individual is on the roof or could gain access to the roof during radiography
  - b. Means of preventing access to the roof
  - c. A commitment that the roof will be posted with "Caution (or Danger) Radiation Area" signs
  - d. Steps taken to minimize radiation on the roof



- e. Limitations (if needed) on positioning of sources, or type and amount of radioactive material, that may be used in the installation to ensure that areas adjacent to, above, and below the installation will be unrestricted areas during the performance of radiography
3. If radiation levels on the radiography installation roof<sup>1</sup> exceed 100 mrem (1.0 mSv) in any one hour, then provide the following information in addition to the items above to apply for this variance:
  - a. A commitment that the roof will be posted with "Caution (or Danger) High Radiation Area" signs
  - b. Evidence of constant surveillance of the roof by closed-circuit TV
  - c. Fluctuation of the dose rate
  - d. A description of a control device that would automatically reduce the radiation level to 100 mrem (1mSv) in any one hour at 30 cm from the radiation source if someone enters the roof.
  - e. A description of a control device that activates a visible-audible signal so that both an individual entering the roof and the radiographer on duty are made aware of the entry
4. Appendix H, "Security of Radiographic Devices" addresses the requirements for security measures that will be used to prevent unauthorized access to the radioactive devices and radioactive material.
5. Describe the radiological posting of the permanent gauge storage facility and confirm that the facility will always be properly posted.
6. Describe any remote handling equipment that will be available for use

## APPENDIX H

### INCREASED CONTROLS FOR LICENSEES THAT POSSESS SOURCES CONTAINING RADIOACTIVE MATERIAL QUANTITIES OF CONCERN

The purpose of the increased controls (ICs) for radioactive sources is to enhance control of radioactive material in quantities greater than or equal to values described in Table 1, to reduce the risk of malevolent use of radioactive materials, through access controls to aid prevention, and prompt detection, assessment, and response to mitigate potentially high consequences that would be detrimental to public health and safety. These ICs for radioactive sources are established to delineate licensee responsibility to maintain control of licensed material and secure it from unauthorized removal or access. The following ICs apply to licensees who, at any given time, possess radioactive sources greater than or equal to the quantities of concern of radioactive material defined in Table 1.

1. In order to ensure the safe handling, use, and control of licensed material in use and in storage each licensee shall control access at all times to radioactive material quantities of concern and devices containing such radioactive material (devices), and limit access to such radioactive material and devices to only approved individuals who require access to perform their duties.
  - a. The licensee shall allow only trustworthy and reliable individuals, approved in writing by the licensee, to have unescorted access to radioactive material quantities of concern and devices. The licensee shall approve for unescorted access only those individuals with job duties that require access to such radioactive material and devices. Personnel who require access to such radioactive material and devices to perform a job duty, but who are not approved by the licensee for unescorted access, must be escorted by an approved individual.
  - b. For individuals employed by the licensee for three years or less, and for non-licensee personnel, such as physicians, physicists, housekeeping personnel, and security personnel under contract, trustworthiness and reliability shall be determined, at a minimum, by verifying employment history, education, and personal references. The licensee shall also, to the extent possible, obtain independent information to corroborate that provided by the employee (i.e., seeking references not supplied by the individual). For individuals employed by the licensee for longer than three years, trustworthiness and reliability shall be determined, at a minimum, by a review of the employees' employment history with the licensee.
  - c. Service providers shall be escorted unless determined to be trustworthy and reliable by an NRC-required background investigation as an employee of a manufacturing or distribution (M&D) licensee. Written verification attesting to or certifying the person's trustworthiness and reliability shall be obtained from the manufacturing/distribution licensee providing the service.
  - d. The licensee shall document the basis for concluding that there is reasonable assurance an individual granted unescorted access is trustworthy and reliable, and does not constitute an unreasonable risk for malevolent use of radioactive material quantities of concern.

The licensee shall maintain a list of persons approved for access to such radioactive material and device(s) by the licensee.

2. In order to ensure the safe handling, use, and control of licensed material in use and in storage, each licensee shall have a documented program to monitor and immediately detect, assess, and respond to unauthorized access to radioactive material quantities of concern and devices. Enhanced monitoring shall be provided during periods of source delivery or shipment, where the delivery or shipment exceeds 100 times the Table 1 values.
  - a. The licensee shall respond immediately to any actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices. The response shall include requesting assistance from Local Law Enforcement Agency (LLEA).
  - b. The licensee shall have a pre-arranged plan with LLEA for assistance in response to an actual or attempted theft, sabotage, or diversion of such radioactive material or of the devices which is consistent in scope and timing with realistic potential vulnerability of the sources containing such radioactive material. The pre-arranged plan shall be updated when changes to the facility design or operation affect the potential vulnerability of the sources. Pre-arranged LLEA coordination is not required for temporary job sites.
  - c. The licensee shall have a dependable means to transmit information between, and among, the various components used to detect and identify an unauthorized intrusion, to inform the assessor, and to summon the appropriate responder.
  - d. After initiating appropriate response to any actual or attempted theft, sabotage, or diversion of radioactive material or of the device(s), the licensee shall, as promptly as possible, notify Arkansas Department of Health and Human Services, Radioactive Materials Program at 1-800-633-1735.
  - e. The licensee shall maintain documentation describing each instance of unauthorized access and any necessary corrective actions to prevent future instances of unauthorized access.
3. a. In order to ensure the safe handling, use, and control of licensed material in transportation for domestic highway and rail shipments by a carrier other than the licensee, for quantities that equal or exceed those in Table 1 but are less than 100 times Table 1 quantities, per consignment, the licensee shall:
  1. Use carriers which:
    - A. Use package tracking systems,
    - B. Implement methods to assure trustworthiness and reliability of drivers,
    - C. Maintain constant control and/or surveillance during transit, and
    - D. Have the capability for immediate communication to summon appropriate response or assistance.

The licensee shall verify and document that the carrier employs the measures listed above.

2. Contact the recipient to coordinate the expected arrival time of the shipment;
  3. Confirm receipt of the shipment; and
  4. Initiate an investigation to determine the location of the licensed material if the shipment does not arrive on or about the expected arrival time. When, through the course of the investigation, it is determined the shipment has become lost, stolen, or missing, the licensee shall immediately notify the Arkansas Department of Health and Human Services, Radioactive Materials Program at 1-800-633-1735. If after 24 hours of investigating, the location of the material still cannot be determined, the radioactive material is deemed missing and the licensee shall immediately notify the Arkansas Department of Health and Human Services, Radioactive Materials Program at 1-800-633-1735.
- b. For domestic highway and rail shipments, prior to shipping licensed radioactive material that exceeds 100 times the quantities in Table 1 per consignment, the licensee shall:
1. Notify NRC\*, in writing, at least 90 days prior to the anticipated date of shipment. The NRC will issue the order requiring implementation of Additional Security Measures (ASMs) for the transportation of Radioactive Material Quantities of Concern (RAM QC). The licensee shall not ship this material until the ASMs for the transportation of RAM QC are implemented or notified otherwise, in writing, by NRC.
  2. Once the licensee has implemented the ASMs for the transportation of RAM QC, the notification requirements of 3.b.1 shall not apply to future shipments of licensed radioactive material that exceed 100 times the Table 1 quantities. The licensee shall implement the ASMs for the transportation of RAM QC.
- c. If a licensee employs a M&D licensee to take possession of the licensed radioactive material and ship it under its M&D license, the requirements of 3.a. and 3.b above shall not apply (because the M&D licensee will have to comply with equivalent requirements).
- d. If the licensee is to receive radioactive material greater than or equal to the Table 1 quantities, per consignment, the licensee shall coordinate with the originating licensee to:
1. Establish an expected time of delivery; and

---

\* Director, Office of Nuclear Material Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555

2. Confirm receipt of transferred radioactive material. If the material is not received at the expected time of delivery, notify the originating licensee and assist in any investigation.

4. In order to ensure the safe handling, use, and control of licensed material in use and in storage each licensee who possesses mobile or portable devices containing radioactive material in quantities greater than or equal to Table 1 values, shall:
  - a. For portable devices, have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.
  - b. For mobile devices:
    1. that are only moved outside of the facility (e.g., on a trailer), have two independent physical controls that form tangible barriers to secure the material from unauthorized removal when the device is not under direct control and constant surveillance by the licensee.
    2. that are only moved inside a facility, have a physical control that forms a tangible barrier to secure the material from unauthorized movement or removal when the device is not under direct control and constant surveillance by the licensee.
  - c. For devices in or on a vehicle or trailer, licensees shall also utilize a method to disable the vehicle or trailer when not under direct control and constant surveillance by the licensee.
5. The licensee shall retain documentation required by these increased controls for three years after they are no longer effective:
  - a. The licensee shall retain documentation regarding the trustworthiness and reliability of individual employees for three years after the individual's employment ends.
  - b. Each time the licensee revises the list of approved persons required by 1.d., or the documented security program required by 2, the licensee shall retain the previous documentation for three years after the revision.
  - c. The licensee shall retain documentation on each radioactive material carrier for three years after the licensee discontinues use of that particular carrier.
  - d. The licensee shall retain documentation on shipment coordination, notifications, and investigations for three years after the shipment or investigation is completed.
  - e. After the license is terminated or amended to reduce possession limits below the quantities of concern, the licensee shall retain all documentation required by these increased controls for three years.
6. Detailed information generated by the licensee that describes the physical protection of radioactive material quantities of concern, is sensitive information and shall be protected from unauthorized disclosure.
  - a. The licensee shall control access to its physical protection information to those persons who have an established need to know the information, and are considered to be trustworthy and reliable.

- b. The licensee shall develop, maintain and implement policies and procedures for controlling access to, and for proper handling and protection against unauthorized disclosure of, its physical protection information for radioactive material covered by these requirements. The policies and procedures shall include the following:
1. General performance requirement that each person who produces, receives, or acquires the licensee's sensitive information, protect the information from unauthorized disclosure,
  2. Protection of sensitive information during use, storage, and transit,
  3. Preparation, identification or marking, and transmission,
  4. Access controls,
  5. Destruction of documents,
  6. Use of automatic data processing systems, and
  7. Removal from the licensee's sensitive information category.

**Table 1**

Radionuclide	Minimum Quantity of Concern <sup>1</sup> (TBq)	Minimum Quantity of Concern <sup>2</sup> (Ci)
Am-241	0.6	16
Cf-252	0.2	5.4
Cm-244	0.5	14
Co-60	0.3	8.1
Cs-137	1	27

Gd-153	10	270
Ir-192	0.8	22
Pm-147	400	11,000
Pu-238	0.6	16
Pu-239	0.6	16
Se-75	2	54
Sr-90 (Y-90)	10	270
Tm-170	200	5,400
Yb-169	3	81
Combinations	Unity <sup>3</sup>	

Notes:

1. The aggregate activity of multiple, co-located sources of the same radionuclide should be included when the total activity exceeds the quantity of concern. Radioactive materials are considered aggregated or co-located if breaching a common physical barrier (e.g., a locked storage room door) would allow access to the material.
2. The primary values used for compliance are TBq. The curie (Ci) values are rounded to two significant figures for informational purposes only.
3. Use the following method to determine which sources of radioactive material require increased controls (ICs):
  - Include any single source larger than the quantity of concern in Table 1
  - Include multiple co-located sources of the same radionuclide when the combined quantity exceeds the quantity of concern

For combinations of radionuclides, include multiple co-located sources of different radionuclides when the aggregate quantities satisfy the following unity rule: [(amount of nuclide A) ÷ (quantity of concern of nuclide A)] + [(amount of nuclide B) ÷ (quantity of concern for nuclide B)] + etc ... ≥ 1

### **Guidance for Aggregation of Sources**

The NRC supports the use of the IAEA's source categorization methodology as defined in TECDOC-1344, "Categorization of Radioactive Sources," (July, 2003) (see [http://www-pub.iaea.org/MTCD/publications/PDF/te\\_1344\\_web.pdf](http://www-pub.iaea.org/MTCD/publications/PDF/te_1344_web.pdf)) and as endorsed by the agency's Code of Conduct for the Safety and Security of Radioactive Sources, January, 2004 (see <http://www-pub.iaea.org/MTCD/publications/PDF/Code-2004.pdf>). The Code defines a three-tiered source categorization scheme. Category 1 corresponds to the largest source strength (greater than 100 times the quantity of concern values listed in Table 1) and Category 3, the smallest (equal or exceeding one-tenth the quantity of concern values listed in Table 1). Increased controls (ICs) apply to sources that are greater than the quantity of concern values listed in Table 1, plus

aggregations of smaller sources that add up to greater than the quantities in Table 1. Aggregation only applies to sources that are co-located.

Licensees who possess sources in total quantities that exceed the Table 1 quantities are required to implement ICs. Where there are many small (less than the quantity of concern values) co-located sources whose total aggregate activity exceeds the Table 1 values, licensees are to implement ICs.

Some source handling or storage activities may cover several buildings, or several locations within specific buildings. The question then becomes: When are sources considered co-located for purposes of aggregation? For purposes of the ICs, sources are considered co-located if breaching a single barrier (e.g., a locked door at the entrance to a storage room) would allow access to the sources. Sources behind an outer barrier should be aggregated separately from those behind an inner barrier (e.g., a locked source safe inside the locked storage room). However, if both barriers are simultaneously open, then all sources within these two barriers are considered to be co-located. This logic should be continued for other barriers within or behind the inner barrier. The following example illustrates the point: A lockable room has sources stored in it. Inside the lockable room, there are two shielded safes with additional sources in them. Inventories are as follows:

The room has the following sources outside the safes: Cf-252, 0.12 Tbq (0.3 Ci); Po-210, 0.36 TBq (10 Ci), and Pu-238, 0.3 Tbq (8 Ci). Application of the unity rule yields:  $(0.012 \div 0.2) + (0.36 \div 0.6) + (0.3 \div 0.6) = 0.06 + 0.6 + 0.5 = 1.2$ . Therefore, the sources would require ICs. If the sources are distributed and shipped individually, ICs would not apply because they do not exceed the quantities in Table 1.

Shielded safe #1 has a 1.9 Tbq (51 Ci) Cs-137 source and a 0.75 Tbq (20 Ci) Ra-226 source. In this case, both sources would require PMs, because they exceed the quantities in Table 1. The Ra-226 source, although not licensed by the NRC, was collocated with an NRC licensed source and, therefore, would need to be similarly protected.

Shielded safe #2 has two Po-210 sources, each having an activity of 0.2 Tbq (5 Ci). In this case, neither source would require ICs. (Total activity = 0.4 Tbq (10 Ci)). They do not exceed the threshold quantity 0.6 Tbq (20 Ci).

Because certain barriers may cease to exist during source handling operations (e.g., a storage location may be unlocked during periods of active source usage), licensees should, to the extent practicable, consider two modes of source usage — “operations” (active source usage) and “shutdown” (source storage mode). Whichever mode results in the greatest inventory (considering barrier status) would require ICs for each location.



## APPENDIX I

### RADIATION SURVEY PROGRAM

A radiation survey program is required of Industrial Radiography licensees. The licensee shall perform radiation surveys during use, movement, and storage of radiographic devices to help insure the radioactive material is used safely and according to the regulations and the Radioactive Material License. Radiation surveys shall be performed as prescribed by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1300, "Surveys".

Radiation surveys shall be made whenever a source is manipulated or moved. Surveys shall be made with a calibrated radiation survey instrument that has been verified operable prior to performing the survey.

The following information provides examples of radiation surveys, made during radiographic and associated operations that must be included in the operating and emergency procedures. Complete this Appendix by writing the specific Operating and Emergency Procedure Numbers in the Procedure Reference column and submitting this Appendix with the Application.

<u>FREQUENCY</u>	<u>TYPE OF RADIATION SURVEY</u>	<u>PROCEDURE REFERENCE</u>
------------------	---------------------------------	----------------------------

#### DIRECT RADIATION SURVEYS

- |  |   |  |
|--|---|--|
| 1. During the first exposures for each set up of radiographic device | 1. Boundary of restricted area at temporary job site does not exceed 2 millirem in any one hour                           |  |
| 2. At intervals not to exceed 12 months                              | 2. Unrestricted area in vicinity of permanent radiographic installation or storage area does exceed 100 millirem per hour |  |
| 3. Each receipt of package   | 3. External radiation levels when a package is received and opened  |  |

**FREQUENCY****TYPE OF RADIATION SURVEY****PROCEDURE REFERENCE**

- 
- |   |   |  |
|---|---|--|
| 4. Each installation of new source in radiographic device         | 4. Dose rate does not exceed 200 millirem per hour on surface and 10 millirem at one meter  |  |
| 5. Each installation of new source in container or source changer | 5. Dose rate does not exceed 200 millirem per hour at any exterior surface, and 10 millirem per hour at 1 meter from any exterior surface with a sealed source in the shielded position |  |
| 6. After every radiographic exposure                              | 6. Confirm radioactive source has returned to shielded position   |  |
| 7. After every radiographic device is placed in storage           | 7. Confirm radioactive source is in shielded position   |  |
| 8. After every source exchange is placed in storage               | 8. Confirm radioactive source is in shielded position   |  |
| 9. Every movement of radioactive material on public roads         | 9. Dose rates meet labeling of package (i.e. Yellow II) and determine Transportation Index (TI)   |  |
| 10. Every movement of a package labeled Yellow II                 | 10. Dose rates in and around vehicle do not exceed 2 millirem per hour in driver's seat, 200 millirem per hour on surface, and 10 millirem per hour at 2 meters from vehicle            |  |
-

**FREQUENCY**

**TYPE OF RADIATION SURVEY**

**PROCEDURE REFERENCE**

**Radioactive Material Leak Test**

-----  
1. At intervals not to exceed 6 months

1. Contamination level for leak test of sealed sources  
does not exceed 0.005 microCuries

-----  
2. At intervals not to exceed 12 months

2. Contamination levels for leak test of depleted  
uranium shielding of radiographic device does not  
exceed 0.005 microCuries  
-----

## APPENDIX J

### ORDERING, RECEIVING, OPENING, AND SHIPPING PACKAGES CONTAINING RADIOACTIVE MATERIAL

To insure that radiographic devices and source changers containing radioactive material are properly ordered, received, opened and shipped, the following procedures are used:

#### I. Ordering and Receiving

- A. Radioactive material will be ordered by \_\_\_\_\_(Name/Title).
- B. The Radiation Safety Officer (RSO) must approve or place all orders for radioactive material and insure that the requested radioactive material(s), quantities, manufacturer and model are authorized by the license and that possession limits are not exceeded.
- C. Transportation carriers will be provided instructions on when and where to deliver packages containing radioactive materials.

#### II. Receiving and Safely Opening Packages

- A. Only Authorized Users are permitted to open shipping packages (shipping/transport containers) containing radioactive material. If the RSO or an Authorized User is not available when the package is delivered, the package will be placed in a secure, pre-designated remote location of the facility awaiting the RSO or an Authorized User. The package will not be opened.
- B. Packages containing radioactive material shall be inspected as soon as practical after the package is received, but not later than three (3) hours after the package is received during normal working hours.
- C. Packages containing radioactive material will not be received after normal working hours.
- D. Each package will be visually inspected for any sign of damage. **If damage is noted, immediately notify the RSO.** If the RSO determines that the shielding may have been compromised, the RSO will either survey the device or make arrangements to have the device surveyed to determine the presence and extent of any shielding failure or radioactive contamination. **If damage is noted, the device will immediately be leak tested and placed in a secure storage area.. The device will not be used until it has been repaired and approved for use by the manufacturer.** The RSO will notify the Department in accordance with the Emergency Procedures.

- E.** If the physical inspection indicates no damage, remove the packing slip. Open the container and verify the contents. Closely examine the gauge for damage and check the manufacturer model number to verify that it is one that is authorized by the radioactive materials license. If anything appears out of place or missing, notify the RSO.
- F.** If the inspection results are satisfactory, store and lock the gauge in the designated storage area.
- G.** Records of receipt and transfer shall be maintained for inspection purposes and shall be retained for at least 3 years following the date the record was created.

### **III. Preparing Packages for Shipment**

- A.** Radiographic devices and source changers offered to common carriers for shipment will be prepared in accordance with applicable U.S. Department of Transportation regulations. Specific instructions for preparing packages for shipment are provided in the Transportation section of the Operating Procedures. Proper packaging, markings and labels will be used, and proper shipping papers and emergency response information will be provided with each package. Transfer records will be maintained on file for inspection purposes.
- B.** Radiographic devices and source changers will be prepared for shipment only by personnel that have completed hazmat employee training specified in the U.S. Department of Transportation, Subpart H, 49 CFR Part 172.

## APPENDIX K

### DISPOSAL OR TRANSFER OF RADIOACTIVE MATERIAL

Paragraphs RH-1400 through RH-1407, Rules and Regulations for Control of Sources of Ionizing Radiation, address the transfer and disposal of radioactive material. In accordance with Paragraph RH-1400 a., radiographic devices or source changers containing radioactive material, including depleted uranium shielding, will only be transferred to an Authorized Recipient, companies or individuals who are specifically licensed to possess them, in accordance with the below procedure or equivalent procedure.

#### I. Description of Waste Disposal Program

Describe the procedures for handling, storing, and disposing of radioactive waste by checking the appropriate boxes. Identify the commercial waste disposal service employed and provide the Radioactive Material License number. If sealed sources and/or devices will be returned to the manufacturer, identify the manufacturer and provide the Radioactive Material License number.

**Commercial Waste Disposal Company will be used using these procedures**

Name of Waste Disposal Company: \_\_\_\_\_

Vendor Radioactive Material License Number: \_\_\_\_\_

**Radiographic Device or Source Changer containing the sealed source will be returned to manufacturer using these procedures**

Name of Manufacturer: \_\_\_\_\_

Vendor Radioactive Material License Number: \_\_\_\_\_

**Radiographic Device or Source Changer containing the sealed source will be disposed of using equivalent procedures, which are attached.**

#### II. Verification

If a Radiographic Device or Source Changer containing radioactive material is bought, sold or transferred for disposal, verification of the transferor's and transferee's authorization to possess the radioactive material will be documented. A copy of each other's Radioactive Materials License will be exchanged and the transferor's license will be retained on file as evidence of an authorized transfer.

#### III. Documentation

As a minimum, documentation of the transfer will include the following:

- ◆ The material being transferred (Radiographic Device manufacturer name, model and serial number, type and activity of radioactive material, and source manufacturer name and model number)
- ◆ The date of the transfer
- ◆ The name, address, and license number of the transferor and transferee
- ◆ The signatures of the individuals shipping and/or receiving the Radiographic Device.

All transfer and disposal records shall be maintained on file for inspection purposes until license termination.

#### **IV. Notification**

The Department should be notified of the disposal of Radiographic Devices or Source Changers containing radioactive material as soon as practical following the transfer.

## APPENDIX L

### ACCESS CONTROL AND SECURITY OF TEMPORARY JOB SITES

#### I. Introduction

Radiological controls must be implemented and maintained at the job site while the radiographic devices are being used or temporarily stored on the transport vehicle. The Radiographer at the job site is responsible for establishing the controls and insuring that no unauthorized individual(s) enter the restricted areas. The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1208, "Dose Limits for Individual Members of the Public", prescribes the dose levels for members of the public in unrestricted areas.

Security measures must also be implemented when the radiographic device is being used at the site and whenever the device is temporarily stored at the job site. The security measures described in Appendix H for temporary job sites will be implemented and maintained.

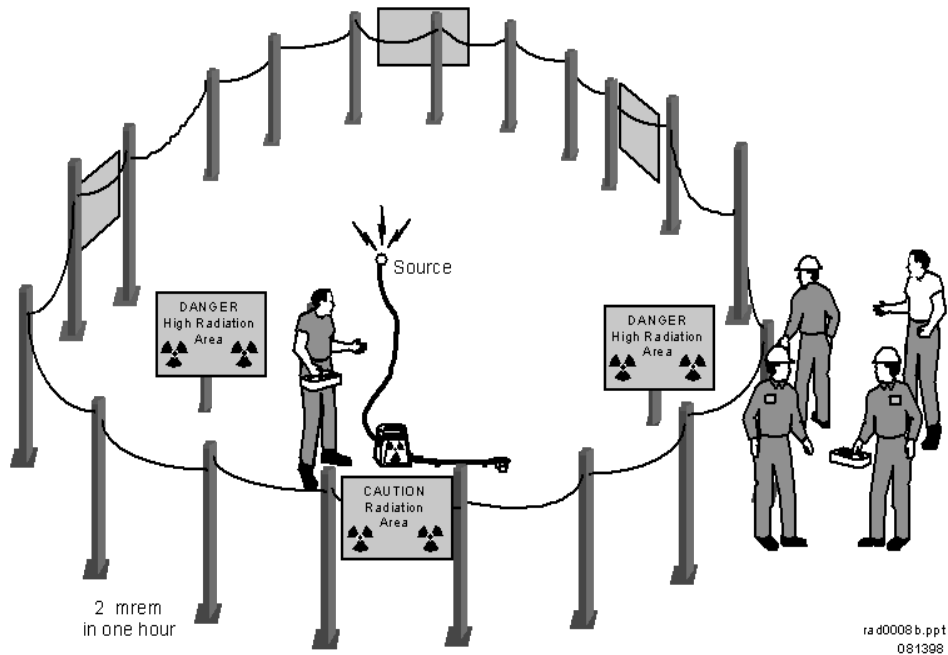
Each licensee must control access to areas where radiographic devices are either used or stored to prevent the unnecessary radiation exposure of members of the public. This can be achieved using posting, by locking devices and areas where radioactive materials are stored, and by maintaining constant control and continuous surveillance of areas where radiographic operations are conducted. Operating and emergency procedures must include steps for radiographic personnel to ensure that access to radioactive materials is controlled for the types of operations that will be performed.

#### II. Temporary Jobsites

- a. When radiographic operations are performed outside a permanent radiographic installation, two qualified radiographic personnel must be present. At least one of the individuals must be a Radiographer; the other may be another Radiographer or a Radiographer's Assistant. Both individuals must maintain constant surveillance of the operations and be capable of providing immediate assistance to prevent unauthorized entry to the restricted area. Operating procedures must comply with the "two-man rule" for radiographic operations at any locations other than permanent radiographic facilities.
- b. Radiographic personnel are required to maintain continuous direct visual surveillance of operations to protect against unauthorized entry to the high radiation area during radiographic operations. Radiographic personnel shall be instructed to keep the perimeter of the restricted area under continuous surveillance to prevent unnecessary exposure of individuals.



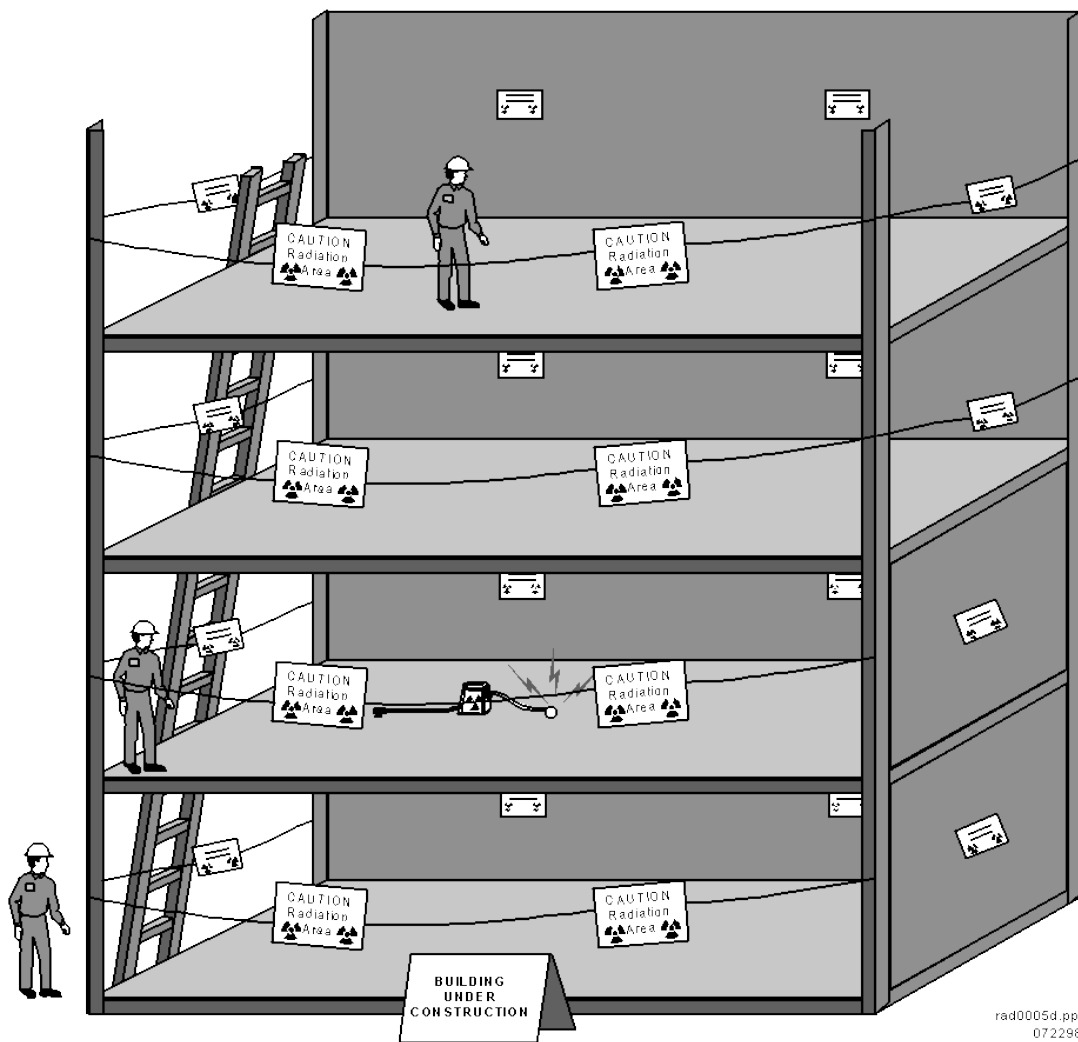
Operating procedures shall specify steps for responding to unauthorized entry to the restricted area. For example, personnel should be instructed to terminate the radiographic exposure immediately, before confronting the person who entered the restricted area.



**Figure L.1. Radiological Posting of a Temporary Jobsite**

- c. All areas where radiographic operations are conducted require posting of the radiation areas and the high radiation areas as shown in Figure L.1. It is acceptable to post the perimeter of the restricted area rather than the perimeter of the radiation area. Personnel should be instructed to post "Caution Radiation Area" signs at the point where radiation levels have been calculated to reach 2 mrem (0.02 mSv) in any one hour. A confirming survey during to the first exposure of the source must be conducted to confirm the location of the boundary and any necessary adjustments should be made.
- d. The perimeter of the high radiation area must be posted with a "Caution (or Danger) High Radiation Area" sign(s) at the point where radiation levels have been calculated to reach 100 mrem (1 mSv) in any one hour. A confirming survey of the high radiation area perimeter should not be conducted, since such a survey could lead to unnecessary radiation exposure of personnel.
- e. Surveillance of the restricted area at facilities with multiple levels and multiple access points, or where members of the public are close to the

radiographic operations (e.g., boilers, commercial manufacturing plants, or power plants during outages) can usually be performed only when more than two radiographic personnel are assigned to the job. Figure L.2 provides one example of such a temporary jobsite. Operating procedures and instruction to personnel shall include specific steps for these circumstances to ensure that access into the restricted area is properly controlled. These special instructions may include the use of additional personnel to assist radiographic personnel in controlling access into the restricted area, providing instruction to other workers in the area, or making announcements over the public address system before and during radiographic operations.



**Figure L.2 Surveillance and Posting at a Temporary Job Site with Multiple Floors and Access Points**

rad0005d.ppt  
072298

### **III. Permanent Radiographic Installations**

- a. For permanent radiographic installations, instruct personnel about posting each entrance to the facility with a "Caution (or Danger) High Radiation Area" sign(s), and provide procedures to ensure that the visible-audible signal system is operable. The operability of the visible-audible system must be checked daily. The following procedures may be used:
  - Expose a radiation source in the permanent installation with all entrances closed.
  - Determine that each visible signal in and outside the installation is functional.
  - Open the door to each entrance into the installation to activate the audible alarm.
  - Close the entrance and confirm that the alarm stops. If the installation has more than one entrance, only one entrance should be tested at a time.
  - Record results of test.
  
- b. In the event that an entrance control device or an alarm fails to operate properly at the permanent radiographic installation, the installation may continue to operate for up to 7 days while the defective equipment is fixed, provided that:
  - The entrance control device is labeled as defective;
  - Radiography personnel maintain continuous, direct, visual surveillance of access installation points; and
  - Radiography personnel use an alarming rate meter.
  - The Radiographer must be accompanied by at least one other qualified radiographer or individual who has at a minimum met the requirements of the Rules and Regulations, Paragraph RH-1802.b.3 (qualifications for a Radiographer's Assistant).

### **IV. Storage Areas**

Radiographic equipment containing radioactive material stored in controlled or unrestricted areas must be secured from unauthorized removal or access, as specified in Appendix H. Operating procedures should generally address how stored radiographic devices should be secured and who is authorized access to the devices.

A vehicle used to transport licensed material can also be used for storage at locations such as temporary jobsites or overnight lodging. If the applicant plans to use vehicles for storage, procedures and instructions to personnel addressing posting of the vehicle shall be available. Vehicles shall be posted with a "Caution - Radioactive Material" sign on the entrance to the area of the vehicle where radioactive material is stored. A physical survey shall be performed to confirm that the area around the storage facility is an unrestricted area. Radiation levels may not exceed 2 mrem/hr (0.02 mSv/hr) at 18 inches from any external surface of the vehicle and the vehicle shall be locked when it is used for storage.

Radiographic equipment stored at temporary jobsites must be secured at a location that prevents access by unauthorized personnel. It is not acceptable for a device to be chained to a post and left unattended at the place of use during lunch, breaks, or after hours. Storage of Radiographic devices at a private residence is not authorized.

**V. Response from Applicant**

Include the procedures to control access to radiographic operations and storage areas in Appendix N.

## APPENDIX M

### TRANSPORTATION OF RADIOGRAPHIC DEVICES

Radioactive material Licensees are required to develop, implement and maintain procedures for transporting radioactive material to insure public safety and compliance with the U.S. Department of Transportation (DOT) regulations. Licensees are responsible for ensuring that their gauges are properly packaged, marked, labeled, secured, blocked and braced, and that proper documentation accompanies the devices.

The following discussion serves as basic guidance only. The U.S. DOT regulations should be consulted prior to packaging and transporting radioactive material.

#### U.S. DOT Guidance

##### A. General

Markings and labels on gauge transport containers must be durable, legible, in English, and printed on or affixed to the package surface (e.g., a label, tag or sign).

Required **markings** include:

- ◆ Shipping name (ex.: radioactive material, special form, n.o.s., Class 7)
- ◆ RQ (for gauges with an Am-241:Be source  $\geq 10$  mCi); add to shipping name
- ◆ Identification number (ex.: UN 2974)
- ◆ Package type (ex.: TYPE A)

##### B. Markings and labels

Required **labels** include:

- ◆ “Cargo Aircraft Only” label (required for shipments by air)
- ◆ Two DOT warning labels (gauges typically require RADIOACTIVE YELLOW II labels; see table) applied to opposite sides of the package, listing the package contents and

activity in SI and customary units, and the package’s Transport Index (TI), the dimensionless number indicating the package’s radiation level at 1 meter (manufacturers provide the TI for their gauges).

***Package Labeling Criteria***

<b>Warning Label</b>	<b>Max. Rad. Level at Package Surface (mR/hr)</b>	<b>Max. Rad. Level at 1 m (TI)</b>
RADIOACTIVE WHITE I	0.5	none
RADIOACTIVE YELLOW II	50	1
RADIOACTIVE YELLOW III	200	10

**C. Shipping papers**

The information required on shipping papers depends on the type of shipment being made. Transporting gauges to and from temporary job sites in company vehicles (without any transfers) can be exclusive use shipments, which require minimal information on the shipping paper (commonly known as a “bill of lading”). Gauges shipped by common carrier to the manufacturer or another recipient require additional information. Gauges shipped by air or internationally require still more information.

1. **Exclusive use shipments** (shipments to and from job sites) require a bill of lading with the information listed below. The shipping paper must be immediately accessible to the driver during transport.
  - ◆ Description of shipment [proper shipping name, RQ (if applicable), identification number, hazard class, type of package, name and activity of each nuclide, category of labeling and Transport Index)
  - ◆ Emergency response telephone number (24-hour monitored number of a person knowledgeable about the hazards associated with portable gauges)
2. **Common carrier shipments** (shipments offered to third parties for transport) require a bill of lading with the information listed below, if the shipment is made by highway. If shipped by air, the carrier will

provide a “Dangerous Goods Airbill” that will describe the required information:

- ◆ Name and address of shipper [can be the *consignee* (company offering the package for shipment) or the *consignor* (company shipping the package)]
  - ◆ Description of shipment (same as for exclusive use shipments)
  - ◆ Emergency response telephone number (24-hour monitored number of a person knowledgeable about the hazards associated with portable gauges)
  - ◆ Shipper’s certification (statement certifying that the package has been properly classified, described, packaged, marked and labeled, and is in proper condition for transportation)
  - ◆ Signature of shipper (commits the signor to certification of the shipment)
3. **Emergency response information (ERI)** will be provided with the bill of lading and will be immediately accessible to the driver during shipment.
4. **Accessibility of shipping papers.** Shipping papers and ERI will be immediately accessible to the driver during transport of gauges.

### **Transportation Procedures Guidance**

- A. Instructions to personnel should not reference DOT requirements. Information should be extracted, paraphrased and placed into the procedures so that radiography personnel know exactly what is required and expected when transporting radioactive material. The following items should be covered in instructions to personnel:
- Labeling containers appropriately (i.e., when to use labels Radioactive White I, Radioactive Yellow II, or Radioactive Yellow III).
  - Securing the radiographic device or storage container within the transporting vehicle. The instructions shall address “load bracing” and shall specify the methods to be used to prevent the package from moving during normal transportation conditions. Radiographic devices may not be transported in a vehicle’s passenger compartment.
  - Preparation of shipping papers. The instructions shall specify that the papers must be completed before transporting the radioactive material and the papers must be accessible in the driver's compartment at all times.

- Placarding both sides, the front, and the back of the vehicle with "RADIOACTIVE" placards if the package being transported requires a Radioactive Yellow III label. If the vehicle requires placarding and the package radiation levels exceed 200 millirem/hr (2 mSv/hr) or the transport index exceeds 10, exterior surfaces and passenger compartment of the vehicle must be surveyed to ensure that the radiation levels do not exceed 2 millirem/hr (0.02 mSv/hr) from any exterior surface and 2 millirem/hr (0.02 mSv/hr) in the passenger compartment. Include instructions to personnel on the measures to take if the radiation level exceeds 2 millirem/hr (0.02 mSv/hr) in the passenger compartment (e.g., adding more shielding or repositioning the device within the vehicle).
  - If an exposure device is transported in an overpack, the procedures should include instructions that the overpack must be properly marked with the shipping name and identification number, labeled (Radioactive White I or Radioactive Yellow II), and marked when required with a statement that indicates the inner package complies with prescribed specifications.
  - Prior to shipment, inspect transport containers to ensure proper packaging and unimpaired physical condition of the container and its closure devices. Promptly report any defects to the Radiation Safety Officer (RSO) prior to shipment or use. The RSO will label and remove from use any device or package found to be defective and insure the repair or replacement.
- B.** Because the licensee may have authorization to possess and use several sealed source/device combinations that are registered by NRC or an Agreement State and meet the safety performance requirements of the Rules and Regulations, Paragraph RH-1801, "Equipment Control", the applicant must, before using a new sealed source/device combination, develop written inspection and maintenance procedures for it and for the corresponding Type B transport package. In addition, the applicant must provide adequate training for radiographic personnel before using a new sealed source/device combination.

***NECESSARY FOR ARKANSAS GUIDE????????***

***Note:*** Before the 1997 revision of 10 CFR Part 34, a licensee who intended to transport a radiographic Type B package was required to submit a quality assurance program to NRC for approval, separate from the license approval. The 1997 revision to 10 CFR Part 34 requires written procedures for inspection and maintenance of radiographic Type B packages (10 CFR 34.31(b)). In conjunction with the revision to 10 CFR Part 34, the NRC also amended 10 CFR 71.101(g) to specifically state that if the applicant's written



procedures for inspection and maintenance of radiographic Type B packages are approved, then the applicant also meets NRC quality assurance requirements in Part 71 and does not have to submit or maintain a separate quality assurance program to transport a Type B package. The application's inspection and maintenance procedures for radiographic equipment, which are also used for Type B packages, should ensure that these packages are shipped and maintained in accordance with their COC.

**Response from Applicant:**

Submit operating and emergency procedures for transporting sealed sources containing radioactive material, radiographic devices, and source changers. Include the procedures in Appendix N and O.

## APPENDIX N

### OPERATING PROCEDURES

#### I. Radiation Safety Program

Industrial Radiography Licensees are required to develop, implement, and maintain a comprehensive radiation safety program to help insure the protection of the public and licensee personnel who are occupationally exposed to ionizing radiation. As a minimum, the Radiation Safety Program shall include the following elements:

- Description of the organizational structure and the management commitment for ensuring implementation of the Radiation Safety Program (See Item 25)
- Policy statement and requirement to maintain radiation dose ALARA (Appendix A)
- Description of equipment and facilities adequate to protect personnel, the public, and the environment (See Item 16)
- Conduct of licensed activities by individuals qualified by training and experience (See Item 10)
- Written operating and emergency procedures (See Items 22 and 23)
- Program to routinely inspect the job performance of radiographic personnel
- Records management (See Item 24)

#### II. Operating Procedures

- A. Operating procedures must be developed, implemented, and maintained current. The purpose of operating procedures is to provide radiography personnel with specific instructions and guidance on how to safely perform all operations that are required for industrial radiography, including device storage and transportation. A complete copy of the Operating Procedures must be submitted to the Department as part of the application
- B. It is not necessary for operating procedures to be specific to a particular make and model of radiographic device, source exchanger, or survey instrument. Procedures submitted to the Department should provide sufficient guidance and instruction to radiography personnel for each specific type of device. For example, a single operating procedure for crank-out radiographic device may be submitted regardless of the manufacturer; provided specific notes of caution and instructions are included for unique equipment or instruments.
- C. Specific procedures are required for performing source exchanges, including those at temporary jobsites or field stations, and in a permanent radiographic

installation. The procedures should contain warnings of areas of concern during source exchanges. Recent incidents of sources becoming dislodged from the shielded position indicate the importance of training personnel in the appropriate techniques. Procedures must require the use of radiation survey instruments, personnel monitoring, and radiation surveys during and after movement of sources.

- D.** Specific procedures are required for inspecting and maintaining radiographic devices, source changers, associated equipment, transport and storage containers, and survey instruments. Inspection and maintenance must be performed at intervals not to exceed 3 months, or before the first use thereafter, to ensure the proper functioning of components important to safety. The licensee must also have procedures necessary to maintain the Type B packaging used to transport radioactive materials, ensure that Type B packages are shipped properly, and maintain Type B packages in accordance with the Certificate of Compliance (COC) issued by NRC or other agencies approving such transport packages.

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

These procedures are intended to allow the licensee to evaluate equipment used in radiography for safe continued use, to provide a record of this evaluation, and to guidance in performing maintenance. Equipment found to be unsuitable for service must be withdrawn until repair and an evaluation for return to service is made. These procedures may be based on the manufacturer's recommendations and are to be specific to the equipment. Procedures are also required for Type B packaging used to transport radioactive materials. These procedures are to be used for shipping and maintenance, and may be properly drawn from the manufacturer's procedures and information.

- E.** The Operating Procedures must include as a minimum, detailed instructions in the following topics:
- Appropriate handling and use of radioactive sealed sources, radiographic devices, and source changers so that no person is likely to be exposed to a radiation dose in excess of the limits prescribed in the Rules and Regulations
  - Steps to take to maintain radiation dose ALARA
  - Personnel monitoring and the use of personnel monitoring equipment
  - Methods and occasions for conducting radiation surveys
  - Instructions for controlling access to radiographic areas and performing surveillance in the immediate area during operations and use.

- Provide step-by-step instructions for using each type of radiographic device.
- Steps to maintain accountability during use
- Steps to control access to work sites
- Instructions for maintaining security during storage and transportation
- Methods and occasions for locking and securing radiographic devices, transport and storage containers and sealed sources.
- Personnel monitoring and the use of personnel monitoring equipment
- Transporting sealed sources to field locations, including packaging of radiographic devices and storage containers in the vehicles, placarding of vehicles when needed, and control of sealed sources during transportation.
- Inspection, maintenance, and operability checks of radiographic devices, radiation survey instruments, transport containers, and storage containers
- Instructions for performing source exchanges
- Maintenance of records

F. These topics must be included in the operating procedures and need not be presented in order of importance. A sequential set of procedures and instructions from the beginning to the end of the workday is an acceptable format. Instructions for non-routine operations, for example, quarterly (not to exceed 3 months) inspection and maintenance or instrument calibration, may be included as separate appendices. If a Radiographer is also assigned the responsibility to perform sealed source exchange, leak testing of sealed sources, and/or the quarterly inspection and maintenance of equipment, operating procedures and detailed instructions for performing these activities must be included.

## APPENDIX O

### EMERGENCY PROCEDURES

If the source fails to return to the shielded position or if any other emergency or abnormal event arises (e.g., vehicle accident, off-scale dosimeter, etc.), the following specific response actions must be taken.

Each Licensee who proposes to perform source retrieval operations must have appropriate equipment, training, and emergency procedures.

### THE INDIVIDUAL AT THE EMERGENCY SCENE MUST DO THE FOLLOWING

#### IMMEDIATE ACTIONS



rad0005e.ppt  
072298

**Figure O-1 Emergency Actions at the Emergency Scene**

## FOLLOW ACTIONS

- **SECURE AREA AND MAINTAIN SURVEILLANCE** Immediately secure the area and post the restricted area at the 2 millirem/hr radiation level; maintain continuous surveillance and restrict access to the restricted area.
- **NOTIFY** Notify the Radiation Safety Officer (RSO) and/or Management Personnel.
- **AWAIT INSTRUCTIONS** Take no further actions until instructions are received from the RSO.
- **TAKE NO RETRIEVAL ACTION** Do **not** attempt source retrieval until the situation has been discussed with the RSO or other knowledgeable personnel.
- **DON'T PANIC** Source retrieval can be performed with very little exposure when properly planned by trained personnel.
- **NOTIFY** Notify the persons in the order listed below of the situation.

Name	Work Phone Number	Home Phone Number
RSO		

Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the Radiation Safety Officer (RSO), or other knowledgeable licensee staff , licensee's consultant, device manufacturer) to be contacted in case of emergency.

- **FOLLOW DIRECTIONS** Follow the directions provided by the person contacted above.

<b><u>NOTE:</u>      DO NOT HANDLE UNSHIELDED SOURCES OF RADIOACTIVE MATERIAL</b>
---

## **THE RSO AND LICENSE MANAGEMENT MUST DO THE FOLLOWING**

- Discuss emergency operating procedures, and ensure no operations are conducted until the situation has been discussed with and approved by the Radiation Safety Officer or other knowledgeable staff, consultants, or device manufacturer.
- Issue instructions to on-scene radiography personnel for minimizing radiation dose to members of the public and radiography personnel and for maintaining the surveillance and security of the emergency scene and area.
- Arrange for licensed individuals to conduct emergency response activities and the emergency scene (for example, specifically licensed radiography personnel to conduct source retrieval emergency response actions). Recovery operations and decontamination must only be attempted by properly trained and licensed individuals.

**NOTE: If the Licensee intends to perform source retrieval, specific emergency procedures must be developed, implemented, and maintained current by the Licensee. The Department must approve all source retrieval procedures. The requirements for source retrieval procedures are discussed later in this Appendix.**

- Management should have access to emergency equipment to keep doses to radiographers as low as reasonably achievable. Emergency equipment may include high range dosimeters, extra lead shielding, remote tongs, etc.
- Make necessary notifications to local authorities as well as the **Arkansas Department of Health and Human Services, 1-800-633-1735 or 1-501-661-2136** (staffed 24 hours a day) Immediate **Department** notification is required when radiographic devices containing radioactive material are lost or stolen, when a device is damaged or involved in an abnormal event, or when a source fails to return to a shielded position.
- Reports to the **Department** must be made within the reporting timeframes specified by the regulations.
- Reporting requirements are found in **Paragraphs RH-1501 and RH-1502.**

**NOTE: In the event of a transportation accident involving radioactive material, the Arkansas Department of Health and Human Services, the Arkansas State Police and the U.S. Department of Transportation must be notified.**

## **SOURCE RETRIEVAL**

Applicants must develop source retrieval procedures if they propose to use licensee radiographic personnel with appropriate training and experience to perform source retrieval operations. If procedures are submitted, the Department will review and, as appropriate, approve Applicants to perform source retrieval. If source retrieval procedures are not submitted for review, then source retrieval activities must be conducted by a person licensed by the USNRC or Agreement State to specifically perform these services.

Radioactive Material Licensees specifically approved to perform source retrievals will have a specific Radioactive Material License condition authorizing these services. Additionally, these individuals would be authorized to perform source retrieval services for other licensees.

The Department will review the applicant's procedures for source retrieval with respect to keeping irradiation doses ALARA and controlling the exposure to radiation. Since it is not possible to specify all potential exposure situations, a general procedure is acceptable. A retrieval procedure should 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 shall be used during source retrievals, for example, pocket dosimeters with a range greater than 200 mrem (2 mSv) 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.

Radiography personnel shall not attempt to perform operations involving source retrieval or recovery unless they have actual practice in retrieval operations using a dummy source with the appropriate handling tools, radiation survey instruments, and personnel monitoring equipment.

**Response from Applicant:**

- Submit the following: "We will not perform source retrievals and will use the services of a person specifically licensed by the Department, the USNRC or an Agreement State to perform the retrievals of our sources."

**OR**

- Submit source retrieval procedures and specific training for Department review in accordance with the criteria listed

## APPENDIX P

### ADMINISTRATIVE REQUIREMENTS

Each of the following paragraphs of the Rules and Regulations for Control of Sources of Ionizing Radiation must be read and understood and incorporated into the Radiation Safety Program. Compliance with these regulations is mandatory. The Rules and Regulations may be found on the Internet at **www.healthyarkansas.com**.

Indicate that the referenced paragraphs have been read and are understood, and will be complied with by checking the space preceding each reference.

- \_\_\_\_\_ 1. Section 2, Part F, Paragraphs RH-600 through RH-602, “Records, Reports, and Inspections”.
- \_\_\_\_\_ 2. Paragraph RH-1305, “Instruction of Personnel, Posting of Notice to Employees”.
- \_\_\_\_\_ 3. Section 3, Part F, Paragraphs RH-1500 through RH-1506, “Records, Reports, and Notifications”.
- \_\_\_\_\_ 4. Section 3, Part F, Paragraphs RH-1509, “Reports of Individual Monitoring”.
- \_\_\_\_\_ 5. Section 3, Part I, Paragraphs RH-1800.d.1-14, “Recordkeeping Requirements”.
- \_\_\_\_\_ 6. Section 3, Part N, Paragraphs RH-2801 through RH-2808, “Notices, Instructions and Reports to Workers; Inspections”.

# APPENDIX Q

## EXAMPLE RADIATION SAFETY PROGRAM ANNUAL REVIEW

### 1. INTRODUCTION

This form documents performance of the annual radiation protection program review required by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1004, "Radiation Protection Programs". The review consists of an evaluation of the program's content and implementation, evaluating it's effectiveness in complying with regulatory requirements and keeping radiation exposures to workers and the general public as low as reasonably achievable (ALARA). Records of the annual review shall be maintained for inspection purposes and shall be retained for at least 3 years following the date the record was created.

License Name: \_\_\_\_\_

License No.: \_\_\_\_\_ Review Date \_\_\_\_\_

Auditor: \_\_\_\_\_

(name, title)

(signature)

Management Review: \_\_\_\_\_

(name, title)

(signature)

### 2. REVIEW HISTORY

A. Last review conducted on (date): \_\_\_\_\_

B. Any deficiencies noted?..... Yes No

C. Were corrective actions taken?.....Yes No N/A  
(look for signs of recurrence)

D. Brief description of prior deficiencies, corrective actions taken: \_\_\_\_\_

---

---

---

---

---

3. **INDEPENDENT REVIEWS/AUDITS/INSPECTIONS**

A. Any independent reviews/audits/inspections conducted since the last internal review (e.g. Consultant or Department inspection)?.....Yes No

B. Brief description of prior deficiencies, corrective actions taken: \_\_\_\_\_

---

---

4. **ORGANIZATION AND SCOPE OF PROGRAM**

A. If the mailing address or permanent address changed, has the license been amended to reflect the change? .....N/A Yes No

B. If ownership has changed or bankruptcy has been filed, was the Arkansas Department of Health notified?.....N/A Yes No

C. Current Radiation Safety Program organization matches description in license (if not amend license to reflect changes in organization).....Yes No

D. Is company management appropriately involved with the radiation protection program and oversight of the RSO's activities? .....Yes No

E. **Does Management/RSO emphasize the ALARA Program to radiography personnel, along with the importance of maintaining occupational radiation dose ALARA?**.....Yes No

.....F. **Are good radiological work practices used by radiography personnel?**.....Yes No

.....G. Does the license authorize all sources and devices possessed? ....Yes No

H. If the RSO has changed, has the license been amended to identify the new RSO?.....N/A Yes No

I. Is the RSO meeting the duties and responsibilities for the position?.....Yes No

J. Does RSO have sufficient time and support to perform all duties and responsibilities?.....Yes No

K. Staffing sufficient to support to Radiation Protection Program?.....Yes No

L. Do all temporary job sites meet regulatory definition.....Yes No

M. If no to A., has the Department been notified? .....Yes No

**5. FACILITIES AND EQUIPMENT**

**A.** Is the facility correctly described in the license (i.e., any changes impacting Radiographic operations have been submitted to and approved by the Department)?.....Yes No

**B.** Permanent radiographic installation

1. Correctly posted?.....Yes No

2. Entrance controls and alarms present and operable?.....Yes No

**C.** Temporary High Radiation Area entry controlled?.....Yes No

**D.** Storage Area

1. Storage facilities correctly described in license?.....Yes No

2. Facilities adequate to hold all authorized sources?.....Yes No

3. Sources locked in devices?.....Yes No

4. Radiographic devices secured as described in license?.....Yes No

**E.** Temporary job site radiography

1. Radiography performed as described in license?.....Yes No

2. Correctly posted?.....Yes No

3. Job site controlled as described in license?.....Yes No

**F.** Radiography equipment

1. Radiographic devices, source assemblies, and source changers currently in use comply with regulatory requirements?.....Yes No

2. Licensee registered with the USNRC as a Type B package user for all Type B models in use and documentation of registration on file?.....Yes No

3. Source changers and storage containers meet radiation level limits?.....Yes No

4. Equipment exempted by specific license condition is used in accordance with license commitments and authorization?.....Yes No

**6. POSTING AND LABELING**

**A. Following documents posted at permanent facility**

- 1. Emergency Procedures.....Yes No
- 2. Department "Notice To Employees".....Yes No
- 3. Department letter containing "Notice of Violations" posted within 5 days.....Yes No
- 4. Other documents listed in Rules and Regulations posted, unless posted notice identifies where documents may be viewed.....Yes No
- 5. Above documents posted in conspicuous location(s) to allow workers to observe them on the way to/from work?.....Yes No

**B. Radiation Posting correctly displayed**

- 1. Caution Radioactive Material?.....Yes No
- 2. Caution Radiation Area?.....Yes No
- 3. Caution High Radiation Area?.....Yes No

**C. Devices and Containers correctly labeled**

- 1. Radiographic Devices?.....Yes No
- 2. Source Changers?.....Yes No
- 3. Storage or Transport Containers?.....Yes No

**D. Other required posting or labeling?.....Yes No**

**7. SECURITY**

Radioactive materials secured as described in the license?.....Yes No

**8. COMPLIANCE WITH PUBLIC DOSE LIMITS**

**A.** Public dose compliance study approved by the Department?.....Yes No

**B.** Have licensed activities changed during the year to increase potential for public dose limits being exceeded?.....Yes No

**C.** If Yes to **B**, has study been updated to demonstrate compliance with limits.....Yes No

**9. TRAINING, RETRAINING, AND CERTIFICATION**

- A. Radiation safety training and retraining is unchanged and is as described by license or as amended?.....Yes No  
If No, describe changes\_\_\_\_\_
- B. Radiation workers have received Radiation Awareness Training and Instructions To Workers Training?.....Yes No
- C. Workers with assigned duties affecting transportation safety of radioactive material have received USDOT HAZMAT training (49CFR 172.700-172.704)?.....Yes No
- D. Radiography personnel have been provided copies of required documents e.g. Rules and Regulations, License, Operating and Emergency Procedures)?.....Yes No
- E. Radiography personnel have received training as described by license?.....Yes No
- F. Radiography personnel have received at least 8 hours of radiation safety refresher training annually?.....Yes No
- G. All Radiography personnel are certified?.....Yes No
- H. Radiation workers cognizant of requirements for various dose limits (e.g., dose limits to the public, embryo/fetus and declared pregnant worker, annual limit for occupationally exposed personnel, etc.).....Yes No

**10. INTERNAL REVIEWS, AUDITS OR INSPECTIONS**

- A. Field audits demonstrate radiography personnel use of ALARA, safe work practices, and compliance with the license, Operating and Emergency Procedures and regulatory requirements?.....Yes No
- B. Equipment check before use each day?.....Yes No
- C. Equipment inspection and maintenance performed at 3-month intervals?.....Yes No

**11. OPERATING AND EMERGENCY PROCEDURES**

- A. Operating and Emergency Procedures as approved by Department and compatible with the Rules and Regulations?.....Yes No

- B. Procedures contain the correct telephone numbers of the Radiation Safety Officer, the Department, and the USNRC Regional Office?.....Yes No
- C. Radiography personnel take all required documents to field temporary job Sites and maintain copies of the required documents on site for the duration Of the job?.....Yes No

**12. PERSONNEL MONITORING (PM)**

- A. All radiography personnel have been assigned a PM badge?.....Yes No
- B. Pm badges are worn properly by radiography personnel and are protected from heat, light, moisture, and chemicals when not worn?.....Yes No
- C. PM badges are stored with control badge in a protected area?.....Yes No
- D. PM badges exchanged and processed at the required frequency?.....Yes No
- E. Have any PM badges been lost or damaged?.....Yes No
- F. If Yes to E, was the RSO properly notified and a record of the individual's estimated dose provided to the PM badge vendor and kept on file?.....Yes No
- G. Have any spare PM badges been assigned to individuals since the last review?.....Yes No
- H. If Yes to G, were spare PM badges marked to identify individuals they were assigned to, and PM badge vendor notified to add dose from spare badge to individual's occupational dose totals?.....Yes No
- I. If Yes to G and spare PM badges were used for newly-hired individuals, were assigned PM badges ordered and used during the next monitoring period?.....Yes No

If No to I, describe why, and summarize the corrective action taken to prevent recurrence: \_\_\_\_\_  
 \_\_\_\_\_

- J. If Yes to E, and spare PM badge(s) used to replace lost or damaged badges(s), were the incidents investigated and documented?.....Yes No

If Yes to J, describe the investigation; if No, describe actions taken to prevent recurrence: \_\_\_\_\_  
 \_\_\_\_\_



**K.** Are dosimetry reports reviewed by the Radiation Safety Officer within 7 days of receipt?.....Yes No

**L.** Has a “Cumulative Occupational Exposure History”, Department Form Z, been completed for each monitored individual?.....Yes No

**M.** Has an “Occupational Exposure Record for a Monitoring Period”, Department Form Y, been completed for each monitored individual?.....Yes No

**N.** Female workers advised on risks to embryo/fetus; provided instructions for declaring pregnancy and receipt of instructions documented?.....Yes No

**O.** If female worker declared pregnancy, was declaration documented; individuals Provided instructions for limiting dose during pregnancy; and receipt of Instructions documented?.....Yes No

**P.** For declared pregnant individuals, records are maintained that document embryo/fetus dose is less than 500 millirem for the gestation period?.....Yes No

**Q.** Annual and Termination personnel radiation dose reports issued to individuals?.....Yes No

**R.** Personnel Monitoring Records reviewed from (dates) \_\_\_\_\_ to \_\_\_\_\_

1. Highest dose for monitoring period: \_\_\_\_\_ millirem Date: \_\_\_\_\_

2. Highest dose for a Quarter: \_\_\_\_\_ millirem Date: \_\_\_\_\_

3. Highest Annual dose: \_\_\_\_\_ millirem Date: \_\_\_\_\_

**S.** Describe the results of the review of the personnel monitoring badge, including any corrective actions taken or planned to address identified weaknesses:

---

---

**T.** Are occupational doses within regulatory limits?.....Yes No

**U.** Are occupational doses ALARA?.....Yes No

If No, describe actions being taken to reduce/eliminate unnecessary dose and achieve ALARA dose levels: \_\_\_\_\_

---

---

**13. POCKET DOSIMETERS OR ELECTRONIC PERSONAL DOSIMETERS**

- A. Adequate number of 0 – 200 R/hr range calibrated/operable dosimeters available?.....Yes No
- B. Adequate number of high-range calibrated/operable dosimeters available?.....Yes No
- C. Dosimeters calibrated at 12-month intervals?.....Yes No
- D. Dosimeters bear calibration labels and calibration records are maintained?.....Yes No
- E. Dosimeters checked on days of use?.....Yes No
- F. Out-of-service dosimeters tagged or stored to prevent use?.....N/A Yes No
- G. Dosimeters read and recorded at start of each shift?.....Yes No
- H. Daily readings recorded?.....Yes No
- I. Off-scale dosimeter procedure available; records maintained?.....Yes No

**14. ALARM RATEMETERS**

- A. Adequate number of calibrated/operable ratemeters available?.....Yes No
- B. Ratemeters set to alarm at 500 mR/hr?.....Yes No
- C. Ratemeters calibrated at 12-month intervals and after repair?.....Yes No
- D. Ratemeters bear calibration labels and calibration records are maintained?.....Yes No
- E. Ratemeters checked on days of use and receive quarterly inspection and maintenance?.....Yes No
- F. Out-of-service ratemeters tagged or stored to prevent use?.....Yes No
- G. Checked to insure that alarm functions properly at the start of each shift?.....Yes No

**15. RADIATION SURVEY INSTRUMENTS**

- A. Adequate number of 0 – 1 R/hr range calibrated/operable radiation survey instruments are available?.....Yes No
- B. Instruments are calibrated at 3-month intervals and after repair?.....Yes No
- C. Instruments bear calibration labels and calibration records are maintained?.....Yes No

D. Instruments checked on days of use and receive quarterly inspection and maintenance?.....Yes No

E. Out-of-service meters tagged or stored to prevent use?.....Yes No

**16. LEAK TESTING**

A. Sealed sources are leak tested as described in the license at 6 month Intervals?.....Yes No

B. Radiography devices and source changers are leak tested for depleted uranium contamination as described in the license at 12 month intervals?.....Yes No

C. Do leak test records include all the information required by the Rules and Regulations?.....Yes No

D. Have any sources or devices or containers been found to be leaking?.....Yes No

If Yes, was the Department properly notified as required by the license?.....Yes No

If No, Explain: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

E. Leak test records properly maintained?.....Yes No

**17. RADIATION SURVEYS**

A. Radiation surveys comply with the Rules and Regulations?.....Yes No

B. Radiation survey performed after each exposure, (including radiographic device and guide tube) to insure the radiation source has returned to the shielded position?.....Yes No

C. Radiation survey performed of radiographic device when placed in storage to insure the radiation source is in the shielded position?.....Yes No

D. Radiation survey performed to demonstrate protection of members of the public?.....Yes No

E. Radiation survey performed to verify that unrestricted area radiation levels do not exceed 2 millirem in any 1 hour?.....Yes No

F. Records of radiation surveys are properly maintained?.....Yes No

**18. TRANSPORTATION**

A. Radioactive material ordered, received, opened, and stored as described in the license and in accordance with USDOT regulations?.....Yes No

B. USDOT approved and authorized transport containers are the only containers used by the licensee?.....Yes No

C. The licensee is registered with the USNRC as a user of all Type B packages approved for use?.....Yes No

D. Transport of radioactive material to field sites by the licensee are performed as described in the license?.....Yes No

E. Shipments of radioactive material by a common carrier are performed as Described in the license?.....Yes No

F. Shipping papers are prepared and use as described in the license and in accordance with USDOT regulations?.....Yes No

**19. RECEIPT, TRANSFER, AND ACCOUNTABILITY OF RADIOACTIVE MATERIAL**

A. Receipt, transfer, and disposal of radioactive material as described in the license and is performed in accordance with the Rules and Regulations?.....Yes No

B. Radioactive material is physically inventoried at 3-month intervals?.....Yes No

C. Incidents of lost or missing radioactive material are promptly reported to the Department?.....Yes No

**20. EQUIPMENT INSPECTION AND MAINTENANCE**

A. Inspection and maintenance of radiography equipment (radiographic devices, source storage and transport containers, source changers, radiation survey instruments, etc.) is performed as described in the license?.....Yes No

B. Inspection and maintenance performed on a quarterly basis?.....Yes No

C. Copies of the manufacturer's operation and maintenance manuals are maintained by the licensee?.....Yes No

D. Manufacturer's recommendations for the operation and maintenance of radiography equipment are followed?.....Yes No

**21. RECORDKEEPING, NOTIFICATIONS, AND REPORTS**

A. All required documents maintained as described in the license?.....Yes No

B. Have any incidents or emergencies occurred since the last review?.....Yes No

C. If Yes to B, was the response adequate?.....Yes No

D. If No to C, briefly describe identified weaknesses: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

E. If No to C, describe the corrective actions taken or planned: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

F. Have all required reports been issued as described in the license?.....Yes No

**22. REVIEW FINDINGS**

**A. Summary of STRENGTHS identified during the review:**

---

---

---

---

---

**B. Summary of DEFICIENCIES identified during the audit:**

---

---

---

---

---

**C. Description of Corrective Action Taken or Planned:**

---

---

---

---

---

**D. Description of other recommendation for improvement:**

---

---

---

---

---

**EXHIBIT A**

<b>SHIPPER'S DECLARATION OF DANGEROUS GOODS</b>
---

**SHIPPER'S DECLARATION OF DANGEROUS GOODS** (Provide at least two copies to the airline)

<b>Shipper</b>	<b>Air Waybill No.</b> Page                      of <b>Shipper's Reference Number</b>
----------------	---

<b>Consignee</b>	
------------------	--

<i>Two completed and signed copies of this Declaration must be handed to the operator.</i>		<b>WARNING</b> Failure to comply in all respects with the applicable Dangerous Goods Regulations may be a breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder, or an IATA cargo agent.		
<b>TRANSPORT DETAILS</b>				
This shipment is within the limitations prescribed for: (delete non-applicable) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">PASSENGER AND CARGO AIRCRAFT</td> <td style="padding: 2px;">CARGO AIRCRAFT ONLY</td> </tr> </table>	PASSENGER AND CARGO AIRCRAFT		CARGO AIRCRAFT ONLY	Airport of Departure
PASSENGER AND CARGO AIRCRAFT	CARGO AIRCRAFT ONLY			
Airport of Destination:		Shipment type:           (delete non-applicable) <table border="1" style="display: inline-table; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">NON-RADIOACTIVE</td> <td style="padding: 2px;">RADIOACTIVE</td> </tr> </table>	NON-RADIOACTIVE	RADIOACTIVE
NON-RADIOACTIVE	RADIOACTIVE			

**NATURE AND QUANTITY OF DANGEROUS GOODS**

Dangerous Goods Identification					Quantity and type of packaging	Packing Inst.	Authorization
Proper Shipping Name	Class or Division	UN or ID No.	Pack-ing Group	Subsi-diary Risk			

**Additional Handling Information**

<b>Emergency Telephone Number</b>	
I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable International and National Governmental Regulations.	Name/Title of Signatory  Place and Date  Signature (see warning above)

**IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.**





EXHIBIT B

**BILL OF LADING**

Shipper: \_\_\_\_\_

Address: \_\_\_\_\_

**Radioactive Material, Type B(U) Package, RQ  
Hazard Class 7, Special Form, UN2916  
USA/9283/B(U)-85**

**Package contains:**

Radionuclide: \_\_\_\_\_  
\_\_\_\_\_ TBq ( \_\_\_\_\_ Ci)

**RADIOACTIVE YELLOW II Label**  
Transport Index (TI) = \_\_\_\_\_

**EMERGENCY RESPONSE INFORMATION  
CONTACT NO.:**

\_\_\_\_\_

This is to certify that the above-named materials are properly classified, described, packaged, marked and labeled, and are in proper condition for transportation according to the applicable regulations of the U.S. Department of Transportation.

Shipper: \_\_\_\_\_

Date: \_\_\_\_\_

# EXHIBIT C

## RADIOGRAPHY EQUIPMENT INSPECTION AND MAINTENANCE

Date of I &M: \_\_\_\_\_ I & M Performed by: \_\_\_\_\_

Signature

RSO (or RSO Designee): \_\_\_\_\_ Date: \_\_\_\_\_

Signature

<b>1.</b>	<b>Survey Meters</b>
-----------	----------------------

<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%;">Model:</td> <td style="width: 50%;">Serial No.:</td> </tr> <tr> <td>SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check</td> <td rowspan="4" style="vertical-align: top;">Notes:</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Visual Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Battery Check</td> </tr> <tr> <td><input type="checkbox"/> <input type="checkbox"/> Source Check</td> </tr> </table>	Model:	Serial No.:	SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:	<input type="checkbox"/> <input type="checkbox"/> Visual Check	<input type="checkbox"/> <input type="checkbox"/> Battery Check	<input type="checkbox"/> <input type="checkbox"/> Source Check
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															
Model:	Serial No.:														
SAT/UNSAT <input type="checkbox"/> <input type="checkbox"/> Calibration Check	Notes:														
<input type="checkbox"/> <input type="checkbox"/> Visual Check															
<input type="checkbox"/> <input type="checkbox"/> Battery Check															
<input type="checkbox"/> <input type="checkbox"/> Source Check															

Notes:
--------

2.

## Radiography Camera & Associated Equipment

### Radiographic Exposure Device

Camera Manufacturer/Model	Camera Serial No.	Source Manufacturer/Model	Source Serial No.	Activity (Ci)
<small>SAT/UNSAT</small>				
<input type="checkbox"/> <input type="checkbox"/> No abnormal radiation levels anywhere on camera				
<ul style="list-style-type: none"> <li style="display: inline-block; width: 45%;">• Highest reading at surface:                      mR/hr</li> <li style="display: inline-block; width: 45%;">• Notify Department if &gt; 200 mR/hr at surface</li> </ul>				
<ul style="list-style-type: none"> <li style="display: inline-block; width: 45%;">• Highest reading @ 1 meter:                      mR/hr</li> <li style="display: inline-block; width: 45%;">• Notify Department if &gt; 10 mR/hr at 1 m)</li> </ul>				
<input type="checkbox"/> <input type="checkbox"/> General condition of exterior surfaces (clean with cloth and mild cleansing solution)				
<input type="checkbox"/> <input type="checkbox"/> Condition of safety plugs (clean as necessary)				
<input type="checkbox"/> <input type="checkbox"/> Operation of locking mechanism/plunger/selector ring/source position indicator				
<input type="checkbox"/> <input type="checkbox"/> Condition of pigtail connector				
<input type="checkbox"/> <input type="checkbox"/> Condition of carrying features (straps, handle, etc.)				
<input type="checkbox"/> <input type="checkbox"/> Proper and legible labeling <ul style="list-style-type: none"> <li>• Trefoil radiation symbol and CAUTION (or DANGER) RADIOACTIVE MATERIAL warning</li> <li>• Camera manufacturer name, model and serial no.</li> <li>• Source isotope (i.e., Ir-192), manufacturer name, model no., serial no., activity when loaded and date loaded)</li> <li>• Company name, address and phone number</li> </ul>				
<b>Notes:</b>				

### Control Cables & Drive Mechanisms

<small>SAT/UNSAT</small>				
<input type="checkbox"/> <input type="checkbox"/> Proper drive mechanism with camera				
<input type="checkbox"/> <input type="checkbox"/> General condition of exterior surfaces (clean with cloth and mild cleansing solution)				
<input type="checkbox"/> <input type="checkbox"/> Changes in general operating characteristics				
<input type="checkbox"/> <input type="checkbox"/> Condition of connector on drive cable				
<input type="checkbox"/> <input type="checkbox"/> Drive cable flexibility, wear and rust				
<input type="checkbox"/> <input type="checkbox"/> No excessive wear or damage to crank assembly parts				
<input type="checkbox"/> <input type="checkbox"/> No damage to drive cable conduit that could prevent cable from moving freely				
<input type="checkbox"/> <input type="checkbox"/> Proper connector mating between drive cable and pigtail (source assembly)				
<input type="checkbox"/> <input type="checkbox"/> No evidence of radioactive contamination (verify with survey)				
<b>Notes:</b>				

<b>2. Radiography Camera &amp; Associated Equipment (contd.)</b>
--

<b>Guide Tube</b>
<small>SAT/UNSAT</small>
<input type="checkbox"/> <input type="checkbox"/> General condition of exterior surfaces (clean with cloth and mild cleansing solution)
<input type="checkbox"/> <input type="checkbox"/> Damage (e.g., crimps, deformed threads, obstructions or cuts in sheath (cable conduit) that could prevent cable from moving freely)
<input type="checkbox"/> <input type="checkbox"/> Drive cable flexibility, wear and rust
<input type="checkbox"/> <input type="checkbox"/> Condition of source tube connector
<input type="checkbox"/> <input type="checkbox"/> Condition of source stop
<input type="checkbox"/> <input type="checkbox"/> Interior rust, dirt, or sludge buildup (clean as needed)
<input type="checkbox"/> <input type="checkbox"/> No evidence of radioactive contamination (verify with survey)
<b>Notes:</b>

<b>3. Storage/Transport Container</b>
Container Manufacturer/Model:
Container Design/Description:
<b>USDOT Package Type (check boxes that apply):</b>
Type A <input type="checkbox"/> Type B <input type="checkbox"/> Overpack <input type="checkbox"/> Strong/Tight Package <input type="checkbox"/>
<small>SAT/UNSAT</small>
<input type="checkbox"/> <input type="checkbox"/> General condition of exterior surfaces (clean with cloth and mild cleansing solution)
<input type="checkbox"/> <input type="checkbox"/> Operation of locking mechanism
<input type="checkbox"/> <input type="checkbox"/> Condition of hardware (hinges, braces, bolts, rings, etc.)
<input type="checkbox"/> <input type="checkbox"/> Condition of carrying features (straps, handle, etc.)
<input type="checkbox"/> <input type="checkbox"/> Proper and legible labels for overpacks <ul style="list-style-type: none"> <li>• Trefoil radiation symbol</li> <li>• CAUTION (or DANGER) RAM – DO NOT HANDLE – NOTIFY CIVIL AUTHORITIES (or NDE)</li> <li>• Manufacturer name, model and serial no. (if available; not required)</li> <li>• If used as overpack: INNER PACKAGE COMPLIES WITH PRESCRIBED SPECIFICATIONS</li> </ul>
<b>Notes:</b>

<b>Source Changer</b>
-----------------------

Changer Manufacturer/Model	Serial No.	Source Manufacturer/Model	Serial No.	Activity (Ci)
SAT/UNSAT				
<input type="checkbox"/> <input type="checkbox"/> No abnormal radiation levels anywhere on changer				
<ul style="list-style-type: none"> <li>Highest reading at surface: mR/hr</li> </ul>		<ul style="list-style-type: none"> <li>Notify Department if &gt; 200 mR/hr at surface</li> </ul>		
<ul style="list-style-type: none"> <li>Highest reading @ 1 meter: mR/hr</li> </ul>		<ul style="list-style-type: none"> <li>Notify Department if &gt; 10 mR/hr at 1 m)</li> </ul>		
<u>Note:</u> depleted uranium shielding will produce 1 – 2 mR/hr at surface				
<input type="checkbox"/> <input type="checkbox"/> General condition of exterior surfaces (clean with cloth and mild cleansing solution)				
<input type="checkbox"/> <input type="checkbox"/> Condition of safety plugs (clean as necessary)				
<input type="checkbox"/> <input type="checkbox"/> Proper operation of locking mechanism				
<input type="checkbox"/> <input type="checkbox"/> Condition of pigtail connectors				
<input type="checkbox"/> <input type="checkbox"/> Condition of carrying features (handle, etc.)				
<input type="checkbox"/> <input type="checkbox"/> Proper and legible labeling				
<ul style="list-style-type: none"> <li>Trefoil radiation symbol and "CAUTION (or DANGER) RADIOACTIVE MATERIAL" warning</li> <li>Changer manufacturer name, model and serial no.</li> <li>Source isotope, manufacturer name, model &amp; serial no., activity when loaded and date loaded)</li> </ul>				
<b>Notes:</b>				

## EXHIBIT D

### PERFORMANCE REVIEW CHECKLIST

AUDITOR NAME/TITLE: \_\_\_\_\_  
Signature

WORKER NAME/TITLE: \_\_\_\_\_  
Signature

WORKER NAME/TITLE: \_\_\_\_\_  
Signature

WORKER NAME/TITLE: \_\_\_\_\_  
Signature

RSO INITIALS/DATE: \_\_\_\_\_  
(N/A if RSO is auditor)

**SAT. UNSAT.**

#### **DOSIMETRY**

- |   |                          |                          |
|---|--------------------------|--------------------------|
| • Assigned PM badge, pocket dosimeter(s) and alarm ratemeter worn on front of torso   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Pocket dosimeter(s) and alarm ratemeter calibrated within past 12 months and bear calibration labels (or calibration records available on site) | <input type="checkbox"/> | <input type="checkbox"/> |
| • Pocket dosimeter(s) zeroed at start of shift and re-zeroed if dose reaches 75 millirem  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Function test performed on alarm ratemeter at start of shift  | <input type="checkbox"/> | <input type="checkbox"/> |

#### **SURVEY METERS**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| • Meter checks (cal., visual, battery, condition and rad'n response) performed at start of shift | <input type="checkbox"/> | <input type="checkbox"/> |
| • At least one calibrated and operable meter in use, and cal./op. backup meter on site           | <input type="checkbox"/> | <input type="checkbox"/> |

#### **RADIOGRAPHIC EQUIPMENT**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| • Camera radiation levels match reference survey results recorded in Daily Survey Report | <input type="checkbox"/> | <input type="checkbox"/> |
| • Camera label legible, visible and complete   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Daily equipment checks performed per operating procedures                              | <input type="checkbox"/> | <input type="checkbox"/> |
| • Camera and associated equipment exhibit no signs of modifications or damage            | <input type="checkbox"/> | <input type="checkbox"/> |

#### **TRANSPORTATION**

- |  |                          |                          |
|--|--------------------------|--------------------------|
| • Dosimetry worn and survey meter kept w/ driver during transport  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Shipping papers (Bill of Lading) available and properly completed  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Emergency Response Information (ERI) available and kept w/ Bill of Lading  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Bill of Lading and ERI kept within arm's length of driver during transport   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Radiation. levels < 2 millirem/hr in driver compartment and on all exterior vehicle surfaces   | <input type="checkbox"/> | <input type="checkbox"/> |
| • Transport container properly blocked & braced to prevent movement  | <input type="checkbox"/> | <input type="checkbox"/> |
| • Transport container properly marked & labeled (two completed Rad'n Yellow II labels, rad'n symbol, Caution – RAM – Do Not Handle – Notify Civil Authorities/company) | <input type="checkbox"/> | <input type="checkbox"/> |
| • Post-transport surveys of transport container and camera performed   | <input type="checkbox"/> | <input type="checkbox"/> |

---

---

**RADIOGRAPHIC OPERATIONS**

---

- 2 millirem/hr isodose perimeter properly established w/ rope/tape
- Survey of 2 millirem/hr isodose line matches results recorded on Daily Survey Report
- 2 millirem/hr isodose line properly posted with Caution – Radiation Area signs
- 100 millirem/hr isodose line properly posted w/ Caution (or Danger) – High Radiation. Area signs
- Surveillance of restricted area perimeter maintained to prevent unauthorized access
- Guide tube positioned without sharp bends
- Collimator used whenever possible
- After each exposure, crew verifies source is properly secured in shielded position per camera manufacturer and regulatory requirements, including performance of reference survey and survey of guide tube
- Assistant directly supervised by radiographer
- At end of operations, equipment properly disassembled and secured in transport case

---

---

**IR PERFORMED IN PERMANENT RADIOGRAPHIC INSTALLATION**

---

- Visible/audible alarm system tested at beginning of shift and documented in DSR
- Positive control of vault entry maintained during radiographic operations

---

---

**RAM SECURITY**

---

- Camera kept locked when not under direct surveillance
- When in storage, at least 2 locks used to secure camera

---

---

**RAM STORAGE AREA**

---

- Storage container posted w/ Caution/Danger – Radioactive Material(s) sign
- Radiation levels < 2 millirem/hr at exterior surfaces of RAM storage area

---

---

**RECORDS**

---

- Current AR Rules and Regulations present
- Current copy of radioactive materials license/certificate of registration
- Operating and Emergency Procedures
- Latest leak test label/tag/record for source
- Calibration labels/records for survey meters/dosimeters/alarm ratemeters
- Radiographer certification card
- Daily Survey Report available and properly completed
- Source Movement Log (if source stored overnight) available and properly completed
- Individual Dosimeter Log up-to-date for each worker

---

---

**MISC.**

---

- Crew demonstrates knowledge of emergency procedures
  - Other safety-related concerns (OSHA-related, etc.)
- 
-





## **EXHIBIT E**

### **INFORMATION FOR APPLICANTS TO CONSIDER WHEN DEVELOPING PROCEDURES FOR OPERATING RADIOGRAPHY EQUIPMENT**

#### **Crank-out Device**

- Locate the source shield at the desired distance from the object to be radiographed.
- Mount the source tip firmly, using jigs or other attachments, with the tip in the exact exposure position.
- Locate the control unit at the maximum distance (25 feet) from the source shield with the control tubes laid out as straight as possible.
- Join the control cable to the unit following the manufacturer's instructions.
- Establish and post the restricted area and high radiation area.
- Unlock the device.
- Turn the hand crank steadily to move the source out of the source shield to the exposure position.
- Survey the perimeter of the restricted area to be sure that radiation levels do not exceed 2 millirem (0.02 mSv) in any one hour.
- Maintain continuous surveillance over the restricted area during an exposure, keeping all persons from entering.
- After completing the exposure, retract the source by turning the crank until the "safe" position is indicated.
- Survey the entire circumference of the device and the guide tube to determine that the source is in a shielded position.
- Lock the device and remove the key.

## **Source Exchange**

### **Removing the Old Source**

**Caution:** Always use a calibrated, operable radiation survey instrument while performing a source exchange.

1. Survey the shipping container upon receipt with a survey meter. Note that the surface reading should not exceed 200 millirem/hr (2 mSv/hr).
2. Attach the end of the source guide tube to the exposure device.
3. Connect the other end of the source guide tube to the empty side of the source changer.
4. Unlock the empty side of the source changer.
5. Unlock the camera and crank out the source from the camera into the source changer.
6. Survey the source changer and guide tube to verify that the source is in the safe position.
7. Lock the source changer.
8. Disconnect the source guide tube and drive cable to the source pigtail. Replace the dust cap on the source changer.
9. Remove the source identification plate from the exposure device and affix the plate to the side of the source changer loaded with the old source.

### **Installing the New Source**

1. Remove the dust cap on the source changer lock body identified with the new source tag.
2. Align the camera and source guide tube with the source changer.
3. Connect the new source to the drive cable.
4. Connect the source guide tube to the source changer.
5. Unlock the source changer and retract the new source into the exposure device.
6. Survey the exposure device and guide tube to assure that the source is in the safe position.
7. Lock the exposure device.
8. Disconnect the source guide tube and drive accessories.
9. Affix the new source identification plate on the exposure device.

## EXHIBIT F

### DAILY MAINTENANCE CHECK OF RADIOGRAPHIC EQUIPMENT

The Radiographer or Radiographer Assistant shall perform a daily maintenance check of the radiographic device and related radiography equipment. This inspection will be performed before using the equipment on each day the equipment is to be used. Report defective equipment to the RSO immediately. Do **not** attempt to use defective equipment. After the inspection, document the results of the inspection.

1. Inspect the survey meter for battery check, zero and operation. If batteries are low, replace, and then check for operability. If not able to correct a problem with the survey meter, obtain another meter and start over.
2. Check survey meter with a check source (which should give a reading of millirem) (or check with camera which should give a reading of millirem) as indicated on the survey meter. If reading is not acceptable, obtain another meter and start again.

**NOTE:** RSO or calibration vendor should determine the acceptable meter reading for each survey meter and post the expected reading on each instrument. This reading shall be obtained and noted at the time of calibration.

3. a. Inspect the cables for cuts, breaks, and broken fittings.
- b. Carefully inspect approximately one foot of the drive cable immediately next to the male connector. Take care not to introduce any dirt or dust on the drive cable during this inspection. In addition to the previously mentioned items, the examination of the cable should look for any of the following:
  - excessive or uneven wearing
  - fraying
  - unraveling
  - nicks
  - kinks or bends
  - loss of flexibility (abnormal stiffness)

- excessive grit or dirt
- stretching
- Inspect the crank unit for damage and loose hardware.
- Check operation of the control for freedom of drive cable movement.
- Inspect the guide tube for cuts, crimps, and broken fittings.
- Survey for radiation levels and record readings. The radiation levels should be about the same as those in the previous day's inspection, unless there has been a source change.
- 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.

4. Record the results of the daily inspection.

**EXHIBIT G**  
**EMERGENCY RESPONSE INFORMATION**

**POTENTIAL HAZARDS**

**1. IMMEDIATE HAZARDS TO HEALTH**

- External radiation hazard from unshielded radioactive material.
- Potential internal radiation hazard from inhalation, ingestion, or breaks in skin, but only if special form capsule is breached.
- Radioactive material; degree of hazard will vary greatly, depending on type and quantity of radioactive material.
- Materials in special form or in Type B packaging are not expected to cause contamination in accidents.

**2. FIRE OR EXPLOSION**

- No risk of fire or explosion; radioactivity does not change flammability or other properties of the materials.

**EMERGENCY ACTION**

**3. IMMEDIATE PRECAUTIONS**

- Isolate hazard area to at least a 150-foot radius and restrict access; greater distances may be necessary if advised by the qualified Radiation Safety Officer.
- Enter hazard area only to save life; limit entry to shortest possible time.
- Emergency response actions may be performed prior to any measurement of radiation.
- Notify local authorities and Department of accident conditions.
- Detain uninjured persons, isolate equipment with suspected contamination, and delay cleanup until instruction from the Radiation Safety Officer.

**4. FIRE**

- Do not move damaged containers; move undamaged containers out of fire zone.
- Fight fire from maximum distance.
- Small fire: Dry chemical, CO2, Halon, water spray, or standard foam
- Large fire: Water spray, fog (flooding amounts)

**5. SPILL OR LEAK**

- Do not touch damaged containers or exposed contents.
- Damage to outer container may not affect primary inner container.
- Special form capsules are not expected to leak because of an accident or fire.

**6. FIRST AID**

- Use first aid treatment according to the nature of the injury.
- Advise medical personnel that victim may be contaminated with radioactive material.
- If not affecting injury, remove and isolate potentially contaminated clothing and shoes. Wrap victim in blanket before transporting.
- Except for the injured, detain persons exposed to radioactive material until arrival or instruction of the Radiation Safety Officer.

**CALL THE FOLLOWING FOR EMERGENCY ASSISTANCE:**

**RADIATION SAFETY OFFICER:  
RSO PHONE NO.:**

<b>LOCAL AUTHORITIES:</b>	<b>911, police, sheriff, fire department</b>
<b>ARKANSAS DEPARTMENT OF HEALTH .....</b>	<b>(800) 633-1735</b>
<b>U.S. DEPT. OF TRANSPORTAT.....</b>	<b>(800) 424-8802</b>
<b>AEA TECHNOLOGY QSA.....</b>	<b>(800) 815-1383</b>
<b>INDUSTRIAL NUCLEAR CO.....</b>	<b>(800) 424-9300</b>
<b>SOURCE PRODUCTION AND EQUIPMENT CO.....</b>	<b>(800) 992-4589</b>