

# **ARKANSAS DEPARTMENT OF HEALTH**

**RADIATION CONTROL SECTION  
RADIOACTIVE MATERIALS PROGRAM**

## **LICENSING GUIDE**

**INSTRUCTIONS FOR PREPARING APPLICATIONS  
FOR RADIOACTIVE MATERIALS LICENSES AUTHORIZING  
THE  
USE OF SEALED RADIOACTIVE SOURCES  
IN  
FIXED GAUGES**

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## **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 fixed gauges. It also describes the Department of Health criteria for evaluating a fixed device license application. The phrases “fixed gauge”, or “gauging device”, or “gauge” 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 fixed gauges.

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. 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 (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 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 is in compliance 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 fixed gauges 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.

Fixed gauge 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 from the U.S. Government Printing Office by calling (202)-512-1800 or writing the Superintendent of Documents, Post Office Box 371954, Pittsburg, Pennsylvania 15250-7954. The web site address for U.S.DOT rules and regulations is <http://hazmat.dot.gov/rules.htm>.

#### **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 a Radioactive Materials License”, a set of appendices and exhibits are enclosed to assist the applicant in the development of a fixed 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 4, “Consolidated Guidance About Materials Licenses, Program-Specific Guidance About Fixed Gauge Licenses”, and**
- **State of Florida, Department of Health, Bureau of Radiation Control, Regulatory Guide 1.20, “Use of Sealed Sources in Fixed Gauges” (Draft).**

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

## **FILING AN APPLICATION**

### **A. GENERAL**

An application for a specific license to use radioactive material in the form of sealed sources in fixed gauges should be submitted on the "Application For Radioactive Materials 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  
Radioactive Materials Program  
4815 W. Markham, Slot 30  
Little Rock, AR 72205-3867**

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 are available in the Department for review by the general public. 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:

License Application Fee A non-refundable administrative fee for processing a new license application. The amount is dependent on the number of gauges the applicant includes on the license, as follows:

<u>Number of Gauges To Be Licensed</u>	<u>Fee</u>
1-5	\$300
6 or more	\$500

Review of the application will not begin until the proper fee is received by the Department.

License Amendment Fee 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.

Review of the amendment request will not begin until the proper fee is received by the Department.

Annual fee An annual fee covers the Department costs for administering the radioactive materials licensing program. The amount of the fee is dependent on the number of gauges the applicant is includes on the license, as follows:

<u>Number of Gauges To Be Licensed</u>	<u>Fee</u>
1-5	\$300
6 or more	\$500

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.

**NOTE: The Department must receive prior notification in the event of change of ownership or control or any bankruptcy proceedings.**

### **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.

### **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".**

### **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 an Authorized User (AU) of the radioactive material, specifically a gauge operator.

**NOTE:** Depending on the number of Authorized Users, the Department normally lists the name of each Authorized User on the Radioactive Material License. However, the Department has the authority to issue a license that states the radioactive material may be used under certain specified criteria. The specific method of identifying the Authorized Users will be chosen by the Department during the application evaluation process.

## 8. TRAINING AND EXPERIENCE OF USERS

Each Authorized User must have adequate training and experience. The formal training requirement may be satisfied by either of the following two methods:

- (1) An approved radiation safety course provided by a third party (gauge manufacturer or another training provider), supplemented by training in the licensee's operating and emergency (O&E) procedures, the Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation, and the Radioactive Material License; or
- (2) An in-house training program must be approved by the Department. If this option is chosen, a detailed description of the in-house training program must be submitted. An in-house training program is required to be equivalent to a vendor-supplied, third-party training program.

Submit documentation of radiation safety training for each individual listed in Item 7 of the application. Appropriate training certificates or other documentation stating completion of training, such as provided by gauge manufacturers or other approved third parties are acceptable, but may need to be supplemented with documentation of completion of training in company operating and emergency (O&E) procedures (third party trainers often do not provide training in specific O&E procedures). If seeking approval to conduct in-house radiation safety training, a detailed description of the training program must be submitted for review.

Describe any additional relevant work experience with radiation for any individual listed in Item 7 and include where the experience was obtained. Descriptions of experience are typically unnecessary unless seeking approval to act as a 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.

Maintaining documentation of training (including training certification) for each Authorized User on file for inspection purposes is required by the Department to demonstrate that personnel are adequately trained.

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

Provide the name of the individual assigned the position of RSO. This person is designated by, and responsible to, management 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". Management involvement in and support of the radiation protection program is discussed in Item 25, Management Control.

The RSO must have independent authority to stop operations that are considered unsafe. In a small program not requiring a full-time RSO, the duties may be assigned to one of the individuals listed in Item 7. However, it must be committed to and confirmed by management that the individual serving as the RSO will have the opportunity to devote sufficient time to implementing the radiation safety program to insure that the radioactive material is used in a safe manner.

Describe the training and experience of the individual assigned the position of RSO. As a minimum, the RSO shall have sufficient training and experience to be an Authorized User of the requested radioactive materials, unless otherwise specified in the license. The individual should have also completed a formal training course for Radiation Safety Officers offered by the gauge manufacturer or another training provider. A copy of the certificates or other documents should be submitted showing successful completion of the training.

Describe the Duties and Responsibilities of the RSO. Appendix B, "Typical Duties and Responsibilities of the Radiation Safety Officer" is an example that may be used to provide this information.

## 10. **TRAINING PROGRAM**

Describe the training program for Authorized Users 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 three 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

List each type of radioactive material requested.

### b. CHEMICAL AND/OR PHYSICAL FORM

Complete for each type of radioactive material requested. State the name of the source manufacturer and the source model number.

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

Complete for each radioactive material requested. Indicate the total amount of radioactive material 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. Cesium 137	1. Sealed source (ABC Tech, Model Number 9999)	1. 400 millicuries; no single source to exceed 200 millicuries
2. Cesium 137	2. Sealed source (ABC Tech, Model Number 8888)	2. 600 millicuries; no single source to exceed 50 millicuries

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

Complete for each radioactive material requested. Include the name of the manufacturer of the gauge or source holder in which each source is used or stored. The following is an example of the information to be submitted and the proper format to provide the information.

1. To be used in an ABC Tech, Model A source holder for level measurements.
2. To be used in an ABC Tech, Model 5 source holder for level measurements.

## 12. LEAK TESTS

Each sealed radioactive source shall be periodically tested to determine if radioactive material is leaking from the source in the gauge.

Appendix D, "Leak Tests of Sealed Radioactive Sources", describes the requirement for leak testing sealed sources 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. Please complete Form D and include it with the application.

### 13. RADIATION DETECTION INSTRUMENTS

It is necessary for fixed gauge licensees to possess a radiation survey instrument to perform radiation surveys.

Radiation surveys **are required if an applicant plans to conduct non-routine maintenance.** This includes installation, initial radiation surveys, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge.

Radiation surveys are also **required to verify source lockout** in preparation for personnel entering a vessel or performing maintenance work in the immediate vicinity of the radiation beam. Because some of these activities may increase the risk of radiation exposure, individuals performing these activities must be carefully monitored with a survey instrument.

Radiation survey instruments must be properly calibrated, as addressed in Item 14 of this Application. Licensees who perform surveys pursuant to Paragraph RH-1300 must possess a survey instrument that:

- Measures at least 1 millirem per hour through 50 millirem per hour,
- Is capable of measuring the radiation being emitted from the gauges sealed source,
- Is checked for operability with a source of radiation at the beginning of each day of use (e.g., with the gauge or a check source),
- Is calibrated.

It is important to determine as soon as possible after an incident, by the use of a radiation survey instrument, whether or not the shielding and source are intact. Therefore, emergency procedures need to include instructions regarding access to a survey instrument (refer to Appendix N, Emergency Procedures).

### 14. CALIBRATION OF INSTRUMENTS

Radiation survey instruments must be periodically calibrated to insure they accurately detect and measure radiation from the gauge. The calibration service must be performed by a Arkansas Registered Service Vendor who is licensed to perform the service by the Arkansas Department of Health, the U.S. Nuclear Regulatory Commission, or an Agreement State. However, the licensee may be authorized to calibrate survey instruments “in-house” provided certain requirements are met. Additional guidance for performing instrument calibration is provided in Appendix E, “Calibration of Radiation Survey Instruments”. 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 DEVICES

Personnel monitoring devices, or more commonly known as personnel monitoring badges, may be required to be worn by Authorized Users or other individuals working with or around fixed gauges to measure the radiation dose received by the individual. Typical badges include film badges, thermoluminescent dosimeters (TLDs) and optically stimulated luminescent dosimeters (OSLDs, for example, LUXEL), which are described in Appendix F, "Personnel Monitoring".

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

## 16. FACILITIES AND EQUIPMENT

Facilities and equipment must be adequate to protect health and to minimize danger to life or property.

Fixed gauges incorporate many engineering features to protect the user from unnecessary radiation exposure in a wide variety of environments. Fixed gauges may be located in harsh environments involving variables such as pressure, vibration, mounting height or method, temperature, humidity, air quality, corrosive atmospheres, corrosive chemicals including process materials and cleaning agents, possible impact or puncture conditions, and fire, explosion, and flooding potentials. Applicants need to consult the sections on the Sealed Source and Device Registration Certificate entitled, "Conditions of Normal Use" and "Limitations and/or Other Considerations of Use" to determine the appropriate gauge for a location. In those instances when a proposed location is not consistent with the Sealed Source and Device Registration Certificate, the applicant may ask the source or device manufacturer or distributor to request an amendment to modify the Sealed Source and Device Registration Certificate to include the new conditions. If the manufacturer or distributor does not request an amendment, the applicant must provide the Department with specific information demonstrating that the proposed new conditions will not impact the safety or integrity of the source or device.

Provide a description and drawing of the area where gauges containing radioactive material are located and used, including:

- a. Shielding
- b. Physical location of each gauge
- c. Adjacent areas
- d. Access to areas in the vicinity of the gauges. Describe personnel access points to gauge use areas, including the proximity to normal work stations, location of catwalks or other similar traffic flow areas in relation to the gauge use areas.
- e. Control of access to and the security of gauge use area, i.e., barriers, interlocks or administrative controls.
- f. Radiation posting of the area in the vicinity of the gauge use area.
- g. Gauge storage area

Submit a description and an annotated diagram of the permanent gauge storage facility, identifying facility construction, all entrances and points of access, rooms, uses of the rooms, the location of the gauge storage area, and its distance from occupied work areas. Describe and label all areas (including fencing and gates) adjacent to the permanent facility. If the facility is a multistory and/or multi-tenant building, identify floors above and below the gauge storage area and their uses, including areas occupied by other tenants.

Describe the radiological posting of the permanent gauge storage facility and confirm that the facility will always be properly posted.

Describe any remote handling equipment that will be used.

## **17. RADIATION SURVEY PROGRAM**

Radiation surveys are required according to the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1300, “survey”.

Appendix G, “Radiation Survey Program” contains an adequate radiation survey program for most fixed gauge activities. Procedures that are equivalent to Appendix G may also be submitted to comply with the radiation survey program requirements.

Complete Item 17 of the Application by describing how the Radiation Survey Program will be performed and submitting the appropriate procedures.

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 Paragraph RH 1208, “Dose Limits for Individual Members of the Public” of the Rules and Regulations for Control of Sources of Ionizing Radiation. These limits are not to exceed:

- a. Total Effective Dose Equivalent: 100 millirem per year
- b. 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 H, “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 H by marking the appropriate boxes and providing the requested information. Attach the completed Appendix H to the application.

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

Radioactive material may only be possessed and used in accordance with a Radioactive Material License issued by the Arkansas Department of Health, 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 Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1307, "Procedures for Picking Up, Receiving and Opening Packages".

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

Complete Item 18 of the Application by providing the name and title of the individual in Appendix I and submit Appendix I with the Application as the procedures that will be used. If the Appendix I 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 fixed gauges must be disposed of in accordance with Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph 1400 a., "General Requirements" for Waste Disposal.

The preferred method of disposing of fixed gauges containing radioactive material is to return the gauge to the manufacturer. However, it is also acceptable to transfer the gauge to a licensed, commercial radioactive waste disposal company. 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 Item 19.

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

## **20. CONTROL AND SECURITY OF TEMPORARY JOB SITES**

Not Applicable for Fixed Gauge Applicants or Licensees.

## 21. **TRANSPORTATION**

Fixed gauges containing radioactive material must be transported in accordance with U.S. Department of Transportation (DOT) regulations. Licensees are responsible for ensuring that gauges are properly packaged, marked, labeled, and secured, and that proper documentation accompanies the gauges.

U.S. DOT regulations, 49 CFR 172, Subpart H requires every hazardous material employer (Licensee) to provide all Hazardous Material Employees who package and transport radioactive materials, 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 Hazardous Material Employees.

Appendix K, “Transportation of Gauges”, 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**.

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

## 22. **OPERATING PROCEDURES**

Gauges containing radioactive material 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 Authorized Users 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 gauge use and operation.

The Radiation Safety Officer (RSO) is responsible for assuring that the gauges 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 performing a Quarterly Inventory of all radioactive sources at the Licensee’s facility, and periodically leak testing the radioactive sources. These functions must also be addressed in the operating or equivalent procedures.

Appendix L, “Operating Procedures”, contains operating procedures for a program using fixed gauges. Typically, the operating procedures also include the use of gauge manufacturer’s operator’s manual for operating the gauge. The procedures in Appendix L will assist the Authorized User to safely use the radioactive gauges and to keep the radiation doses ALARA. However, the Applicant may submit equivalent procedures with the application for review by the Department.



Appendix M, “Lockout Procedures”, contains operating procedures that may be used for safely locking out a gauge before individuals perform any work where operating gauges could cause unnecessary radiation exposure to the individuals. The procedures in Appendix M will assist the Authorized User to safely lockout a radioactive gauge and to keep the radiation doses ALARA. However, the Applicant may submit equivalent procedures with the application for review by the Department.

Procedures for performing non-routine maintenance such as installation, initial radiation surveys, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge **must be specifically approved by the Department** prior to use.

In addition to the Appendix L Procedures, provide a copy of the following Operating Procedures:

- a. **Gauge Lockout Procedures (Appendix M)**
- b. **Non-Routine Maintenance Procedures**
- c. **Gauge Leak Test Procedures (Appendix D)**

**NOTE: Copies of operating and emergency procedures should be posted at each location of use or if posting procedures is not practicable, a notice which briefly describes the procedures and states where they may be examined may be posted instead.**

**Copies of operating and emergency procedures should be provided to all gauge users.**

Complete Item 22 of the Application by submitting a copy of the procedures that will be followed when using the gauge(s). If Appendix L and Appendix M procedures will be used, submit a copy of Appendix L and Appendix M with the application. If the Appendix L or Appendix M procedures will not be used, submit equivalent procedures describing how the gauge will be used and locked out. Also, submit a copy of the Gauge Leak Test Procedures.

## **23. EMERGENCY PROCEDURES**

Emergency procedures must be developed and implemented to manage accident situations involving gauges containing radioactive material. Accidents may include fire, explosion, mechanical damage, or tornados. The use of Emergency Procedures will help minimize the risk to personnel and the environment.

Appendix N, “Emergency Procedures” contains emergency procedures that may be used by the Applicant to guide the emergency response to various accidents or incidents involving the gauges. 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 the procedures that will be followed when responding to an accident. If Appendix N procedures will be used, submit a copy of Appendix N with the application. If the Appendix N procedures will not be used, submit equivalent emergency procedures describing the emergency response.

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

The Radiation Safety Officer 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 O, “Administrative Requirements” provides a summary listing of requirements in the Rules and Regulations which must be included in the Radiation Safety Program.

Complete Appendix O 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 O 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 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 for implementing the Radiation Safety Program, including the authority to stop potentially unsafe work involving the radiation sources.

Confirm that the annual audit of the Radiation Safety Program, as required by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph 1004, will be performed and documented. Also, 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.

**NOTE:** 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.

**NOTE:** Please identify all other individuals in the Applicant's organization who may be authorized to sign documents for the Applicant/Licensee.

#### **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 or on the "Application For Radioactive Materials License". The request must be dated and signed by a certifying official, identify the license by name and number, be submitted in duplicate, and 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.

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

#### **V. LICENSE RENEWAL**

A Radioactive Material License remains in effect for a specific period of time, typically 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.

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 Paragraph RH-411.b., Arkansas Rules and Regulations for Control of Sources of Ionizing Radiation. 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 "Application For Radioactive Materials 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>
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## **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	Personnel Monitoring			
App. G	Radiation Survey Program			
App. H	Dose for Members of the Public			
App. I	Ordering, Receiving, Opening and Shipping Gauges			
App. J	Disposal or Transfer of Radioactive Material			
App. K	Transportation of Gauges			
App. L	Operating Procedures			
App. M	Lockout Procedures			
App. N	Emergency Procedures			
App. O	Administrative Requirements			

**TABLE 2. EXHIBITS**

<b>Exhibit</b>	<b>Title</b>	<b>Attached</b>	<b>Equivalent</b>	<b>N/A</b>
	Model Facility Diagram		<b>X</b>	
Ex. A	Model Inventory Form			
Ex. B	Model Fixed Gauge Survey Form			
Ex. C-1	Model Shipping Paper – Exclusive Use Shipments			
Ex. C-2	Model Shipping Paper – Common Carrier Shipments			
Ex. D	Model Emergency Response Information			
Ex. E	Model Radiation Protection Program Audit Form			

# 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 exposure limits provide a very low risk of injury.

The objective is to reduce occupational exposures (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 exposures 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 conduct a formal review of the radiation protection program's content and implementation, as required by Paragraph RH-1004. "Radiation Protection Programs". 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.

## APPENDIX B

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

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

- Gauges are used in a manner such that the radiation dose to workers and the public is As **L**ow As is **R**easonably **A**chievable (**ALARA**)
- RSO stops licensed activities which the RSO considers unsafe
- Possession, use, storage, and maintenance of gauges are consistent with the limitations in the license and the manufacturer's recommendations and instructions
- Individuals using gauges are properly trained
- Personnel monitoring devices are used and exchanged at the proper intervals; records of the results of such monitoring are maintained
- Gauges are properly stored and secured against unauthorized removal
- Gauges are leak tested as required by the license
- Proper authorities are notified in case of accident, damage to gauges, fire, or theft
- Unusual occurrences involving the gauge (e.g., accident, damage) are investigated, cause(s) and appropriate corrective action are identified, and corrective action is taken
- Audits are performed at least annually, 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

The handling and use of a fixed nuclear gauge are restricted to trained personnel. Individuals working directly with the gauge must be an **Authorized User**--an individual that has completed an approved formal radiation safety class and is specifically listed on a Radioactive Material License.

There are three training components associated with using radioactive material for fixed gauging. Authorized User Training will be provided to individuals who will be independently working directly with or who will be directly supervising the use of the radioactive material. 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 near the radioactive material (for example, work station near a permanent or temporary storage area for radioactive material) during their work. The training will be conducted at the frequency specified in the following table:

#### Training Requirement

#### Frequency of Training

- |   |                                  |
|---|----------------------------------|
| • Authorized User Training (including individuals who are supervised by Authorized Users) | Initial; Annual Refresher        |
| • Hazardous Materials (Hazmat) Training   | Initial; Refresher every 3 years |
| • Ancillary Personnel Radiation Awareness Training  | Initial; Annual Refresher        |

#### II. Authorized User Training

- A. Radioactive material will only be used by individuals who have completed a formal radiation safety training program. Authorized Users will complete a training program which has been approved by the Arkansas Department of Health. Any third party course offered by a private company or independent consultant may be used, provided the Department approves the training.

If in-house radiation safety training is provided, it will be conducted in accordance with a training program that has been approved by the Department and incorporated into the company's radiation protection program.

**Criteria for acceptable Authorized User radiation safety training is provided in Attachment 1 of this Appendix.**



- B.** Operating and Emergency (O&E) procedures, including **Lockout Procedures**, are a required training topic. Unless training in the O&E procedures is addressed during third party training and documentation is provided by the trainer demonstrating its inclusion in the course, in-house training in O&E procedures will be provided. O&E procedures training will be conducted by the RSO or another qualified individual and separate documentation of O&E procedures training will be provided for each worker.
- C.** Prior to working with radioactive material, packaging or transporting radioactive material, all Authorized Users and other individuals who may be supervised by Authorized Users in working with the radioactive material, will receive the general radiation safety training as required by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-2803, "Instructions to Workers". The following instructions will be provided:
- ◆ Information on the storage and use of radioactive material, including Operating and Emergency Procedures.
  - ◆ The health protection problems associated with exposure to radiation or radioactive material
  - ◆ Precautions and procedures used to minimize exposures
  - ◆ Applicable provisions of Arkansas' radiation control regulations and the company's radioactive materials license
  - ◆ Workers' responsibility to report any unsafe conditions in the workplace
  - ◆ Appropriate responses to warnings made in the event of incidents having the potential to involve radiation exposure
  - ◆ Reporting requirements for occupational radiation exposures described in Paragraph RH-2804, "Notifications and Reports to Individuals".

This portion of the training 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.

- D.** Individuals performing non-routine maintenance such as installation, initial radiation surveys, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge. Work involving the sealed radioactive source may only be performed by specifically licensed persons. The use of a radiation survey meter is required during all non-routine maintenance.

<p><b>NOTE:</b>      <b>The training of individuals to perform non-routine operations shall be provided by the manufacturer or by another qualified third party individual specifically approved by the Department.</b></p>
---

- E. Documentation of radiation safety training for each Authorized User and other individuals who may be supervised by Authorized Users in working with the radioactive material, will be maintained on file for inspection purposes.

### III. Hazmat Employee/Driver Training

- A. Radioactive material contained in fixed gauges 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 (packaging and preparing for transport) that directly affects hazardous material transportation safety. (Exception: employees can work 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 AU 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:
- The employee's name and date of most recent training completed;
  - Description, copy or location of training materials used;
  - Name and address of the person providing the training; and
  - Certification that the employee has been trained and tested as required.

### IV. Ancillary Personnel Radiation Awareness Training

- A. Ancillary personnel (office personnel, janitorial personnel, shift personnel, non-radiation workers, etc.) who may work in the general vicinity of the gauges (for example, shift tours in the vicinity of installed fixed gauges, the gauge permanent and temporary storage areas) will receive hazard 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 will be conducted by the RSO for ancillary personnel at the time of employment. Refresher training for all ancillary personnel will be conducted annually.
- C. The training will last about one hour and personnel will 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 will be maintained on file for inspection purposes.

## APPENDIX C

### ATTACHMENT 1

#### Course Content for Acceptable Training for Authorized Users

Classroom training may be in the form of lecture, videotape, or self-study emphasizing practical subjects important to the safe use of the gauge:

##### **Radiation Safety:**

- Radiation vs. contamination
- Internal vs. external exposure
- Biological effects of radiation
- Types and relative hazards of radioactive material possessed by the Licensee
- ALARA concept
- Use of time, distance, and shielding to minimize exposure
- Radiation survey meters
- Personnel monitoring devices
- Location of sealed source within the gauge

##### **Regulatory Requirements:**

- Applicable regulations
- License conditions, amendments, renewals
- Locations of use and storage of radioactive materials
- Material control and accountability
- Annual audit of radiation safety program
- Transfer and disposal
- Recordkeeping
- Prior events involving fixed gauges
- Handling incidents
- Recognizing and ensuring that radiation warning signs are visible and legible
- Licensing and inspection by regulatory agency
- Need for complete and accurate information
- Employee protection
- Deliberate misconduct

**Practical Explanation of the Theory and Operation for Each Gauge Possessed by the Licensee:**

- Operating and emergency procedures
- Routine vs. non-Routine maintenance
- Lock-out procedures, including radiation surveys

**On-the-job training must be done under the supervision of an AU or RSO:**

- Supervised Hands-on Experience Performing:
  - Operating procedures
  - Test runs of emergency procedures
  - Performing radiation surveys
  - Routine maintenance
  - Lock-out procedures

**Training Assessment**

Management will ensure that proposed Authorized Users are qualified to work independently with each type of gauge with which they may work. This may be demonstrated by written or oral examination or by observation.

<p><b>Note:</b> Additional training is required for those applicants intending to perform non-routine operations such as installation, initial radiation survey, repair, and maintenance of components related to the radiological safety of the gauge, gauge relocation, replacement, and disposal of sealed sources, alignment, or removal of a gauge from service.</p>
---

**Course Instructor Qualifications**

Instructor should have:

- Bachelor's degree in a physical or life science or engineering
- Successful completion of a fixed gauge manufacturer's or distributor's course for users (or equivalent)
- Successful completion of an 8 hour radiation safety course; and
- 8 hours hands-on experience with fixed gauges

**OR**

- Successful completion of a fixed gauge manufacturer's or distributor's course for users (or equivalent)
- Successful completion of 40 hour radiation safety course; and
- 30 hours of hands-on experience with fixed gauges.

**OR**

- The applicant may submit a description of alternative training and experience for the course instructor.

## Appendix D

### LEAK TESTS OF SEALED RADIOACTIVE SOURCES

Each sealed source contained in a fixed gauge must be tested at regular intervals to ensure that the radioactive material is secure within its capsule and 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".

a. **Leak Test Frequency.**

Radioactive gauges will be leak tested in accordance with the manufacturer's directions and the Sealed Source and Device Catalogue maintained by the U.S. Nuclear Regulatory Commission and the Agreement States. Fixed gauges are typically leak tested either every 6 months or 36 months, unless otherwise specified in the Radioactive Material License.

b. **Leak Test Kit**

Only leak test kits provided by licensed vendors will be used to sample (smear) sealed sources contained in fixed gauges.

c. **Taking the Leak Test Sample**

Leak test samples will be taken only by Authorized Users or Registered Service Vendors (where applicable), wearing their assigned personnel monitoring badges. Leak test samples will be taken in accordance with the written instructions provided by the supplier of the leak test kit and the gauge manufacturer.

d. **Leak Test Sample Analysis**

Leak test sample analysis will be performed only by Arkansas Registered Service Vendors specifically licensed to provide the service by the Arkansas Department of Health, the U. S. Nuclear Regulatory Commission, or other Agreement State.

e. **Leak Test Records**

If a test indicates a gauge's sealed source is leaking, the gauge will be removed from service and the Arkansas Department of Health will be notified by a written report on the leaking source within 5 days. The report will be submitted to Radioactive Materials Program, Radiation Control and Emergency Management, Arkansas Department of Health, 4815 W. Markham Street, Mail Slot #30, Little Rock, Arkansas, 72205-3867. The report will describe the equipment involved, the test results, and the corrective actions taken (i.e., gauge removed from service until repaired; radiation surveys conducted to determine presence of contamination; decontamination as necessary).

Leak test records will be retained for 3 years for inspection purposes. 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,
- ◆ 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 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 or Title of Individual Performing Leak Test  
\_\_\_\_\_
- e. Name of Company to Perform Assay of Leak Test Samples  
\_\_\_\_\_
- 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 least annually and after each maintenance or servicing of the instrument. The calibration should be sensitive enough to detect radiation emitted from the gauge 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". The survey instrument must be capable of measuring 1 to 50 millirem/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. Each scale of the instrument shall be calibrated on at least two points located at approximately  $1/3$  and  $2/3$  of full scale.
  4. The dose rate measured by the instrument shall differ from the true dose rate by less than  $\pm 10$  percent at the two points on each scale. Readings within  $\pm 20$  percent will be considered acceptable if a calibration chart, graph, or response factor is prepared, attached to the instrument, and used to interpret meter readings to within  $\pm 10$  percent for radiation protection purposes.
- 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 operability check should be performed prior to use with a reference source, either a check source or the gauge itself. The readings from the reference source shall be obtained as soon as the instrument is received from the calibration service vendor. The readings shall be taken with the reference source placed in specific repeatable geometry relative to the instrument.

The operability check using the reference source should be taken:

1. Before each radiation survey to ensure that the instrument is operable, and
2. After each battery change.

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 least annually and following each maintenance and repair activity. (Please Check indicating Commitment)
- \_\_\_\_\_ 2. Calibration will be performed at two points on each scale used for radiation protection purposes. (Please Check indicating Commitment)

The two points will be approximately 1/3 and 2/3 full scale. A survey instrument may be considered to be properly calibrated when the instrument readings are within  $\pm 10$  percent of the calculated or known values for each calibration point. Readings within  $\pm 20$  percent will be considered acceptable if a calibration chart, graph, or response factor is prepared, attached to the instrument, and used to interpret meter readings to within  $\pm 10$  percent for radiation protection purposes. Also, when higher scales are not checked or calibrated, a precautionary note will be posted on the instrument.

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

### PERSONNEL MONITORING

#### I. PERSONNEL MONITORING

Personnel monitoring devices, more commonly referred to as personnel monitoring badges, shall be provided to measure the radiation dose for all individuals who are likely to receive more than 10% of the annual dose limit permitted by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1200, "Occupational Dose Limits for Adults." The whole body radiation dose limit which requires personnel monitoring is 500 millirem per year or greater.

An Applicant may provide calculations which demonstrate that an individual who is performing routine operations with the gauge is not likely to exceed the dose limit and is not required to be provided personnel monitoring. Instructions for estimating an individual's annual radiation dose is provided in Attachment 1 of this Appendix.

However, the radiation dose to individuals performing non-routine maintenance such as installation, initial radiation surveys, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge shall be measured by the individual(s) wearing a personnel monitoring device.

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. General

Personnel monitoring badges must detect beta and gamma radiation, so verify the capabilities of available badges 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 worker'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.

**B. 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 exposure. 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.

**C. 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 badge wearer's dose. TLDs should be protected from extreme environmental conditions which may affect their ability to accurately record radiation. They must be exchanged at least every THREE months.

**D. 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 at least every THREE months.

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

**A. General Instructions**

If personnel monitoring is required, a whole body personnel monitoring badge (film, TLD or OSLD) shall be worn at all times when working with or around a fixed nuclear gauge. Each Authorized User or other worker will be assigned a badge, which can only be worn by the individual to whom it has been assigned. Badges are to be worn on the front of the torso, at or above the waist and below the shoulder. Badges must be promptly returned to the Radiation Safety Officer (RSO) at the end of each monitoring period to ensure rapid processing.

**Recommended Work Practices for Personnel Monitoring**

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

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

If personnel monitoring is required, to ensure accurate monitoring of occupational dose, an assigned badge will be ordered immediately for newly-employed workers. A spare/visitor badge may be provided to new workers until the assigned badge arrives. Spare badges may also be used to replace a badge that has been lost or damaged before the end of the monitoring period. To ensure their use by only one individual, spare badges will be imprinted with the worker's name or another form of identification. Workers assigned spare badges will have the dose recorded by the badge added to their occupational dose record. In the event of a lost/damaged badge, the RSO will estimate the worker's dose for the period the badge was worn, and notify the dosimetry processor if the individual's dosimetry record needs to be revised.

**IV. PERSONNEL MONITORING RECORDS REQUIREMENTS**

**A. Records of Prior Occupational Dose**

Prior to assigning a badge to a worker the worker'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 lifetime cumulative occupational radiation dose. If a worker 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 worker 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, 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**

Each worker 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 worker 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 gauge operators that have declared themselves pregnant will be instructed to always wear their assigned badge 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.g., "Records of Dose to Individual Members of the Public", 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-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 Arkansas Department of Health 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**

**Form F**

**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 Device to be Used:**

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

**2. Radiation Detected:**

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

**3. Type Monitoring:**

- Whole body**                       **Extremity**

**4. Frequency of exchange:**

- Monthly**                       **Quarterly**

**5. Supplier of Personnel Monitoring Service:\_\_\_\_\_**

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

- PERSONNEL MONITORING IS NOT REQUIRED BECAUSE THE PROJECTED PERSONNEL RADIATION DOSE IS CALCULATED TO BE LESS THAN 500 MILLIREM PER YEAR.**

**Justification for this decision is provided in the completed Form F, Table 1.**

## APPENDIX F

### Attachment 1

#### **Guidance for Demonstrating That Unmonitored Individuals Are Not Likely to Exceed 10 Percent of the Allowable Limits**

Personnel monitoring is required for individuals who are likely to receive a radiation dose of more than 10% of the annual dose limit permitted by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1200, "Occupational Dose Limits for Adults." The whole body radiation dose limit which requires personnel monitoring is 500 millirem per year or greater. However, if individuals are not expected to receive this dose, personnel monitoring may not be required.

To demonstrate that personnel monitoring devices are not required, the applicant must perform an evaluation to estimate the annual radiation dose to workers and must submit the evaluation with the Application. The applicant/licensee must also retain a copy of the evaluation for inspection purposes.

The most common way that individuals may exceed 10% of the applicable limits is by performing routine maintenance on gauges. Thus, a licensee must evaluate the radiation doses workers might receive in performing these tasks to determine if personnel monitoring is required.

#### **Example**

One gauge manufacturer has estimated the doses to the whole body and the extremities of an individual performing routine maintenance on one of its gauges. The gauge is authorized to contain up to 200 millicuries of Cesium-137. The manufacturer based its estimate on observations of individuals performing the recommended procedure according to good radiation safety practices. The manufacturer determined the following types of information:

- Time needed to perform the entire procedure (e.g., 15 min)
- Expected dose rate received by the whole body of the individual associated with the shielded source and determined using measured or manufacturer-determined data (e.g., 2 millirem per hour at about 18 inches from the shield)
- Time the hands were exposed to the shielded source (e.g., 6 min)
- Expected dose rate received by the extremities of the individual associated with the shielded source and determined using measured or manufacturer-determined data on contact with the shield (e.g., 15 millirem per hour)

From this information, the manufacturer estimated that the individual performing each routine maintenance activity could receive the following:

- Less than 0.5 millirem, dose to the whole body

<b>Calculation:</b> 15 min X 2 millirem/hour X 1 hour/60 minutes = 0.5 millirem
---

- 1.5 millirem, dose to the hands

<b>Calculation:</b> 6 minutes X 15 millirem/hour X 1 hour/60 minutes = 1.5 millirem
---

The applicable limit (whole body) is 5000 millirem per year and 10% of that value is 500 millirem per year. If one maintenance activity results in 0.5 millirem, then an individual could perform 1000 of these operations each year and remain within 10% of the applicable limit.

The applicable limit for the extremities is 50,000 millirem per year and 10% of that value is 5,000 millirem per year. If one maintenance activity results in 1.5 millirem, then an individual could perform 3,333 of these operations each year and remain within 10% of the applicable limit. Based only on this specific situation, personnel monitoring may not be required.

However, using the same type of analysis, the applicant must also determine the radiation dose that the worker receives from other routine daily activities using of the gauge. Specifically, the evaluation should include the performance of the following:

- Routine radiation surveys
- Required Leak Tests
- Lockout Procedures
- Routine maintenance on equipment in close proximity of the gauge
- Shift tours in the vicinity of the gauge
- Other special maintenance activities authorized by the Radioactive Material License

Applicants who wish to demonstrate that they are not required to provide dosimetry to their workers need to perform prospective evaluations similar to that shown in the example above. The calculated radiation dose for each work activity should then multiplied by the number of times the activity is expected to be performed during the year to determine the total annual radiation dose for the activity. The annual radiation dose for each activity should then be summed to determine the total radiation dose to the individual for the year. The attached Table 1 may be helpful in performing a prospective evaluation.

The expected dose rates, times, and distances used in the above example may not be appropriate to individual licensee situations. In their evaluations, applicants need to use information appropriate to the type(s) of gauge(s) they intend to use; this information is generally available from the gauge manufacturer or the Sealed Source and Device and Device Catalogue maintained by the U.S. Nuclear Regulatory Commission and the Agreement States.

Licensees should review evaluations periodically and revise them as needed. Licensees need to check assumptions used in their evaluations to ensure that they continue to be up-to-date and accurate. For example, if workers become lax in following good radiation safety practices, perform the task more slowly than estimated, work with new gauges containing sources of different activities or radioactive material, or use modified procedures, the licensee would need to conduct a new evaluation.



## Appendix F

### Table 1

## Dosimetry Evaluation

**IDENTIFY WORK ACTIVITIES TO BE EVALUATED:**

- |          |           |
|----------|-----------|
| 1. _____ | 2. _____  |
| 3. _____ | 4. _____  |
| 5. _____ | 6. _____  |
| 7. _____ | 8. _____  |
| 9. _____ | 10. _____ |

**CALCULATIONS:**

**Perform this calculation for each work activity identified above**

Dosimetry Evaluation for _____ (Work Activity)	Model _____	Gauge _____				
A.	Time needed to perform the entire routine work activity.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; text-align: center;">_____</td> <td style="width: 30%; text-align: center;">_____ hour</td> </tr> <tr> <td colspan="2" style="text-align: center;"><small>minutes/60</small></td> </tr> </table>	_____	_____ hour	<small>minutes/60</small>	
_____	_____ hour					
<small>minutes/60</small>						
B.	Expected whole body dose rate received by the individual, determined using exposure rates measured on contact with the gauge while the sealed source is in the shielded position.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; text-align: center;">_____</td> <td style="width: 30%; text-align: center;">_____ millirem/hr</td> </tr> </table>	_____	_____ millirem/hr		
_____	_____ millirem/hr					
C.	Time the hands were exposed to the shielded source.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; text-align: center;">_____</td> <td style="width: 30%; text-align: center;">_____ hour</td> </tr> <tr> <td colspan="2" style="text-align: center;"><small>minutes/60</small></td> </tr> </table>	_____	_____ hour	<small>minutes/60</small>	
_____	_____ hour					
<small>minutes/60</small>						
D.	Expected extremity dose rate received by the individual, determined using measured or manufacturer-provided data for the shielded source at the typical distance from the hands to the shielded source.	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 70%; text-align: center;">_____</td> <td style="width: 30%; text-align: center;">_____ millirem/hr</td> </tr> </table>	_____	_____ millirem/hr		
_____	_____ millirem/hr					

**FORMULA:**

**Whole Body**

( \_\_\_\_\_ # hours in Row A) X ( \_\_\_\_\_ millirem per hour in Row B) = ( \_\_\_\_\_ millirem per routine procedure) X ( \_\_\_\_\_ # of routine maintenance procedures each year) =

**Whole Body Dose for Activity:** \_\_\_\_\_ millirem per year for activity

**Extremity**

( \_\_\_\_\_ # hours in Row C) X ( \_\_\_\_\_ millirem per hr in Row D) = ( \_\_\_\_\_ millirem per routine procedure) X ( \_\_\_\_\_ # of routine maintenance procedures each year) =

**Extremity Dose:** \_\_\_\_\_ millirem per year for activity

**TOTAL ANNUAL DOSE:**

<b>Work Activity</b>	<b>Annual Whole Body Dose</b>	<b>Annual Extremity Dose</b>
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____
8.	_____	_____
9.	_____	_____
10.	_____	_____
<b>Total Annual Dose</b>	_____	_____
	<b>Whole Body</b>	<b>Extremity</b>

**REQUIREMENTS FOR PERSONNEL MONITORING:**

**Annual Whole Body Dose equal to or greater than 500 millirem requires personnel monitoring**

**Annual Extremity Dose equal to or greater than 5000 millirem requires personnel monitoring**

## APPENDIX G

### RADIATION SURVEY PROGRAM

A radiation survey program is required for all Applicants who will possess a radiation survey instrument in accordance with Item 13, "Radiation Detection Instruments". The program shall include provisions for determining the following:

- a. Radiation levels at gauge locations will be determined during gauge installation and at least annually thereafter.
- b. Radiation levels in the permanent and temporary storage areas and the adjacent areas with each storage inventory change or at least annually.
- c. Radiation levels during non-routine maintenance such as installation, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge.
- d. Radiation levels at the work location to verify the source is properly shielded during **gauge lockout procedures**.
- e. Transport Index (TI) when preparing a gauge for transport.
- f. Source integrity following an incident involving the gauge.

A permanent record of all surveys will be maintained for three years following the date on which the record was created. The radiation survey record shall include:

- a. Location, date, and identification of radiation survey instrument used, specifically the serial number and date of last calibration.
- b. Name of individual performing the survey.
- c. Drawing of area surveyed, identifying relevant features such as the gauge storage area, nearest occupied work area, etc.
- d. Measured dose rates (millirem per hour) keyed to locations on the drawing of the area.
- e. Corrective actions taken in the event excessive dose rates are identified during the survey.

An acceptable radiation survey form for an installed gauge is provided in Exhibit B. Documentation of radiation surveys for other gauge configurations (for example, gauge in temporary storage, gauge packaged for transportation, etc.) must follow an equivalent format to that shown in Exhibit B.

## APPENDIX H

### DOSE LIMIT FOR MEMBERS OF THE PUBLIC

#### ANNUAL DOSE DETERMINATION COMPLIANCE STUDY

#### Guidance for Demonstrating That Individual Members of the Public Will Not Receive Doses Exceeding the Allowable Limits

---

##### Introduction

The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1208, requires that fixed 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.

Members of the public include persons who live, work, or may be near locations where fixed gauges are used or stored and employees whose assigned duties do not include the use of licensed radioactive materials and who work in the vicinity where gauges are used or stored.

Typical unrestricted areas may include offices, shops, laboratories, a nearby walkway, an area near the gauge that requires frequent maintenance, areas outside buildings, 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.

**NOTE: The information contained in this Appendix was taken from the U.S. Nuclear Regulatory Commission (NRC) document, NUREG-1556, Volume 4, “Consolidated Guidance About Materials Licenses, Program-Specific Guidance About Fixed Gauge Licenses”. The information is used with permission of the NRC.**

Licensees must show compliance with both portions of the regulation. Calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance. These two methods are discussed in the following paragraphs.

### **Calculational Method**

The calculational method for estimating the dose to members of the public 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:

- Each gauge is a point source of radiation
- Typical radiation levels (millirem per hour; mrem/hr) encountered when the source is in the shielded (off) position are taken from either the U.S. Nuclear Regulatory Commission and Agreement State Sealed Source & Device (SSD) Registration Certificate or the manufacturer's literature, and
- No credit is taken for any shielding found between the gauges and the unrestricted areas.

A summary of the tiered evaluation approach is provided in the following examples:

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

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

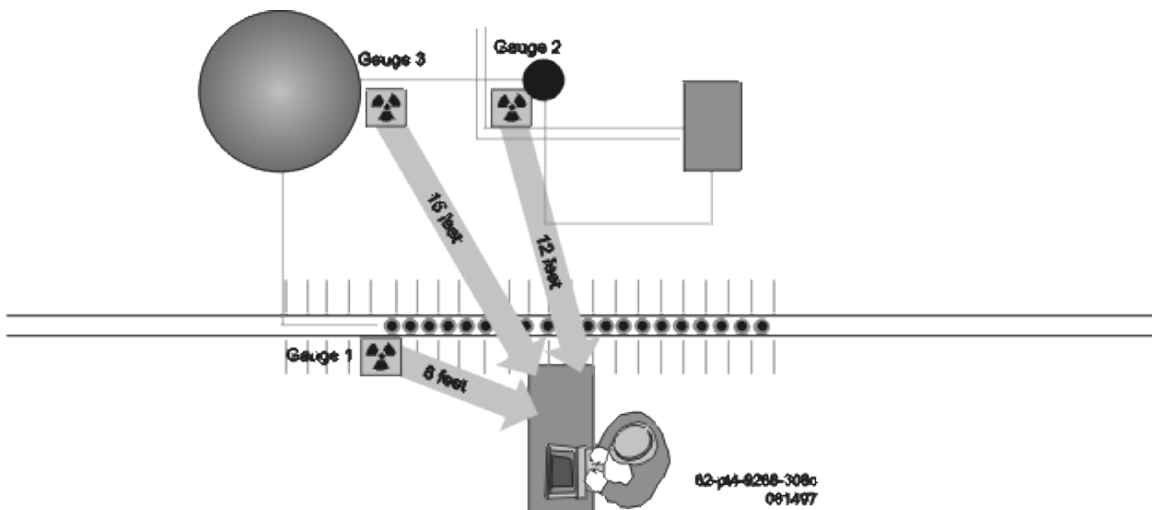
Part 3 considers distance and the portion of time that both the gauge and the affected member of the public are present. Using this approach, licensees make only those calculations that are needed to demonstrate compliance.

In many cases licensees will need to use the calculational method through Part 1 or Part 2. The results of 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, we will look at ABC Bottling, Inc., a fixed gauge licensee. Yesterday, while on a walk-through during product changeover, the company's president noted that three new gauges will be very close to a bottling control panel where a Quality Control Supervisor, a worker who does not work with fixed gauges, works. The company's president asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with the Department's rules and regulations.

Joe measures the distances from each gauge to the bottling control panel and looks up in the manufacturer's literature the radiation levels individuals would encounter for each gauge. Figure I-1 is Joe's sketch of the areas in question, and Table I-1 summarizes the information Joe has determined for each gauge.



**Figure I-1. Drawing of Bottling Line and Fixed Gauges**

**Table I-1. Information Known about Each Gauge**

Description of Known Information	Gauge 1	Gauge 2	Gauge 3
Where gauge is located	Gauge on bottling line	Gauge on main feed line	Gauge on tank
Dose rate in mrem/hr encountered at specified distance from the gauge (from manufacturers literature)	2 mrem/hr at 1 ft	8 mrem/hr at 1 ft	2 mrem/hr at 3 ft
Distance to bottling control panel (feet)	8 ft	12 ft	15 ft

### Example 1: Part 1

Joe's first thought is that the distance between the gauges and the bottling control panel may be sufficient to show compliance with the regulation in RH-1208. So, taking a worst case approach, he assumes:

1. The gauges are constantly present (i.e., 24 hr/d),
2. All three gauges are on (i.e., shutters are open), and,
3. A Quality Control (QC) Supervisor, a worker who does not work with the fixed gauges, is constantly sitting at the control panel (i.e., 24 hr/d).

Joe proceeds to calculate the dose the QC supervisor might receive hourly and yearly from each gauge as shown in Tables I-2, I-3, and I-4, below.

**Table I-2. Calculational Method, Part 1: Hourly and Annual Dose Received from Gauge 1**

Step No.	Description	Gauge 1	
		Input Data	Results
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup> (feet)squared	(1) <sup>2</sup>	1
3	Square of the distance (ft) from the gauge to the bottling control panel in an unrestricted area, in ft <sup>2</sup> (feet)squared	(8) <sup>2</sup>	64
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 1 = 2	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by the worker at the bottling control panel, HOURLY DOSE RECEIVED FROM GAUGE 1, in mrem in an hour.	2/64 = 0.031	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 1, in mrem in a year.	0.031 x 24 x 365 = 0.031 x 8760 = <b>272</b>	

**Table I-3. Calculational Method, Part 1: Hourly and Annual Dose Received from Gauge 2**

		<b>Gauge 2</b>	
<b>Step No.</b>	<b>Description</b>	<b>Input Data</b>	<b>Results</b>
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	8	8
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup> (feet)squared	(1) 2	1
3	Square of the distance (ft) from the gauge to the bottling control panel in an unrestricted area, in ft <sup>2</sup> (feet)squared	(12) 2	144
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	8 x 1 = 8	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received in an hour by the worker at the bottling control panel, <b>HOURLY DOSE RECEIVED FROM GAUGE 2</b> , in mrem in an hour	8/144 = .056	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 2</b> , in <b>mrem in a year</b>	0.056 x 24 x 365 = 0.056 x 8760 = <b>491</b>	

**Table I-4. Calculational Method, Part 1: Hourly and Annual Dose Received from Gauge 3**

		<b>Gauge 3</b>	
<b>Step No.</b>	<b>Description</b>	<b>Input Data</b>	<b>Results</b>
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft <sup>2</sup> (feet)squared	(3)2	9
3	Square of the distance (ft) from the gauge to bottling control panel in an unrestricted area, in ft <sup>2</sup> (feet)squared	(15)2	225
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result)	2 x 9 = 18	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received by the worker at the bottling control panel, <b>HOURLY DOSE RECEIVED FROM GAUGE 3</b> , in mrem in an hour	18/225 = 0.08	
6	Multiply the result of Step 5 by 24 hr/d x 365 d/yr = <b>MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 3</b> , in <b>mrem in a year</b>	0.08 x 24 x 365 = 0.08 x 8760 = <b>701</b>	



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

**Table I-5. Calculational Method, Part 1: Total Hourly and Annual Dose Received from Gauges 1, 2, and 3**

Step No.	Description	Gauge 1	Gauge 2	Gauge 3	Sum
7	<b>TOTAL HOURLY DOSE RECEIVED</b> from Step 5 of Tables K-2, K-3, and K-4, in mrem in an hour	0.031	0.056	0.08	$0.031 + 0.056 + 0.08 = \mathbf{0.167}$
8	<b>TOTAL ANNUAL DOSE RECEIVED</b> from Step 6 of Tables K-2, K-3, and K-4, in mrem in a year	272	491	701	$272 + 491 + 701 = \mathbf{1464}$

**Note: The Sum in Step 7 demonstrates compliance with the 2 mrem in any one hour limit. Reevaluate if assumptions change. If the Sum in Step 8 exceeds 100 millirem in a year, 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 0.167 mrem (less than 2 millirem), but notes that **an individual could receive a dose of 1,464 mrem in a year, much higher than the 100 mrem limit.**

**Example 1: Part 2**

Joe reviews his assumptions and recognizes that the QC supervisor is not at the bottling control panel 24 hr/d. He decides to make a realistic estimate of the number of hours the QC supervisor would be present at the bottling control panel, keeping his other assumptions constant (i.e., the gauges are constantly present (i.e., 24 hr/d), all three gauges remain on (i.e., shutter is open). He then recalculates the annual dose received.

**Table I-6. Calculational Method, Part 2: Annual Dose Received from Gauges 1, 2, and 3**

Step No.	Description	Results
9	A. Average number of hours per day that individual spends in area of concern (e.g., worker present at bottling control panel 5 hr/day; the remainder of the day the worker is away from the area performing other duties that are not in the vicinity of gauges)	5
	B. Average number of days per week in area (e.g., worker is part time and works 3 days/week)	3
	C. Average number of weeks per year in area (e.g., worker works all year )	52
10	Multiply the results of Step 9.A. by the results of Step 9.B. by the results of	$5 \times 3 \times 52$

	Step 9.C. = <b>AVERAGE NUMBER OF HOURS IN AREA OF CONCERN PER YEAR</b>	= <b>780</b>
11	Multiply the sum in Step 7 by the results of Step 10 = <b>ANNUAL DOSE RECEIVED FROM GAUGES CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN</b> , in mrem in a year	0.167 x 780 = <b>130</b>
<i>Note:</i> If Step 11 exceeds 100 mrem 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 Gauge 3 will only be used on the process line during product changeovers and Gauge 2 has different radiation levels depending on whether the gauge is in the on or off position (i.e., shutter is open or closed). As he examines the situation, he realizes he must consider each gauge individually.

**Table I-7. Calculational Method, Part 3: Summary of Information**

<p><b>INFORMATION ON GAUGES:</b></p> <p><b>Gauge 1:</b> Operates continuously (24 hrs/day) on the bottling line.</p> <p><b>Gauge 2:</b> Operates (in the "on" position) while the tank is being filled, approximately 1 hour during the time the worker is present. When the pipe is not filling the tank, the gauge is in the "off" position. While in the "off" position, the radiation level around the gauge drops to 2 mrem/hr at 1ft, one-fourth of the radiation level as when the gauge is in the "on" position.</p> <p><b>Gauge 3:</b> Only used on the process line during product changeovers, 4 weeks per year. While affixed, it operates continuously (24 hrs/day).</p> <p><b>INFORMATION FROM EXAMPLE 1, PART 2, ON WHEN THE WORKER IS PRESENT AT THE BOTTLING CONTROL PANEL:</b></p> <ul style="list-style-type: none"> <li>• 5 hours per day</li> <li>• 3 days per week</li> <li>• 52 weeks per year</li> </ul>
--

**Table I-8. Calculational Method, Part 3: Annual Dose Received from Gauges 1, 2, and 3**

Step No.	Description	Gauge 1	Gauge 2 "On"	Gauge 2 "Off"	Gauge 3
12	Average number of hours per day gauge operates when worker is present at the bottling control panel	5	1	4	5
13	Average number of days per week gauge operates when worker is present at the bottling control panel	3	3	3	3
14	Average number of weeks per year gauge operates when worker is present at the bottling control panel	52	52	52	4
15	Multiply the results of Step 12 by the results of Step 13 by the results of Step 14 = TOTAL HOURS EACH GAUGE OPERATED PER YEAR WHILE WORKER IS PRESENT AT BOTTLING CONTROL PANEL	$5 \times 3 \times 52 = 780$	$1 \times 3 \times 52 = 156$	$4 \times 3 \times 52 = 624$	$5 \times 3 \times 4 = 60$
16	Multiply the results of Step 15 by the results of Step 7 (for Gauge 2 in the "off" position, the radiation level drops to 1/4th, so divide the results of Step 7 by 4) = ANNUAL DOSE RECEIVED FROM EACH GAUGE, in mrem in a year	$780 \times 0.031 = 24$	$156 \times 0.056 = 8.7$	$624 \times (0.056/4) = 8.7$	$60 \times 0.08 = 4.8$ in mrem in a year
17	Sum the results of Step 16 for each gauge = <b>TOTAL ANNUAL DOSE RECEIVED CONSIDERING REALISTIC ESTIMATE OF TIME SPENT IN AREA OF CONCERN AND TIME GAUGE OPERATES, in mrem in a year</b>	$24 + 8.7 + 8.7 + 4.8 = 46.2$			
Note: If the result in Step 17 is greater than 100 mrem/yr, the licensee must take corrective actions.					

Joe is pleased that the result in **Step 17 shows compliance with the 100 mrem in a year limit**. If the result in Step 17 been higher than 100 mrem/yr, then Joe could have done one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each gauge operates are accurate, revise the assumptions as needed, and recalculate using the new assumptions
- Calculate the effect of any shielding located between the gauges and the bottling control panel -- such calculation is beyond the scope of this Appendix
- Take corrective action (e.g., add shielding, move the bottling control panel) and perform new calculations to demonstrate compliance
- Train the QC supervisor as a Radiation Worker

Note that in the example, Joe evaluated the unrestricted area at the bottling control panel. 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., adding a gauge to the process line, changing the QC supervisor's schedule, or changing the estimate of the portion of time spent at the bottling control panel) and to perform additional evaluations, as needed.

**NOTE: RECORD KEEPING. Paragraph 1500.g.1 requires licensees to maintain records demonstrating compliance with the dose limits to members of the public.**

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

This method, which allows the licensee to take credit for shielding between the gauge 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 gauge. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. A maximum dose of 100 millirem received by an individual over a period of 2080 hours (i.e., a work year of 40 hr/wk for 52 wk/yr) is equal to less than 0.05 millirem per hour.

**NOTE: 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 Thermoluminescent Dosimeters (TLD). TLDs used for personnel monitoring (e.g., Lithium Fluoride) may not have sufficient sensitivity for this purpose. Generally, the minimum reportable dose received is 10 millirem. 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, a value in excess of the 100 millirem in a year 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 Calcium Fluoride (CaF<sub>2</sub>) that are used for environmental 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 millirem in a year limit.

## Example 2

As in Example 1, Joe is the RSO for ABC Bottling, Inc., a fixed gauge licensee. The company has three gauges located near a bottling control panel which is operated by a worker who does not work with the fixed gauges. See Figure I-1 and Table I-1 for information. Joe wants to see if the company complies with the public dose limits at the bottling control panel.

Joe placed an environmental TLD badge at the bottling control panel for 30 days. The TLD processor sent Joe a report indicating the TLD received 100 mrem.

**Table I-9. Combination Measurement - Calculational Method**

Step No.	Description	Input Data and Results
<b>Part 1</b>		
1	Dose received by TLD, in mrem	100
2	Total hours TLD exposed	24 hr/d x 30 d/mo = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED, in mrem 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 = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGES, in mrem in a year	365 x 24 x 0.14 = 8760 x 0.14 = <b>1226</b>
<p>Note: For the conditions described above, Step 3 indicates that the <b>dose received in any one hour is less than the 2 mrem in any one hour limit</b>. 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 <b>annual dose received would be much greater than the 100 mrem in a year allowed by the regulations</b>.</p>		
<b>Part 2</b>		
<p>At this point Joe can adjust for a realistic estimate of the time the worker spends at the bottling control panel as he did in Part 2 of Example 1.</p>		
<b>Part 3</b>		
<p>If the results of Joe's evaluation in Part 2 show that the annual dose received in a year exceeds 100 mrem, then he can make adjustments for realistic estimates of the time spent in the area of concern as in Part 3 of Example 1. (Recall that the TLD measurement was made while all the gauges were operating; i.e., 24 hr/d for the 30 days that the TLD was in place.)</p>		

## APPENDIX I

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

To insure that gauges 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 will be monitored for external radiation levels as soon as practical after receipt of the package, but not later than three (3) hours after the package is received at the licensee's facility if it is received during the normal working hours, or not later than three (3) hours from the beginning of the next working day if it is received after working hours.

Action limits for package monitoring will be as follows:

### RADIOACTIVE MATERIAL PACKAGES LABEL CRITERIA

#### DOSE RATE LIMITS

LABEL	AT ANY POINT ON ACCESSIBLE SURFACE OF PACKAGE	AT THREE FEET FROM EXTERNAL SURFACE OF PACKAGE
"RADIOACTIVE-WHITE I"	0.5 mR/hr	0
"RADIOACTIVE-YELLOW II"	50 mR/hr	1.00 mR/hr
"RADIOACTIVE-YELLOW III"	200 mR/hr	10 mR/hr

- 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 gauge or make arrangements to have the gauge surveyed to determine the presence and extent of any shielding failure or radioactive contamination. **If damage is noted, the gauge will immediately be leak tested and placed in a secure storage area. The gauge will not be used until it has been repaired and approved for use by the manufacturer.** The RSO will notify the Arkansas Department of Health 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. Gauges 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. Gauges will be prepared for shipment only by personnel that have completed hazmat employee training specified in the U.S. Department of Transportation, 49 CFR Part 172, Subpart H.

## APPENDIX J

### 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., gauges containing radioactive material will only be transferred to 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: \_\_\_\_\_

- Gauge containing the sealed source will be returned to manufacturer using these procedures

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

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

- Gauge containing the sealed source will be disposed of using equivalent procedures, which are attached.

#### II. Verification

If a gauge 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 (gauge 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 gauge.

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

#### IV. Notification

The Arkansas Department of Health should be notified of the disposal of gauges containing radioactive material as soon as practical following the transfer.



## APPENDIX K

### TRANSPORTATION OF GAUGES

The U.S. Department Of Transportation establishes requirements for the transportation of radioactive material. Licensees are responsible for ensuring that their gauges are properly packaged, marked, labeled, and secured, and that proper documentation accompanies the gauges.

#### 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)
- ◆ Identification number (ex.: UN 2974)
- ◆ Package type (ex.: TYPE A)
- ◆ RQ (if applicable)

#### 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**

Warning Label	Max. Rad. Level at Package Surface (mR/hr)	Max. Rad. Level at 1 m (TI)
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 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** **MOST COMMON PROCEDURE FOR FIXED GAUGE LICENSEES** (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.** Shipping papers and ERI will be immediately accessible to the driver during transport of gauges.

### D. Inspection

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 RSO prior to shipment or use. The RSO will label and remove from use any gauge or package found to be defective and ensure their repair or replacement.

## APPENDIX L

### OPERATING PROCEDURES

The following Operating Procedures will be used by all Authorized Users who use or supervise the use of the fixed gauge(s). Any deviations from these Operating Procedures must be approved by the Radiation Safety Officer.

#### Preparation for Work

- If a personnel monitoring badge is provided:
  - Always wear your assigned thermoluminescent dosimeter (TLD) or film badge when using the gauge.
  - Never wear another person's TLD or film badge.
  - Never store your TLD or film badge near the gauge.

#### Using the Gauge

- Use the gauge according to the manufacturer's or distributors instructions and recommendations. Perform routine cleaning and maintenance according to the manufacturer's or distributors instructions and recommendations.
- Test each gauge for the proper operation of the on-off mechanism (shutter) and indicator, if any, at intervals not to exceed 6 months or as specified in the SSD certificate.
- Do not touch the unshielded source with your fingers, hands, or any part of your body.
- Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded source.
- Post a radiation warning sign at each entryway to an area where it is possible to be exposed to the beam.
- Prevent employees from entering the radiation beam during maintenance, repairs, or work in, on, or around the bin, tank, or hopper on which the device is mounted by using the attached **Gauge Lockout Procedures**. These procedures specify who will be responsible for ensuring that the lock-out procedures are followed.
- Prevent unauthorized access, removal, or use of the gauge.
- After making changes affecting the gauge (e.g., changing the location of gauges , removing shielding, adding gauges, changing the occupancy of adjacent areas, ), reevaluate compliance with public dose limits and ensure proper security of gauges.

### **Maintaining the Gauge(s)**

1. Personnel monitoring badges, if applicable, will always be worn when cleaning or maintaining the gauge.
2. Routine cleaning and maintenance of the gauge will be performed in accordance with the manufacturer's instructions and recommendations.
3. No maintenance will be performed on the gauge that includes removing the radioactive source from the gauge. Any maintenance that is not included in the manufacturer's instructions and recommendations will be performed by the manufacturer or by another person who is specifically licensed to perform the maintenance.
4. Non-routine maintenance such as installation, initial radiation surveys, relocation, removal from service, dismantling, alignment, replacement, disposal of the sealed source, and non-routine maintenance and repair of components related to the radiological safety of the gauge, is performed using the attached **Non-Routine Maintenance Procedures**.
5. A Quarterly Inventory of all gauges will be performed by the Radiation Safety Officer or their designee. Records of the inventory will be maintained by the Radiation Safety Officer.
5. Leak testing of the radioactive sources will be performed and documented as specified in the Radioactive Material License using the **Gauge Leak Test Procedures**, which are attached. Gauges that do not have a current leak test will not be used.

## APPENDIX M

### LOCKOUT PROCEDURES

#### I. Scope and Purpose

This procedure establishes the minimum requirements for the lockout of fixed nuclear gauges when maintenance or servicing is performed on or near gauges such that workers could be exposed to the gauge's primary radiation beam or scattered radiation.

This procedure shall be used to ensure that gauges are properly locked out and/or tagged out before personnel perform any work where operating gauges could cause unnecessary radiation exposures.

As used in this procedure, "lockout/tag-out" refers to methods used to safeguard workers from exposure to radiation emitted by radioactive sources contained in fixed gauges installed on process equipment. Lockout devices provide protection by serving as positive restraints that no one can remove without a key or other unlocking mechanism, or through extraordinary means, such as bolt cutters. Tag-out devices, by contrast, are prominent warning devices used to warn workers not to open a gauge shutter or otherwise expose a gauge source while the service or maintenance activity is being performed. Tag-out devices are easier to remove and, by themselves, provide workers with less protection than do lockout devices.

All workers are required to comply with the restrictions and limitations imposed upon them when conditions require gauge lockout/tag-out.

#### II. Conditions Requiring Lockout

A gauge source holder will be locked out by locking the on/off or shutter mechanism into a safe position – the "off" or closed position:

- Prior to any work being performed in the immediate vicinity of a gauge radiation beam when a distance or gap exists between a gauge's radioactive source and the radiation detector that permits entry of all or a portion of a person's body into the primary radiation beam;
- During any manipulation of a gauge, including the source holder or the detector, which involves physical movement of the device or separation from a pipe, vessel, etc. including installation, relocation or storage;
- When individuals are working on or adjacent to a gauge during periods of shutdown;
- Whenever an individual enters a vessel in which such a gauge is located; and
- Whenever a vessel with such a gauge is empty and an individual is working around the exterior of the vessel.

### **III. Lockout/Tag-out Specifications**

Tag-out devices will consist of a durable tag and a means of attachment that can be securely fastened to the gauge to indicate that the gauge may not be operated until the tag-out device is removed.

Tag-out devices will be substantial enough to prevent inadvertent or accidental removal, and able to withstand the ambient environment for the maximum period of time that exposure is expected.

Tag-out devices will warn against hazardous conditions if the gauge is operated and must include a legend such as **Do Not Open** or **Do Not Operate**. Tags shall be legible and understandable to all personnel who may be in the area.

Lockout and/or tag-out devices will indicate the identity of the individual applying the device(s). Lockout and/or tag-out devices will be standardized in at least one of the following criteria: color; shape; or size, and the print and format of tag-out devices.

### **IV. Lockout/Tag-out Sequence**

Only the Radiation Safety Officer (RSO) and fixed gauge users designated by the RSO are authorized to lockout/tag-out a gauge. All workers, upon observing a gauge that is locked and/or tagged, shall not attempt to operate the gauge or remove the lock and/or tag.

1. When work is required on or near a gauge, notify all affected personnel that the gauge shutter must be closed, locked-out, and tagged prior to initiating the work.
2. The RSO or another authorized fixed gauge user will lockout/tag-out the gauge in accordance with manufacturer recommendations, using lockout/tag-out devices meeting the specifications described in this procedure.
3. When locking out a gauge, the on/off or shutter mechanism will be tagged to indicate that the gauge is locked out. If a gauge is incapable of being locked out, a tag-out device must still be used.
4. The RSO or fixed gauge users designated by the RSO will verify that the gauge has been effectively locked out. Radiation surveys are required to verify gauge lockout. The surveys may be performed by using a radiation survey meter or, as appropriate, by using the gauge's radiation detector.
5. A warning sign will be posted at each entryway to areas where it is possible to be exposed to the primary radiation beam from the gauge. Such warning signs will include safety instructions (e.g., "Contact the Radiation Safety Officer Before Entering Vessel").

# APPENDIX N

## EMERGENCY PROCEDURES

Damage to a gauge from an accident or emergency event (fire, explosion, mechanical damage, tornado) could lead to a gauge shutter mechanism that cannot be closed or an exposed radiation source. These events could result in elevated radiation dose rates in the vicinity of the damaged gauge. Specific emergency procedures must be implemented to properly manage the event and minimize personnel radiation exposure.

### EMERGENCY PROCEDURE FOR ALL EMPLOYEES

If the gauge becomes damaged or if any other emergency or unusual situation arises:

- **STOP USE** of the gauge.
- **SECURE THE AREA** and keep people away from the gauge until the situation is assessed and radiation levels are known. However, perform first aid for any injured individuals and remove them from the area only when medically safe to do so.
- **ISOLATE EQUIPMENT** until it is determined there is no contamination present.
- **REMAIN AT THE SCENE** in a safe location. Gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.
- **NOTIFY** the persons in the order listed below of the situation:

NAME	WORK NUMBER	PHONE HOME NUMBER	PHONE
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

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, gauge manufacturer) to be contacted in case of emergency.

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

**NOTE: DO NOT HANDLE UNSHIELDED SOURCES OF RADIOACTIVE MATERIAL**

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

- Arrange for a radiation survey to be conducted as soon as possible by a knowledgeable person using appropriate radiation detection instrumentation. This person could be a licensee employee using a survey meter or a consultant. To accurately assess the radiation danger, it is essential that the person performing the survey be competent in the use of the survey meter.
- Make necessary notifications to local authorities as well as the **Arkansas Department of Health, 1-800-633-1735 or 1-501-661-2136** (staffed 24 hours a day). Immediate **Department** notification is required when gauges containing radioactive material are lost or stolen, when gauges are damaged or involved in incidents.
- 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.**
- Recovery operations and decontamination must only be attempted by properly trained and licensed individuals.

**Note: In the event of a transportation accident involving radioactive material, both the Arkansas Department of Health and the Arkansas State Police must be notified. Department of Transportation should be notified in accordance with 49 CFR § 171.15.**



## APPENDIX O

### 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:

<http://www.healthy.arkansas.gov/aboutADH/RulesRegs/IonizingRadiation.pdf>

Indicate that the referenced paragraphs have been read and are understood, and will be complied with by initialing 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 N, Paragraphs RH-2801 through RH-2808, “Notices, Instructions and Reports to Workers; Inspections”.

**EXHIBIT A**  
**EXAMPLE INVENTORY FORM**

**Company:** \_\_\_\_\_ **Radioactive Materials License No.** \_\_\_\_\_

**Date of Inventory:** \_\_\_\_\_ **Radiation Safety Officer Signature:** \_\_\_\_\_

Number	GAUGE MANUFACTURER & MODEL	GAUGE SERIAL NO.	SOURCE MANUFACTURER & MODEL	SOURCE SERIAL NO.	SOURCE TYPE & EST. ACTIVITY	LOCATION	CONDITION

**Notes:** Listing "Use" in the CONDITION means Active Use; "In Storage" means a source held in secured storage with no use anticipated prior to transfer/disposal.

**EXHIBIT B**  
**FIXED GAUGE SURVEY FORM**

**Gauge Location:** \_\_\_\_\_

**Gauge Manufacturer and Model No.:** \_\_\_\_\_

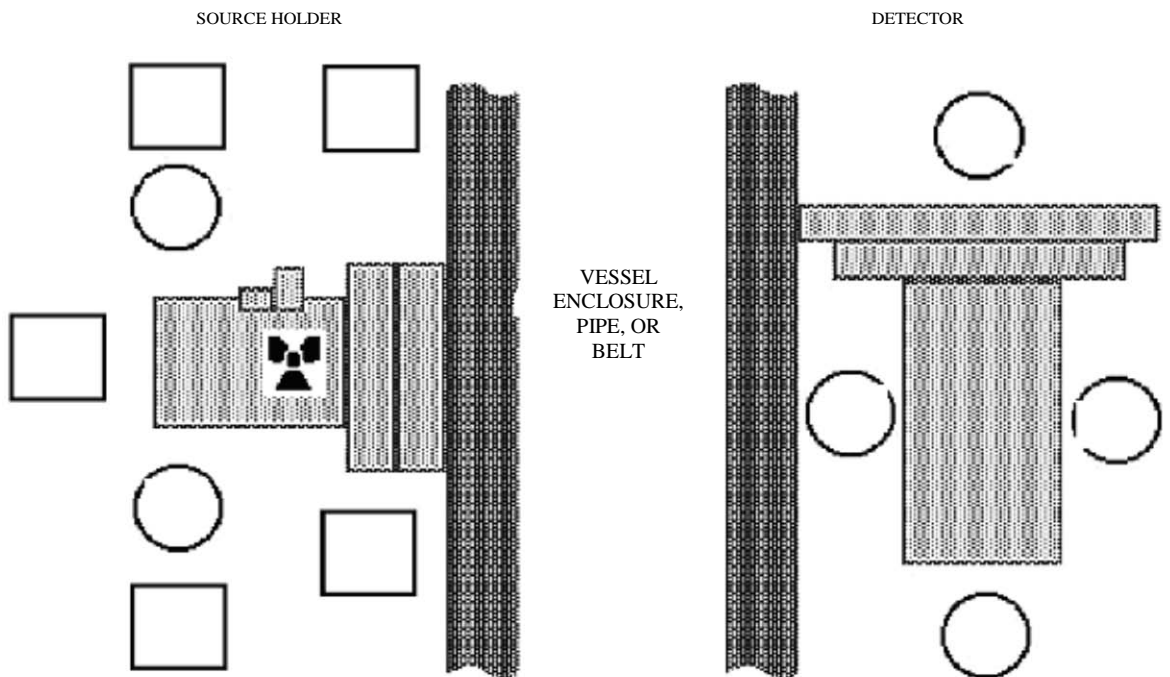
**Gauge Serial No.:** \_\_\_\_\_

**Source Manufacturer and Model No.:** \_\_\_\_\_

**Source Serial No.:** \_\_\_\_\_ **Source Isotope and Activity:** \_\_\_\_\_

**Radiation Survey Meter Manufacturer and Model No.:** \_\_\_\_\_

**Radiation Survey Meter Calibration Date:** \_\_\_\_\_



- Surface- millirem/hr
- 12 inches - millirem/hr

Background: \_\_\_\_\_ millirem/hr

**Corrective Actions Taken (If required):** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Survey Performed By:** \_\_\_\_\_

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

**EXHIBIT C-1**

**EXAMPLE SHIPPING PAPER-EXCLUSIVE USE SHIPMENTS**

**BILL OF LADING**

**Shipper:** \_\_\_\_\_ **Date:** \_\_\_\_\_

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

**Phone No.:** \_\_\_\_\_

**RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM**

**RQ, HAZARD CLASS 7, UN 3332**

**Package contains:** Cs-137 \_\_\_\_\_ GBq ( \_\_\_\_\_ mCi)

**RADIOACTIVE YELLOW II Label**

**Transport Index (TI)** \_\_\_\_\_

**24 HOUR EMERGENCY RESPONSE INFORMATION**

**TELEPHONE NUMBER ( )** \_\_\_\_\_

**EXHIBIT C-2**

**EXAMPLE SHIPPING PAPER-COMMON CARRIER SHIPMENTS**

**BILL OF LADING**

**Shipper:** \_\_\_\_\_ **Date:** \_\_\_\_\_

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

\_\_\_\_\_

\_\_\_\_\_

**Phone No.:** \_\_\_\_\_

**RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM**

**RQ, HAZARD CLASS 7, UN 3332**

**Package contains:** Cs-137 \_\_\_\_\_ GBq ( \_\_\_\_\_ mCi)

**RADIOACTIVE YELLOW II Label**

**Transport Index (TI)** \_\_\_\_\_

**24 HOUR EMERGENCY RESPONSE INFORMATION**

**TELEPHONE NUMBER ( )** \_\_\_\_\_

**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 Department of Transportation.**

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

**(Signature)**

**EXHIBIT D**  
**EMERGENCY RESPONSE INFORMATION**

**POTENTIAL HAZARDS**

**1. IMMEDIATE HAZARDS TO HEALTH**

- External radiation hazard from unshielded radioactive material.
- Low-level radioactive material; little personal radiation hazard when shielded.
- Materials in special form are not expected to cause contamination in accidents.
- Some radioactive materials cannot be detected by commonly available instruments.
- Potential internal radiation hazard from inhalation, ingestion, or breaks in skin, only if special form capsule is breached.

**2. FIRE OR EXPLOSION**

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

**EMERGENCY PROCEDURES**

**3. IMMEDIATE PRECAUTIONS**

- Isolate hazard area to within a 10-15 foot radius of the gauge and restrict access.
- Emergency response actions may be performed prior to any measurement of radiation; limit entry to shortest time possible.
- Notify local authorities and Radiation Safety Officer of accident conditions.
- Detain uninjured persons, isolate equipment with suspected contamination, and delay cleanup until receiving instruction from Radiation Safety Officer.
- Maintain surveillance
- Remain at scene in safe location

**4. FIRE**

- Do not move damaged containers; move undamaged containers out of fire zone.
- Small Fires: Dry Chemical, CO2, water spray, or regular foam.
- Large Fires: 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 as a result 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 low-level radioactive material.
- Except for the injured, detain persons exposed to radioactive material until arrival or instruction of Radiation Control Authority.

**CALL THE FOLLOWING FOR EMERGENCY ASSISTANCE:**

**RADIATION SAFETY OFFICER:** \_\_\_\_\_

**RSO TELEPHONE NUMBER(S):**

- LOCAL AUTHORITIES:** .....911 or local police, sheriff, or fire department
- ARKANSAS DEPARTMENT OF HEALTH.....(800) 633-1735**
- U.S. DEPT. OF TRANSPORTATION.....(800) 424-8802**
- GAUGE MANUFACTURER.....**\_\_\_\_\_
- GAUGE MANUFACTURER.....**\_\_\_\_\_
- GAUGE MANUFACTURER.....**\_\_\_\_\_

# EXHIBIT E

## 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 annual review must be available for inspection by the Arkansas Department of Health.

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. 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. Does the license authorize all sources and devices possessed? .....Yes No
- D. Do all temporary job sites meet regulatory definition.....Yes No
- E. If no to A., has the Department been notified? .....Yes No
- F. If the RSO has changed, has the license been amended to identify the new RSO? .....N/A Yes No
- G. Is the RSO meeting the duties and responsibilities for the position? .....Yes No
- H. Is company management appropriately involved with the radiation protection program and oversight of the RSO’s activities? .....Yes No
- I. Does RSO have sufficient time to perform all duties/responsibilities?.....Yes No
- J. Staffing sufficient to support to Radiation Protection Program?.....Yes No

**4. DOSE LIMITS FOR MEMBERS OF PUBLIC**

- A. Has a “members of the public” dose study been developed, submitted and approved by the Department? .....Yes No
- B. Have licensed activities changed during the year to increase likelihood of public dose limits being exceeded? .....Yes No
- C. If yes to B., has a new dose study been performed to demonstrate that compliance with dose limits is still being achieved?.....N/A Yes No

**5. TRAINING PROGRAM**

- A. All workers receive radiation awareness training? .....Yes No
- B. All gauge Authorized Users completed Department approved training ?.....Yes No
- C. Hazmat employee training and driver training provided to workers per 49 CFR Parts 172 and 177? .....Yes No

**6. PERSONNEL MONITORING**

**A. If Personnel Monitoring is conducted:**

- 1. Personnel monitoring badges worn properly and protected from heat, light and moisture when not being worn? .....Yes No
- 2. Personnel monitoring badges consistently stored with the control badge in a protected location when not in use?.....Yes No



3. Are badges exchanged in a timely fashion to ensure accurate dosimetry reports?.....Yes No
4. Any badges lost or damaged? .....Yes No
5. If yes to 4., was RSO immediately notified and record of worker's estimated dose provided to badge vendor and kept on file? .....Yes No
6. Any spare badges assigned to workers? .....Yes No
7. If yes to 6., were spare badges marked to identify worker it was assigned to, and vendor notified to add spare badge dose to worker's occupational exposure total?.....Yes No
8. Are dosimetry reports reviewed by the RSO upon receipt?.....Yes No
9. Are personnel monitoring records maintained on Department-issued or equivalent forms?.....Yes No
  - (a) Form Z "Cumulative Occupational Exposure History" completed for each monitored worker? .....Yes No
  - (b) Form Y "Occupational Exposure Record for a Monitoring Period" completed for each monitored worker? .....Yes No
10. For workers with declared pregnancies, records kept demonstrating embryo/fetus dose less than 500 mrem for gestation period?.....N/A Yes No
11. Annual and termination reports provided to workers? ..... Yes No
12. Personnel monitoring records reviewed from (*dates*): \_\_\_\_\_ to \_\_\_\_\_
13. Highest annual dose: \_\_\_\_\_mR Date: \_\_\_\_\_
14. Occupational exposures within limits? ..... Yes No
15. Do personnel monitoring records indicate that worker doses are ALARA? .... Yes No

**B. If Personnel Monitoring is not conducted:**

1. Has a dose study been performed and documented to confirm that personnel monitoring is not required?.....Yes No
2. Have licensed activities changed during the year to increase workers' radiation exposures (i.e., expanded work load)? .....Yes No
3. If yes to 2., has a new evaluation been performed to demonstrate workers' doses are likely to remain  $\leq 500$  mrem/yr?.....Yes No

**7. POSTING AND LABELING**

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

1. Emergency procedures .....Yes No
2. Department Form RH-11 ("Notice to Employees").....Yes No
3. Other documents listed in Paragraph RH-2802 unless other posted notice identifies where documents can be viewed.....Yes No

- B. Above documents posted in conspicuous location(s) to permit workers to observe them on way to/from work? .....Yes No
- C. Radiation signs:
  - 1. “Caution (or Danger), Radioactive Material” signs posted at permanent facility and where gauges are stored [unless documentation kept describing eligibility for exception]? .....Yes No
  - 2. “Caution (or Danger), Radiation Area” signs: Is manufacturers’ information kept on file to demonstrate that gauge radiation levels are too low to require posting of radiation area signs around gauge storage areas?.....Yes No
- D. Gauges bear durable, clearly visible labels w/ radiation symbol, “Caution (or Danger), Radioactive Material” warning, and sufficient information to permit individuals to avoid/minimize exposures? .....Yes No

**8. SECURITY**

- A. When not installed is each gauge provided a storage/transport container equipped with lock? .....Yes No
- B. Gauges kept secured against unauthorized access/removal when not installed? ..... Yes No

**9. OPERATING AND EMERGENCY (O&E) PROCEDURES**

- A. Any revisions to O and E procedures made that have not been reviewed and approved by the Department? .....Yes No
- B. O and E procedures list correct phone numbers for RSO and the Department? .... Yes No
- C. O and E procedures accompany portable gauges at all times?.....Yes No

**10. GAUGE TRANSPORTATION**

- A. Only DOT-authorized packages used to transport gauges? .....Yes No
- B. Packages used to ship gauges properly marked and labeled per 49 CFR Part 172, Subparts D and E? .....Yes No
- C. Prior to shipment, transport containers inspected to ensure proper packaging, unimpaired physical condition of container and closure devices? .....Yes No
- D. Properly completed bill of lading and emergency response information provided for each gauge shipment? .....Yes No

**11. GENERAL RULES OF USE**

- A. Management and RSO emphasize to workers importance of maintaining doses ALARA? .....Yes No
- B. Observations of workers conducted to evaluate performance?.....Yes No
- C. Good work practices used by workers to minimize doses (i.e., time, distance, shielding, general use rules)?.....Yes No

**12. LEAK TESTS**

- A. Gauge sealed sources leak tested at required intervals?.....Yes No
- B. Leak tests conducted by authorized personnel following procedures approved by the Department? .....Yes No
- C. Leak test records include all information required by Paragraph RH-1212? .....Yes No
- D. Any sources found leaking, and, if so, was the Department notified?.....Yes No

**13. GAUGE INVENTORY**

- A. Gauge receipt and transfer/disposal records maintained? .....Yes No
- B. Gauges physically inventoried at quarterly intervals?.....Yes No
- C. Gauge inventory records document all necessary information?.....Yes No

**14. GAUGE MAINTENANCE**

- A. Copies of the manufacturer's operation/maintenance manuals maintained on file for reference? .....Yes No
- B. Manufacturer's procedures referenced and followed for routine cleaning and lubrication of gauges?.....Yes No
- C. Non-routine gauge maintenance performed in-house? .....Yes No
- D. If yes to C., is non-routine gauge maintenance conducted by authorized personnel following procedures approved by the Department?.....Yes No

**15. RADIATION SURVEY INSTRUMENTS**

- A. Has the meter been approved by the Department?.....Yes No
- B. Is there access to an equivalent back-up meter when the primary meter is out for calibration/repair?.....Yes No
- C. Is the meter calibrated annually and after repair by a licensed vendor, and are calibration records maintained?.....Yes No

**16. RADIATION SURVEY INSTRUMENTS**

- A. Annual surveys of installed gauges.....Yes No
- B. Survey of storage locations.....N/A Yes No
- C. Lock out surveys .....N/A Yes No
- D. Non-routine maintenance surveys .....N/A Yes No
- E. Receipt/shipping surveys.....N/A Yes No
- F. Survey at installation/relocation .....N/A Yes No
- G. Survey of gauge involved in an incident .....N/A Yes No

**17. RECORD KEEPING, NOTIFICATIONS & REPORTS**

- A. All required documents maintained on file at permanent facility for duration? .....Yes No
- B. Did any incidents/emergencies occur since last review? ..... Yes No
- C. If yes to B., was the response appropriate? (i.e., operator followed emergency procedures, required notifications/reports timely filed, cause of incident investigated, corrective actions taken & documented?..... Yes No

**18. INDEPENDENT AUDITS/INSPECTIONS**

- A. Any independent audits/inspections conducted since last internal audit (e.g, consultant or Department inspection)? .....Yes No
- B. If yes to A., summary of deficiencies identified and corrective actions \_\_\_\_\_

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**19. REVIEW DEFICIENCIES AND CORRECTIVE ACTIONS**

- A. Summary of problems/deficiencies identified during this review \_\_\_\_\_

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**B. Description of corrective actions planned or taken:** \_\_\_\_\_

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**C. Description of other recommendations for improvement:** \_\_\_\_\_

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