

**ARKANSAS DEPARTMENT OF
HEALTH**

**RADIATION CONTROL SECTION
RADIOACTIVE MATERIALS PROGRAM**

LICENSING GUIDE

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

April 1, 2004

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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 portable moisture/density gauges or other portable devices. It also describes the Department of Health and Human Services' criteria for evaluating a portable device license application. The phrases "portable 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 portable 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.

NOTE:	The Licensing Guide for Portable Gauging Devices is not a regulation. It serves only as guidance to assist the Applicant in completing an Application for Radioactive Material License.
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B. AGREEMENT STATE

Arkansas is an Agreement State with the U.S. Nuclear Regulatory Commission (NRC). This Agreement authorizes the State of Arkansas to assume regulatory authority over most activities involving radioactive material within the state. The exceptions are nuclear power plants and federally controlled facilities, which remain under NRC jurisdiction. The Arkansas Department of Health and Human Services (Department), Division of Health, Radiation Control Section, Radioactive Materials Program, regulates the possession and use of radioactive material within Arkansas.

Under authority of the Arkansas State Board of Health's, Rules and Regulations for Control of Sources of Ionizing Radiation, the Department issues licenses to users of radioactive material and performs inspections to ensure compliance with the regulations.

C. MANAGEMENT RESPONSIBILITY

The Department recognizes that effective implementation and management of the radiation safety program is mandatory for achieving a safe program that 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 portable devices and should be used in conjunction with these instructions:

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

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

Portable 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 by writing the Superintendent of Documents, U.S. Government Printing Office, P.O. Box 371954, Pittsburg, PA 15250-1954. The web site for U.S. Department of Transportation is www.dot.gov.

E. PURPOSE OF APPENDICES AND EXHIBITS

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

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

FILING AN APPLICATION

A. GENERAL

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

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

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

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

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

B. LICENSE FEES

The following fees are assessed:

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

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

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

3. PERSON TO CONTACT REGARDING THIS APPLICATION

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

4. TELEPHONE NUMBER FOR CONTACT PERSON

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

5. **LICENSE FEE ENCLOSED**

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

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

6. **TYPE APPLICATION**

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

7. **INDIVIDUAL USERS**

List each individual to be designated as 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.
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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 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 valid training certificates) 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

Specify each isotope of radioactive material requested, for example, "Cesium-137".

b. CHEMICAL AND/OR PHYSICAL FORM

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

c. MAXIMUM AMOUNT TO BE POSSESSED AT ANY ONE TIME

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

(a) ELEMENT AND MASS NUMBER	(b) CHEMICAL AND/OR PHYSICAL FORM	(c) MAXIMUM AMOUNT TO BE POSSESSED AT ANY ONE TIME
1. Cesium 137	1. Sealed source (XYZ, Inc. Model 123)	1. 20 millicuries; no single source to exceed 10 millicuries
2. Americium 241: Beryllium	2. Sealed source (XYZ, Inc. Model 456)	2. 100 millicuries; no single source to exceed 50 millicuries

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

Specify the use for each source of radioactive material requested. Include the name of the manufacturer of the device 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. and 2. For use in XYZ Corporation Model 2000 moisture/density gauge(s)

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 Test for 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. Complete Form D and submit it with the application.

13. RADIATION DETECTION INSTRUMENTS

The possession and use of a radiation survey instrument is required for all licensees who will conduct routine portable gauging activities.

Provide all of the information requested in Item 13 of the application. If authorization is also sought to perform non-routine gauge maintenance involving access to the sources, then at least one low range beta-gamma survey instrument (with a minimum range of 0 - 50 mR/hr or 0 - 200 mR/hr) is required and must be available for use during the maintenance activity. Approval of non-routine maintenance requires the submittal of personnel qualifications and maintenance procedures for review.

There are other situations where a survey instrument is required to determine if a gauge's radioactive source has been breached (e.g., receipt of a damaged gauge, incidents involving a gauge being run over at a construction site, etc.). In most cases, the source will remain intact. If the radiation survey instrument is not immediately available, it may be necessary to seek technical assistance to arrange for a timely evaluation of the source's integrity following an incident or the receipt of a damaged package. Therefore, emergency procedures must include instructions regarding access to a survey meter (refer to Appendix O, 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 an Arkansas Registered Service Vendor who is licensed or registered to perform the service by the Arkansas Department of Health and Human Services, the U.S. Nuclear Regulatory Commission, or an Agreement State. However, the licensee may be authorized to calibrate instruments "in-house" provided certain requirements are met. Additional guidance for performing instrument calibration is provided in Appendix E, "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 PROGRAM

Personnel monitoring devices, or more commonly known as personnel monitoring badges, may be required to be worn by Authorized Users working with portable gauges to measure the radiation dose received by the Authorized User. 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

Submit a description and an annotated diagram of the permanent gauge storage facility, identifying the type of facility construction and materials, 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 multi-story and/or multi-tenant building, identify floors above and below the gauge storage area and their uses, including areas occupied by other tenants. Exhibit A provides a sample facility diagram.

Provide evidence that the storage area is capable of storing at least the maximum number of gauges to be authorized by the license. Describe the security measures to be used to prevent unauthorized access to the radioactive material. Confirm that the radioactive material will always be secured by a triple lock system. Specifically, confirm that the source rod will be locked, the carrying case will be locked, and the doors leading to the gauge storage area will be locked. Identify the individual who is responsible for maintaining the keys to the storage area and to the individual gauges.

Appendix G, “Security of Portable Gauges” describes the security requirements that must be met to help insure the gauges are not removed from the permanent and temporary storage areas by unauthorized individuals.

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 available for use.

Describe any temporary storage locations and provide the same descriptive information for these locations as was requested for the permanent storage locations. If the temporary storage location includes a vehicle, describe how the radioactive material will be stored and secured in the vehicle and the radiological posting of the vehicle.

Confirm that triple locks will be used when transporting the source. Specifically, that the source rod will be locked, the transport case will be locked, and that the transport case will be secured to the vehicle.

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

17. RADIATION SURVEY PROGRAM

A radiation survey program is required of all applicants who will possess a radiation survey instrument as required in Item 13, Radiation Detection Instruments.

Appendix H, "Radiation Survey Program" contains an adequate radiation survey program for most portable gauge activities. Procedures that are equivalent to Appendix H 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. If Appendix H procedures will be used, submit a copy of Appendix H with the application. If Appendix H procedures will not be used, submit equivalent procedures describing how the Radiation Survey Program will be performed.

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

- 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 I, "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 I by marking the appropriate boxes and providing the requested information. Submit the completed Appendix I with 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 the Arkansas Department of Health and Human Services, the U.S. NRC, or other Agreement State. The types and quantities of radioactive material that are allowed are specified in the license and no other licensable type or quantity of radioactive material may be possessed and used.

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

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

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

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

19. WASTE DISPOSAL

Radioactive material contained in portable gauges must be disposed of in accordance with the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1400 a., “General Requirements” for Waste Disposal.

The preferred method of disposing of portable gauges containing radioactive material is to return (transfer) 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 Appendix K, “Disposal or Transfer of Radioactive Material”.

Complete Item 19 of the application by completing and submitting Appendix K with the application.

20. CONTROL AND SECURITY OF RADIOACTIVE MATERIAL

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

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

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

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

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

21. TRANSPORTATION

Portable gauges containing radioactive material must be transported in accordance with U.S. Department of Transportation (DOT) regulations, regardless if the gauge is being transported by a common carrier on public highways or by the Licensee under an Arkansas Radioactive Material License to a temporary job site. Section 4 of the Rules and Regulations for Control of Sources of Ionizing Radiation also establishes the requirement for compliance with U.S. DOT regulations. Licensees are responsible for ensuring that their gauges are properly packaged, marked, labeled, secured, blocked and braced, 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 Authorized Users who package and transport radioactive materials receive initial and refresher (every three years) hazardous material safety training in accordance with U.S. DOT, 49 CFR 172, Subpart H. The Licensee is responsible for training, testing, documenting, certifying, and maintaining records of this training for all Authorized Users.

Appendix M, “Transportation of Portable 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 transporting or preparing a package containing radioactive material for shipment. Also, confirm that all Authorized Users will be provided training as required by U.S. DOT, 49 CFR 172, Subpart H.

22. OPERATING PROCEDURES

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 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 implementing and maintaining a radioactive source Utilization Log, performing at least a Quarterly Inventory of radioactive sources, and periodically leak testing the radioactive sources. These functions must also be addressed in the operating or equivalent procedures.

Appendix N, "Operating Procedures", contains operating procedures for a program using portable gauges. Typically, the operating procedures also include the use of gauge manufacturer's operator's manual for operating the gauge. The procedures in Appendix N 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.

Complete Item 22 of the Application by submitting a copy of the procedures that will be followed when using the gauge(s). 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 operating procedures describing how the gauge will be used.

23. EMERGENCY PROCEDURES

Emergency procedures must be developed and implemented to manage accident situations involving gauges containing radioactive material. Lost or stolen gauges and gauges damaged by heavy equipment during use at job sites are the most common occurrences that present a potentially significant radiation safety risk. The use of Emergency Procedures will help minimize the risk.

Appendix O, “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 O procedures will be used, submit a copy of Appendix O with the application. If the Appendix O procedures will not be used, submit equivalent emergency procedures describing the emergency response.

24. **ADMINISTRATIVE PROCEDURES**

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

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

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

25. **MANAGEMENT CONTROL**

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

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

Confirm that the annual review of the Radiation Safety Program, as required by the Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1004, "Radiation Protection Programs" will be performed and documented. 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.
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NOTE:	Please identify all other individuals in the Applicant's organization who may be authorized to sign documents for the Applicant/Licensee.
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IV. LICENSE AMENDMENTS

Licensees are required to conduct operations in accordance with applicable regulations and the statements, representations and procedures contained in the license application and supporting documents. The license must be amended if any changes are planned. **Submittal of an amendment request does not allow immediate implementation of proposed changes.** Until the license has been amended to reflect approval of the change(s), the licensee must comply with the original terms and conditions of the license. Applications for license amendments may be filed in letter form. The request must be dated and signed by a certifying official, must identify the license by name and number, must be submitted in duplicate, and must clearly describe the nature of the changes, additions or deletions requested. References to previously submitted documents must be specific and identify the applicable information by date, page and paragraph. The Licensee must maintain a copy of the submitted and referenced documentation on file for inspection.

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

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

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

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

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

Appendix	Title	Attached	Equivalent	N/A
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	Security of Portable Gauges			
App. H	Radiation Survey Program			
App. I	Dose Limit for Members of the Public			
App. J	Ordering, Receiving, Opening and Shipping Packages Containing Radioactive Material			
App. K	Disposal or Transfer of Radioactive Material			
App. L	Access Control and Security of Temporary Job Sites			
App. M	Transportation of Portable Gauges			
App. N	Operating Procedures			
App. O	Emergency Procedures			
App. P	Administrative Requirements			

TABLE 2. EXHIBITS

Exhibit	Title	Attached	Equivalent	N/A
Ex. A	Model Facility Diagram		X	
Ex. B	Model Inventory Form			
Ex. C	Model Utilization Log			
Ex. D-1	Model Shipping Paper – Exclusive Use Shipments		X	
Ex. D-2	Model Shipping Paper – Common Carrier Shipments		X	
Ex. E	Model Emergency Response Information			
Ex. F	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)

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:

- 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

Handling and use of portable nuclear gauges is restricted to trained personnel. A portable gauge operator will 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 portable gauges. Authorized User Training will be provided to workers who will be independently using the gauges. Hazardous Materials (Hazmat) Employee Training will be provided to any worker associated with the packaging and transportation of gauges. Ancillary Personnel Radiation Awareness Training will be provided to all personnel who may handle or work near the gauges (for example, vicinity of gauge permanent storage area) during their work. The training will be conducted at the frequency specified in the following table:

<u>Training Requirement</u>	<u>Frequency of Training</u>
Authorized User (Operator) Training	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. Portable gauges will be used by individuals that have completed at least 8 hours of formal radiation safety training. Authorized Users will complete a training course approved by the Arkansas Department of Health. Any third party course offered by a gauge manufacturer 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.

B. Operating and Emergency (O&E) procedures are a required training topic. Unless training in our company's 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 experienced gauge operator, and separate documentation of O&E procedures training will be provided for each worker.

C. Prior to handling, transporting or operating portable nuclear gauges, all Authorized Users will receive the general radiation safety training as required by Paragraph RH-

2803, “Instructions to Workers”, of the Rules and Regulations for Control of Sources of Ionizing Radiation. The following instructions will be provided:

- ◆ Information on the storage, security, transfer, or use of portable gauges at permanent facilities and temporary job sites
- ◆ The health effects 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.** Documentation of portable gauge radiation safety training for each Authorized User will be maintained on file for inspection purposes.

III. Hazmat Employee/Driver Training

- A.** Radioactive material contained in portable 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 that directly affects hazardous material transportation safety. (Exception: New driver employees can transport for 90 days without the training, provided a hazmat-trained employee directly supervises them.) Refresher training must be provided at least once every 3 years.
- B.** Hazmat training will include the following: general awareness/familiarization, function specific, and safety training. It will be provided either in-house or by qualified third party trainers. **Completion of the Authorized User 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.

- D.** Driver training meeting the requirements of 49 CFR 177.816 must be provided to all personnel driving vehicles containing portable gauges, and may be provided concurrently with hazmat employee training.

IV. Ancillary Personnel Radiation Awareness Training

- A.** Ancillary personnel (office personnel, janitorial personnel, non-radiation workers, etc.) who may work in the general vicinity of the gauges (for example, 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 at least annually thereafter.
- 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 D

LEAK TESTS OF SEALED RADIOACTIVE SOURCES

Each sealed source contained in a portable 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 at least every 6 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 portable gauges.

C. Taking the Leak Test Sample

Leak test samples will be taken only by Authorized Users or Registered Service Vendors, and, where applicable, wearing their assigned personnel monitoring badges, if applicable. 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 portable 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 shall be maintained on file for inspection purposes and shall be retained for at least 3 years following the date the record was created. The records will include the following information:

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

Appendix D

Form D

LEAK TESTS FOR SEALED SOURCES

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

SEALED RADIOACTIVE SOURCES WILL BE LEAK TESTED AS INDICATED:

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

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

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

- a. Frequency of Leak Test _____
- b. Manufacturer of Kit _____
- c. Model number of Kit _____
- d. Name 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 ± 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 ± 10 percent at the two points on each scale. Readings within ± 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 ± 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, and
3. At least quarterly.

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.
- _____ 2. Calibration will be performed at two points on each scale used for radiation protection purposes.

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 ± 10 percent of the calculated or known values for each calibration point. Readings within ± 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 ± 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.

However, an Applicant may provide calculations which demonstrate that an individual 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.

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, gamma and neutron 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.

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 provides 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

A whole body personnel monitoring badge (film, TLD or OSLD) will be worn at all times when handling, using, or transporting a portable nuclear gauge. Each Authorized User 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

To ensure accurate monitoring of occupational dose, an assigned badge will be ordered immediately for new gauge operators. 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 must request approval from the Department to revise the individual's dosimetry record.

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 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.f.5., “Records of Individual Monitoring Results”, will be met.

F. Occupational Dose Limits for Minors

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

G. Worker Overexposure Reports

When a report of an individual’s exposure is sent to the 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 FOR EACH INDIVIDUAL.

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.

Common ways that individuals may exceed 10% of the applicable limits are by frequently using the gauge and by performing routine cleaning and lubrication of gauges. Thus, a licensee would must evaluate the radiation doses workers might receive in performing these tasks to determine if personnel monitoring is required.

Applicants who wish to demonstrate that they are not required to provide personnel monitoring must prepare a written evaluation that includes all potential pathways of radiation exposure (transport, field use, maintenance) similar to that shown in the following example. **The expected dose rates, times, and distances used in the example may not be appropriate to your situation.** In the evaluation, you must use information appropriate to your types of gauges that will be possessed and used. This type of information is generally available from the gauge manufacturers or the Sealed Source and Device Catalogue Registration Sheet maintained by the U.S. Nuclear Regulatory Commission and the Agreement States.

Example

One gauge manufacturer has estimated the doses to the whole body and the extremities of an individual performing routine cleaning and lubrication of one of its gauges. The gauge is authorized to contain up to 9 millicuries of Cesium-137 and 44 millicuries of Americium-241. 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., 10 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., 20 millirem per hour at contact with the shield)

- Time the hands were exposed to the unshielded source (e.g., 3 min)
- Expected dose rate received by the extremities of the individual associated with the unshielded source and determined using measured or manufacturer-determined data for the typical distance that the hands would be from the sealed source (e.g., 900 millirem per hour or 15 millirem per minute)

From this information, the manufacturer estimated that the individual performing each routine cleaning and lubrication could receive the following:

- Less than 4 millirem, dose to the whole body

Calculation: 10 min X 20 millirem/hour X 1 hour/60 minutes = 3.3 millirem
--

- 45 millirem, dose to the hands

Calculation: 3 minutes X 900 millirem/hour X 1 hour/60 minutes = 45 millirem

The applicable limit (whole body) is 5000 millirem per year and 10% of that value is 500 millirem per year. If one cleaning/lubrication results in 4 millirem, then an individual could perform 125 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 cleaning/lubrication results in 45 millirem, then an individual could perform 111 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 workers receive from the routine daily use of the gauge. Specifically, the evaluation must include the following:

- Removal of gauge from permanent storage and securing the gauge in the transport vehicle
- At the job-site, removal of the gauge from the vehicle and transporting the gauge to the work area
- Set up and use of the gauge at the work area (exposing the radiation source, taking measurements, etc.)
- Return the gauge to the vehicle and secure the gauge in the vehicle
- Return the gauge to the permanent storage at the end of the work day

Radiation survey data provided (by the Sealed Source and Device Catalogue Registration Sheet maintained by the U.S. Nuclear Regulatory Commission and the Agreement States) for a typical gauge includes the following:

1. Surface of the gauge in the closed or shielded position:

Bottom: 12 millirem per hour Side: 14 millirem per hour Top: 6 millirem per hour

Front: 21 millirem per hour Back: 5 millirem per hour

2. Highest radiation level at 24" from a gauge in the closed or shielded position:
0.3 millirem per hour
3. Highest radiation level at the surface of the shipping case with gauge for shipment:
Top: 4 millirem per hour Side: 3.5 millirem per hour
4. Radiation level to Operator with probe 8" in soil:
Operator in stooped position at about 18" in back of gauge: About 1 millirem(0.65 millirem)
Personnel in a position at about 36" front of gauge: About 1 millirem (1.25 millirem)

Guidance to Licensees

Table 1, Personnel Dose Evaluation, may be helpful in preparing and documenting an Applicant's evaluation of the personnel monitoring program.

Licensees should review the evaluation periodically and revise it as needed. Licensees must 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, in the example used above, the extremities could be closer to the unshielded source, and they would receive more than 15 mrem per minute. Alternatively, workers could perform the task more slowly than the estimated 10 minutes total and 3 minutes with the hands near the unshielded source. Also, the purchase of new gauges containing sources of different activities, different radionuclides, or different cleaning/lubrication procedures would require a new evaluation.

Table 1
Personnel Dose Evaluation

Dosimetry Evaluation for _____ Portable Gauge, Model _____

1. USING THE GAUGE

NOTE: This estimate is for the Annual Whole Body dose and does not include the extremities (hands)

- Remove gauge from storage: Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem
 - Securing gauge in vehicle: Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem
 - Remove gauge from vehicle
and transport to job-site Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem
 - Set up and use gauge Time _____ hr X Dose Rate _____ millirem/hr X
Number of times gauge is used during work day _____ = Dose _____ millirem
 - Transport and secure gauge
in vehicle Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem
 - Return gauge to storage Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem
- Add the Dose Column Daily Dose _____ millirem

Number of days gauge used in a year by same individual _____ days /yr X Daily dose _____ millirem/day =

Annual Dose _____ millirem

2. MAINTAINING THE GAUGE

NOTE: This estimate is for the Annual Whole Body dose and the Extremities (hands) dose

- Remove gauge from storage

Whole Body Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem

- Perform the cleaning and lubrication procedure

Whole Body Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem

Extremity Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem

- Return gauge to storage

- **Whole Body** Time _____ hr X Dose Rate _____ millirem/hr = Dose _____ millirem

Add the Dose Column **Whole Body Dose** _____ millirem

Extremity Dose _____ millirem

Number of times the gauge is maintained by same individual _____ times/yr X Whole Body Dose _____ millirem =

Annual Whole Body Dose _____ millirem

Number of times the gauge is maintained by same individual _____ times/yr X Extremity Dose _____ millirem =

Annual Extremity Dose _____ millirem

3. TOTAL ANNUAL ESTIMATED DOSE

Whole Body Dose

Whole Body Dose due to Using the gauge _____ millirem
Whole Body Dose due to Maintaining the gauge _____ millirem
Add the Whole Body Dose
Total Annual Estimated Whole Body Dose _____ millirem

Extremity Dose

Extremity Dose due to Maintaining the gauge _____ millirem

Total Annual Estimated Extremity Dose _____ millirem

4. 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

SECURITY OF PORTABLE GAUGES

I. Storage and Control of Licensed Radioactive Material

The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1306, “Storage of Sources of Radiation” requires **licensees to secure sources of radiation from unauthorized removal or access**. Further, Paragraph RH-1308, “Control of Material Not in Storage” states that the **licensee shall control and maintain constant surveillance of radioactive material that is in a controlled or unrestricted area and that is not in storage**.

Despite these requirements, thefts of portable gauges do occur which can pose a potential risk to public health and safety.

II. Security Requirements

The Department is providing licensing guidance to applicants to assist them in improving their gauge security program. **Improved security programs for portable gauges that comply with the provisions of this Appendix will be required in order to obtain or renew an Arkansas Radioactive Material License**. This Appendix requires individuals using portable gauges under specific licenses to use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal, whenever portable gauges are not under the control and constant surveillance of the licensee. The proposed physical controls may also reduce accidental losses such as gauges falling out of a vehicle while in transit.

This Appendix applies to a licensee with a portable gauge regardless of the location, situation, and activities involving the portable gauge. At all times, the licensee would be required to either maintain control and constant surveillance of the portable gauge or use a minimum of two independent physical controls to secure the portable gauge. The Department expects that the physical controls would be designed and constructed of material suitable for securing the gauges from unauthorized removal and that the physical controls could not be easily defeated by the use of small hand tools. In addition, the Department expects that both of the controls must be defeated for the portable gauge to be removed to deter a theft by requiring a more determined effort to remove the gauge.

III. Securing a Portable Gauge at a Licensed Facility

Long term storage of portable gauges is usually at a permanent facility listed in the license or license application. When a portable gauge is stored at a licensed facility, the licensee is required to use a minimum of two independent physical controls to secure the gauge. Examples of two independent physical controls to secure a portable gauge when stored at a licensed facility are as follows:

- a. The portable gauge or transportation case containing the portable gauge is stored inside a locked storage shed within a secured outdoor area, such as a fenced parking area with a locked gate.
- b. The portable gauge or transportation case containing the portable gauge is stored in a room with a locked door within a secured building for which the licensee controls access by lock and key or by a security guard.
- c. The portable gauge or transportation case containing the portable gauge is stored inside a locked, non-portable cabinet inside a room with a locked door if the building is not secured.
- d. The portable gauge or transportation case containing the portable gauge is stored in a separate secured area inside a secured mini-warehouse or storage facility.
- e. The portable gauge or transportation case containing the portable gauge is physically secured to the inside structure of a secured mini-warehouse or storage facility.

IV. Securing a Portable Gauge in a Vehicle

Licensees commonly use a chain and a padlock to secure a portable gauge in its transportation case to the open bed of a pickup truck while using the vehicle for storage. Because the transportation case is portable, a theft could occur if the chain is cut and the transportation case with the portable gauge in it is taken. If the licensee simply loops the chain through the handles of the transportation case, a thief could open the transportation case and take the portable gauge without removing the chain or the case. Because the transportation case is also portable, it must be protected by two independent physical controls if the portable gauge is inside. A lock on the transportation case or a lock on the portable gauge source rod handle would not be sufficient because the case and the gauge are portable.

A vehicle should be used for storage only for a short period of time when a gauge is in transit. Portable gauges should only be kept in a vehicle overnight if it is not practicable to provide temporary storage in a permanent structure. When a portable gauge is being stored in a vehicle, the licensee would be specifically required to use a minimum of two independent physical controls to secure the gauge. Examples of two such independent physical controls to secure portable gauges in these situations are--

- a. The locked transportation case containing the portable gauge is physically secured to a vehicle with brackets, and a chain or steel cable (attached to the vehicle) is wrapped around the transportation case such that the case can not be opened unless the chain or cable is removed. In this example, the transportation case would count as one control since the brackets would prevent easy removal of the case. The chain or cable looped only through the transportation case handle is not acceptable.
- b. The portable gauge or transportation case containing the portable gauge is stored in a box physically attached to a vehicle, and the box is secured with (1) two independent locks, or (2) two separate chains or steel cables attached independently to the vehicle in such a manner that the box cannot be opened without the removal of the chains or cables, or (3) one lock and one chain or steel cable is attached to the vehicle in such a manner that the box cannot be opened without the removal of the chain or cable.

- c. The portable gauge or transportation case containing the portable gauge is stored in a locked trunk, camper shell, van, or other similar enclosure and is physically secured to the vehicle by a chain or steel cable in such a manner that one would not be able to open the case or remove the portable gauge without removal of the chain or cable. In this example, the transportation case would not count as one control because it could be easily removed.

V. Securing a Portable Gauge at a Temporary Job Site or at Locations other than a Licensed Facility

When a job requires storage of a portable gauge at temporary job sites or at locations other than a licensed facility, the licensee must use a permanent structure for storage if practicable to do so. **Storage of radioactive material in a private residence or motel/hotel room overnight on a temporary basis is not authorized or approved.** When a portable gauge is stored at a temporary job site or at locations other than an authorized facility, the licensee is required to use a minimum of two independent physical controls to secure the gauge. Examples of two independent physical controls to secure portable gauges at such locations are--

- a. At a temporary job site, the portable gauge or transportation case containing the portable gauge is stored in a locked non-portable structure (e.g., construction trailer, sea container, etc.), and is physically secured by a chain or steel cable to the structure in such a manner that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable. A lock on the transportation case or a lock on the portable gauge source rod handle would not be sufficient because the case and the gauge are portable.
- b. The portable gauge or transportation case containing the portable gauge is stored inside a locked room within a temporary facility, and is physically secured by a chain or steel cable to a permanent or non-portable structure (e.g., large metal drain pipe, support column, etc.) such that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable.
- c. The portable gauge or transportation case containing the portable gauge is stored in a locked garage, and is within a locked vehicle or is physically secured by a chain or steel cable to the vehicle in such a manner that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable.
- d. The portable gauge or transportation case containing the portable gauge is stored in a locked garage, and is within a locked enclosure or is physically secured by a chain or steel cable to a permanent or non-portable structure in such a manner that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable.

VI. Controlling and Maintaining Constant Surveillance of a Portable Gauge

When a portable gauge is not secured with a minimum of two independent physical controls, the licensee is required to control and maintain constant surveillance of the gauge. This is consistent with Paragraph RH-1308, which states that the licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage. Control and constant surveillance is required when the

gauge is not in storage, e.g., is in use or undergoing maintenance. The Department interprets “control and maintain constant surveillance” of portable gauges to mean being immediately present or remaining in close proximity to the portable gauge so as to be able to prevent unauthorized removal of the gauge.

APPENDIX H

RADIATION SURVEY PROGRAM

A radiation survey program is required of those 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 in **permanent** storage areas will be determined initially when a storage area is established, at least annually, and after any increase in the number of gauges stored in the area. These surveys will provide information for determining the radiation dose to members of the public.
- b. Radiation levels in the **temporary** storage areas will be determined initially when a storage area is established and after any increase in the number of gauges stored in the area. These surveys will provide information for determining the radiation dose to members of the public.
- c. Transport Index (TI) when transporting the gauge
- d. Source integrity following an incident involving the gauge (for example, gauge is "run over" by a construction vehicle).

Records of all radiation surveys shall be maintained for inspection purposes and shall be retained for at least 3 years following the date 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 unexpected dose rates are identified during the survey.

APPENDIX I

DOSE LIMIT FOR MEMBERS OF THE PUBLIC

ANNUAL DOSE DETERMINATION COMPLIANCE STUDY

I. Introduction

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

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

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

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

New license applicant: the procedure describes the methodology that will be used to conduct the dose study after licensed activities begin.

Renewal application: the procedure describes the methodology and results of the completed dose study of existing operations.

II. Dose Limit for Unrestricted Areas

For portable gauge operations, there are three situations that must be addressed in order to demonstrate compliance with the 2 millirem in any one hour dose limit for unrestricted areas:

- ◆ Storage of gauges in transport vehicles;
- ◆ Use and storage of gauges at temporary job sites; and
- ◆ Storage of gauges at the permanent facility.

Section A demonstrates compliance with the unrestricted area dose limit for shipment of gauges to and from temporary job sites and their use and storage at job sites.

Section B's Method 1 describes the procedure to be followed using a survey meter to obtain radiation measurements. Compliance with the unrestricted area dose limit can also be demonstrated without direct measurements. Section B's Method 2 describes an alternate procedure using calculations. The marked box indicates the method selected for use in this study.

A. Transport Vehicles and Temporary Job Sites

Security procedures approved by the Department and incorporated into the license describe measures taken by gauge operators to ensure that public access to restricted areas resulting from gauges in transport vehicles and at temporary job sites is prevented. During transport and storage at temporary job sites, procedures require a minimum of three locks between the device and the public. While in use, the gauge must be maintained under the direct supervision of the

operator to prevent unauthorized access. Adherence to these procedures ensures compliance with the 2 mrem in any one hour public dose limit.

B. Storage Facility

Method 1. Physical Surveys

Procedures approved by the Department prevent unauthorized public access to gauges at the storage facility. When stored at the facility, gauges are kept locked in their transport cases, which are locked in an approved storage area. Unless under the personal supervision of a gauge operator, a minimum of three locks is kept between the device and the public.

A radiation detection instrument was used to measure ambient radiation levels in the unrestricted areas around the storage facility while all possessed gauges were in storage. This survey evaluated the “worst case scenario” – where radiation emitted by the gauge(s) are at their highest levels. Survey results revealing dose rates below 2 millirem per hour demonstrate compliance.

The following information is attached:

- ◆ Date of the survey and the name of the individual(s) performing the measurements.
- ◆ Information about the instrument used to perform the survey (manufacturer and model number, the types of radiation detected by the instrument, its minimum and maximum range, and the date it was last calibrated).
- ◆ Diagram of the storage facility identifying the restricted area, adjacent unrestricted areas, nearby members of the public workstations, and the locations where all recorded measurements were taken.
- ◆ Information about the type and number of gauges present during the survey and a description of their placement within the storage facility (e.g., contained in transport cases, stacked against back wall, etc.).
- ◆ Results of survey(s) of unrestricted area radiation levels, with results keyed to facility diagram.

Note: If surveys identify radiation levels greater than 2 millirem/hr, attach a description of controls in place to further restrict access to the storage area (e.g., establishment of expanded restricted area around the storage area, using barricades and/or posted notices).

Method 2. Calculations

Radiation levels in unrestricted areas can be calculated using information provided by gauge manufacturers. Prior to shipment, the manufacturer lists the Transport Index (TI) number on the RADIOACTIVE YELLOW II labels on the gauge transport case’s exterior surface. The TI indicates the radiation levels at 1 meter (3.3 feet) from the case when it contains a gauge. The TI value was used as the basis for the calculations. If the TI is less than 2, then radiation levels in all directions around the gauge when it is stored in its transport case are 2 millirem per hour (or less) at 1 meter, so that is the boundary of the restricted area. Additional distance and shielding provided by the storage area lower the dose rate even further. Storing the gauge in its case, then

storing the case in a cabinet, locker, room, etc. (in accordance with Appendix G) prevents unauthorized access to within a meter or more, so no member of the public can receive 2 millirem in any one hour. When calculating for two or more stored gauges, each case's TI is added together; this method is overly conservative, but should not cause the 2 mrem limit to be exceeded.

The following information is attached:

- ◆ Diagram of the storage facility identifying the restricted area, adjacent unrestricted areas, and distance to members of the public workstations
- ◆ Information about the type and number of gauges present and a description of their placement within the storage area (e.g., contained in transport cases, stacked by wall)
- ◆ Copies of manufacturer-provided documentation providing information on gauge dose rates and/or TI numbers for the gauges being evaluated
- ◆ Results of calculations demonstrating estimated radiation levels in unrestricted areas, with results keyed to the facility diagram

Note: If calculations note radiation levels greater than 2 millirem/hr, attach a description of controls in place to further restrict access to the storage area (e.g., establishment of expanded restricted area around the storage area, using barricades and/or posted notices).

III. Annual Public Dose Limit

“Total effective dose equivalent” (TEDE) describes the dose from summation of internal and external radiation doses. Since there is little possibility of internal exposures during routine gauging operations so internal doses can be ignored for portable gauge dose studies. Thus, for portable gauge licensees demonstrating compliance with the 100 mrem annual dose limit, the individual's external dose (“deep dose equivalent” or DDE) is equal to the total dose (TEDE).

Paragraph RH-1209 states that licensees can demonstrate compliance with the annual dose limit with measurements or calculations showing that the member of the public likely to receive the highest dose from the licensed operations does not exceed the 100 millirem limit. The following information describes different methods of using this regulatory approach. The marked box indicates the method selected for use in this study.

Method 1. Occupational Worker Dosimetry Data

If personnel monitoring badge readings show that all of a licensee's gauge operators receive less than 100 millirem annually, then by extrapolation, no member of the public receives 100 millirem annually, because gauge operators receive higher exposures from gauges than any member of the public. The monitoring period should cover at least 12 continuous months of operations. If a review of monitored workers' dosimetry reports verifies that none have received annual doses exceeding 100 mrem, completion of Table 1 and attachment of the referenced reports finishes the study.

Table 1. Occupational Worker Dosimetry Data		
<input type="checkbox"/>	DDE = TEDE (millirem)	Monitoring Period (<i>dates</i>): _____ to _____ Enter the highest individual external dose for the monitoring period in the space provided to the left. A dose equal to or less than 100 mrem demonstrates compliance with the annual dose limit specified in Paragraph RH-1208.
Method 2. Dosimetry Data for the Maximally Exposed Individual Member of the Public		

If annual occupational doses for workers exceed 100 millirem, the member of the public that is likely to receive the highest dose from the gauge operations may be used to demonstrate compliance with the annual public dose limit. The “maximally exposed individual member of the public” may be a person that does not operate gauges but works at the same site where gauges are used or stored. It could also be an employee working in a management, clerical, or maintenance position at the permanent facility, or an employee or a regular customer that has routine contact with the gauge operators when they are working.

Justification for how that the maximally exposed individual was identified must be documented; i.e., why the person is likely to receive the highest radiation dose compared to other members of the public. Next, assign the individual a personnel monitoring device (film badge, TLD or OSLD). Provide instructions on when (during working hours) and where (on the torso, waist or chest level) the badge must be worn, and on proper use (protect badge from excessive heat, light, moisture or chemicals, store with control badge in low background area when not being worn). In general, at least one year of monitoring should be conducted to provide adequate measurement data and to account for seasonal fluctuations in work loads. If the dosimetry reports show that the monitored person received less than 100 millirem for the year, compliance with the annual public dose limit has been demonstrated, because if the member of the public likely to receive the highest dose from the gauging activities is receiving less than 100 millirem, then so are all other members of the public. It is not necessary to wait for a full year of dosimetry records to begin drawing conclusions from the collected data. As dosimetry reports arrive, the recorded dose can be multiplied to gain an estimate of the annual exposure, which can serve as a dose study “in-progress” until the year of monitoring is completed. The study can then be updated to reflect the results of a full year of monitoring. If this method is employed, complete Table 2 and attach the following:

- ◆ Description of the maximally exposed individual member of the public (name, title) and justification for why the individual was selected
- ◆ Facility diagram identifying all restricted areas, adjacent unrestricted areas, and where the monitored member of the public workstation is located
- ◆ Copies of the dosimetry reports used in the study (note: black out any birth dates or social security numbers listed in the reports)

Table 2. Dosimetry Data for the Maximally Exposed Individual Member of the Public		
<input type="checkbox"/>	DDE = TEDE (millirem)	Monitoring Period (<i>dates</i>): _____ to _____ Enter the highest individual external dose for the monitoring period in the space provided to the left. A dose equal to or less than 100 mrem demonstrates compliance with the annual dose limit specified in Paragraph RH-1208.

Method 3. Environmental Monitoring Data

If the maximally exposed individual member of the public is a worker at the storage facility, a third approach is available. A film badge/TLD/OSLD can be mounted at the person's work station to record radiation levels, which can then be related to the dose received by the person working in the area. If environmental monitoring demonstrates that continuous exposure to the ambient radiation levels in the workplace for a year results in doses equal to or less than 100 millirem, then no member of the public is likely to exceed the 100 mrem annual public dose limit due to the licensed operations generating the radiation levels. If environmental monitoring indicates that continuous occupancy would exceed the public dose limit, then occupancy factors may be used to demonstrate compliance. The maximally exposed individual member of the public annual occupancy time can be determined by review of the person's time cards, interviews of the person and his/her co-workers, etc.

Note: An environmental badge is not the same type of badge used for personnel monitoring, so it is important to specify to the dosimetry supplier what type of monitoring is planned when ordering badges. In addition, posted badges must be protected from adverse environmental conditions such as excessive heat, light and moisture.

One or more badges should be posted in the unrestricted areas adjacent to restricted areas (or in the restricted area on a wall adjacent to unrestricted areas) for at least 12 months. Badges should be posted where the highest radiation exposure is expected and where exposure to non-regulated sources of radiation will not contribute to the measurements. If the results for the monitoring period total less than 100 millirem, use continuous occupancy for the dose determination; check Box A and enter the total value in the box provided in Table 3. If the results for the monitoring period exceed 100 millirem, it may be possible to demonstrate compliance with the annual dose limit by applying a more realistic (but still very conservative) occupancy factor, such as 2,000 hours for a work year. Box B should be checked if using a normal work week occupancy factor to calculate the TEDE.

Example: The total dose measured by the environmental badge = 280 millirem; the dose received by a member of the public working 2,000 hours in the area that the badge was posted is

$$280 \text{ mrem} / 8,766 \text{ hrs} = .032 \text{ millrem/hr} \times 2,000 \text{ hrs} = 64 \text{ millirem}$$

Using a 2,000 hour occupancy factor means that any annual dose from environmental monitoring that totals less than 438 millirem will demonstrate compliance.

Example: $438 \text{ mrem} / 8,766 \text{ hrs} = .049 \text{ millirem/hr} \times 2,000 \text{ hrs} = 99.9 \text{ millirem}$

If the results for the 12 month monitoring period total greater than 438 mrem, compliance may still be demonstrated by using an even more realistic occupancy factor, provided the number can be legitimized by supporting documentation (e.g., employment records).

Example: Environmental badges total 680 mrem for the 12 month monitoring period; time sheets indicate that a conservative estimate of the most time spent by any member of the public in the monitored area is 25 hours a week, 50 weeks a year = 1,250 hours.

$680 \text{ mrem} / 8,766 \text{ hrs} = .078 \text{ mrem/hr} \times 1,250 \text{ hrs} = 97 \text{ mrem}$

In each case, attach an annotated diagram of the facility identifying restricted areas, adjacent unrestricted areas, and the location of posted badges.

Table 3. Environmental Monitoring Data			
<input type="checkbox"/>	<table border="1" style="width: 100%;"> <tr> <td style="width: 50%; padding: 2px;">DDE = TEDE (millirem)</td> <td style="width: 50%;"></td> </tr> </table>	DDE = TEDE (millirem)	
DDE = TEDE (millirem)			
	<p>Monitoring Period (<i>dates</i>): _____ to _____</p> <p><input type="checkbox"/> A. Check if calculations are based on continuous year-round occupancy (8766 hours) in unrestricted areas</p> <p><input type="checkbox"/> B. Check if calculations are adjusted for workplace occupancy factors (e.g., 2,000 hours for a work year) in unrestricted areas</p> <p>Enter the highest individual cumulative external dose for the monitoring period in the space provided to the left. A dose equal to or less than 100 millirem demonstrates compliance with the annual dose limit specified Paragraph RH-1208.</p>		

Method 4. Radiation Level Data

Survey measurements and calculations can be used to demonstrate that the radiation levels resulting from licensed operations are not likely to cause any member of the public to exceed the annual public dose limit.

Radiation levels generated by radioactive material present in the workplace can be determined by direct measurement with survey instruments, or from indirect information, such as radioactive material package transport index values (describing radiation levels at 1 meter from a package's exterior surface). The radiation level data can then be used with the inverse square law to calculate the DDE.

In Table 4, check to indicate use of either radiation survey instrument measurements (Box A-1) or radioactive material package Transport Index (TI) values (Box B-1) with the inverse square law to calculate the DDE.

The issue of occupancy factors is addressed by selecting one of two options provided in Table 4. Check off the Box A-2 to indicate use of the most conservative scenario -- assuming a member of the public is continuously present in the unrestricted area (24 hours/day, 365.25 days/year = 8766 hours). Check Box B-2 to indicate use of a more realistic (but still very conservative) assumption -- the individual located in the unrestricted area is present during all business hours (8 hours/day x 40 hours/week x 50 weeks/year = 2,000 hours).

Inverse Square Law: $I_2 = \frac{I_1 R_1^2}{R_2^2}$ Where: $I_1 =$ intensity (radiation dose rate) at distance R_1
 $I_2 =$ intensity (radiation dose rate) at distance R_2 .
 $R_1 =$ distance from RAM with dose rate I_1
 $R_2 =$ distance from RAM where dose rate I_2 is calculated

- Notes:**
1. This formula has two limitations: (a) it only applies to gamma-emitters; and (b) the closest distance should be at least five source diameters.
 2. If using the Transport Index (TI), set R_1 at 1 meter (3.3 feet).

Example of an Inverse Square Law Calculation Using Survey Meter Measurements

A laboratory contains a variety of sealed sources. The sources may be treated as a single point source by positioning them together for the measurement. Assuming a collective source diameter of 12 inches, a radiation measurement (I_1) is taken at a distance equal to at least five source diameters from the grouped sources, shielded behind lead brick corral, which serves as R_1 in the inverse square formula. The intensity at 10 feet is the unknown value being sought (the distance to the nearest unrestricted area).

$I_1 = 0.1$ millirem/hr		A 2,000 hour occupancy factor yields:
$I_2 = ?$ millirem/hr	$I_2 = \frac{0.1 \times (60)^2}{(120)^2}$.025 millirem/hr x 2,000 hours
	=	
$R_1 = 60$ in. (5 x 12 in.)	$I_2 = .025$ millirem/hr	= 50 millirem = DDE
$R_2 = 120$ in. (10 ft.)		

Example of an Inverse Square Law Calculation Using a Package Transport Index

A shipping case used to store a portable nuclear density gauge bears a Radioactive Yellow II label that shows its TI = 1.2. The nearest member of the public workstation is located 24 feet away.

$$\begin{array}{lll}
 I_1 = 1.2 \text{ millirem/hr} & & \text{A 2,000 hour occupancy factor yields:} \\
 I_2 = ? \text{ millirem/hr} & I_2 = \frac{1.2 \times (3.3)^2}{(24)^2} & .023 \text{ millirem/hr} \times 2,000 \text{ hours} \\
 R_1 = 3.3 \text{ ft. (1 meter)} & I_2 = .023 \text{ millirem/hr} & = 46 \text{ millirem} = \text{DDE} \\
 R_2 = 24 \text{ ft.} & &
 \end{array}$$

Table 4. Radiation Level Data		
<input type="checkbox"/>	DDE (millirem)	<input type="checkbox"/> A-1. Check to indicate use of radiation survey instrument measurements and the inverse square law to calculate the DDE OR <input type="checkbox"/> B-1. Check to indicate use of RAM package Transport Index (TI) values or radioactive material package surface radiation levels and the inverse square law to calculate DDE ***** ***** <input type="checkbox"/> A-2. Check if dose is based on continuous year-round occupancy (8766 hours) in unrestricted areas OR <input type="checkbox"/> B-2. Check if dose has been adjusted for workplace occupancy factors (e.g., 2000 hours for a work year) in unrestricted areas ***** ***** <input type="checkbox"/> Check to indicate that documentation of all calculations is attached, along with instrument identification, specifications and calibration information <input type="checkbox"/> Check to indicate a facility diagram showing restricted and unrestricted areas is attached ← Enter the calculated DDE in the space provided to the left

APPENDIX J

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 containing radioactive material will not be received after normal working hours.
- D. Each package will be visually inspected for any sign of damage. **If damage is noted, immediately notify the RSO.** If the RSO determines that the shielding may have been compromised, the RSO will either survey the 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, Subpart H, 49 CFR Part 172.

APPENDIX K

DISPOSAL OR TRANSFER OF RADIOACTIVE MATERIAL

Paragraphs RH-1400 through RH-1407, Rules and Regulations for Control of Sources of Ionizing Radiation, address the transfer and disposal of radioactive material. In accordance with Paragraph RH-1400 a., 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 L

ACCESS CONTROL AND SECURITY OF TEMPORARY JOB SITES

Radiological controls must be implemented and maintained at the job site while the portable gauges are being used or temporarily stored on the transport vehicle. The Authorized User at the job site is responsible for establishing the controls and insuring that no unauthorized individual(s) enter the restricted areas. The Rules and Regulations for Control of Sources of Ionizing Radiation, Paragraph RH-1208, "Dose Limits for Individual Members of the Public", prescribes the dose levels for members of the public in unrestricted areas. The following control procedures will be used to limit the radiation dose to other workers (members of the public) who may be at the job site:

- a. Establish a restricted area around the gauge use area.
- b. No unauthorized individuals will be allowed into the restricted area.
- c. Constant surveillance of the restricted area boundaries will be maintained.

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

APPENDIX M

TRANSPORTATION OF PORTABLE GAUGES

U.S. DOT requirements for highway shipments via common carrier are similar to requirements for transporting a gauge to a temporary job site. Operators are responsible for ensuring that their gauges are properly packaged, marked, labeled, secured, blocked and braced, and that proper documentation accompanies the devices.

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

A. General

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

Required **markings** include:

- ◆ Shipping name (ex.: radioactive material, special form, n.o.s., Class 7)
- ◆ RQ (for gauges with an Am-241:Be source ≥ 10 mCi); add to shipping name
- ◆ Identification number (ex.: UN 3332)
- ◆ Package type (ex.: TYPE A)

B. Markings and labels

Required **labels** include:

- ◆ “Cargo Aircraft Only” label (required for shipments by air)
- ◆ Two DOT warning labels (gauges typically require RADIOACTIVE YELLOW II labels; see table) applied to opposite sides of the package, listing the package contents and activity in SI and customary units, and the package’s Transport Index (TI), the dimensionless number indicating the package’s

radiation level at 1 meter (manufacturers provide the TI for their gauges).

Package Labeling Criteria

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

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

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

E. Blocking and Bracing

Block and brace gauge transport containers to prevent shifting during normal transportation conditions. Gauges cannot be transported in a vehicle's passenger compartment.

F. Excepted instruments/articles

Portable devices classified as excepted instruments/articles (e.g., XRF analyzers) are exempt from marking, labeling and shipping paper requirements, but must have a notice included with the package that lists the company's name and provides the following statement: "This package conforms to the conditions and limitations specified in 49 CFR 173.424 for radioactive material, excepted package--instruments or articles, UN2910."

APPENDIX N

OPERATING PROCEDURES

The following Operating Procedures will be used by all Authorized Users to remove, transport, use and return the gauge to storage. Any deviations from these Operating Procedures must be approved by the Radiation Safety Officer.

Preparation for Work

1. If personnel monitoring is provided:
 - Always wear your assigned badge when using the gauge.
 - Never wear another person's badge.
 - Never store your badge near the gauge.
2. Before removing the gauge from its place of storage, ensure that, where applicable, each gauge source is in the fully shielded position and that in gauges with a movable rod containing a sealed source, the source rod is locked (e.g., keyed lock, padlock, mechanical control) in the shielded position. Place the gauge in the transport case and lock the case.
3. Sign out the gauge in a Utilization Log book (that remains at the storage location) including the date(s) of use, name(s) of the authorized users who will be responsible for the gauge, and the temporary jobsite(s) where the gauge will be used.
4. Block and brace the gauge to prevent movement during transport and lock the gauge in or to the vehicle. Follow all applicable Department of Transportation (DOT) requirements when transporting the gauge.

Using the Gauge

1. Use the gauge according to the manufacturer's instructions and recommendations and the Operating Procedures and Emergency Procedures.

The gauge will also be used in a manner that will keep radiation doses **As Low As is Reasonably Achievable (ALARA)** by:

- Minimize the **TIME** spent in close proximity to the gauge (the shorter the time, the lower the dose);

- Maximize the **DISTANCE** from the gauge (doubling the distance reduces radiation intensity); and
 - Make use of available **SHIELDING** to block out radiation.
2. Establish and maintain constant surveillance of the restricted area and always keep unauthorized persons away from the gauge.
 3. Do not touch the unshielded source rod with your fingers, hands, or any part of your body.
 4. Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded source.
 5. Unless absolutely necessary, do not look under the gauge when the source rod is being lowered into the ground. If you must look under the gauge to align the source rod with the hole, follow the manufacturer's procedures to minimize radiation exposure.
 6. After completing each measurement in which the source is unshielded, immediately return the source to the shielded position.
 7. Always maintain constant surveillance and immediate control of the gauge when it is not in storage. At job sites, do not walk away from the gauge when it is left on the ground. Take actions necessary to protect the gauge and yourself from danger of moving heavy equipment.
 8. Always keep unauthorized persons away from the gauge.
 9. Perform routine cleaning and maintenance according to the manufacturer's instructions and recommendations.
 10. When the gauge is not in use at a temporary jobsite, place the gauge in a secured storage location (e.g., locked in the trunk of a car or locked in a storage shed).
 11. Do not smoke, eat, drink, or store any of these types of products in the use or storage area of the gauges containing radioactive material.

Completing the Work

1. Prior to transporting the gauge, ensure that, where applicable, each gauge source is in the fully shielded position. Ensure that in gauges with a movable source rod, the source rod is locked in the shielded position (e.g., keyed lock, padlock, mechanical control). Place the gauge in the transport case and lock the case.

Block and brace the case to prevent movement during transportation. Lock the case in or to the vehicle.

2. Return the gauge to its proper locked storage location at the end of the work shift.
3. Log the gauge into the Utilization Log when it is returned to storage.
4. After making changes affecting the gauge storage area (e.g., changing the location of gauges within the storage area, removing shielding, adding gauges, changing the occupancy of adjacent areas, moving the storage area to a new location), reevaluate compliance with public dose limits and ensure proper security of gauges.

Maintaining the Gauge

1. Personnel monitoring badges will always be worn when performing non-routine maintenance on 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. A Quarterly Inventory of all gauges will be performed by the Radiation Safety Officer or their designee. Records of the inventory shall be maintained on file for inspection purposes and shall be retained for at least 3 years following the date the record was created.
5. Leak testing of the radioactive sources will be performed and documented every six months in accordance with the Radioactive Material License. Gauges that do not have a current leak test will not be used.

APPENDIX O

EMERGENCY PROCEDURES

If the source fails to return to the shielded position (e.g., as a result of being damaged, source becomes stuck below the surface) or if any other emergency or unusual situation arises (e.g., the gauge is struck by a moving vehicle, is dropped, or is in a transport vehicle involved in an accident) specific response actions must be taken.

THE INDIVIDUAL AT THE ACCIDENT SCENE MUST DO THE FOLLOWING

- **RESTRICT ACCESS** Immediately secure the area and establish a restricted area boundary. Keep individuals at least 15 feet 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.
- **MAINTAIN SURVEILLANCE** Maintain constant, direct surveillance of the restricted area by an Authorized User.
- **DETAIN INDIVIDUALS** If any heavy equipment is involved, detain the equipment and operator until it is determined there is no contamination present.
- **REMAIN AT THE SCENE** Gauge users and other potentially contaminated individuals should not leave the scene except for immediate medical attention.
- **NOTIFY** Notify the persons in the order listed below of the situation:

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

Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the Radiation Safety Officer (RSO), or other knowledgeable licensee staff, licensee's consultant, 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 located at the job site 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.
- If gauges are used for measurements with the unshielded source extended more than 3 feet below the surface, contact persons listed on the emergency procedures need to know the steps to be followed to retrieve a stuck source and to convey those steps to the staff on site.
- 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, and when it becomes apparent that attempts to recover a source stuck below the surface will not be successful.
- 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, the Arkansas Department of Health, the Arkansas State Police and the U.S. Department of Transportation must be notified.

APPENDIX P

ADMINISTRATIVE REQUIREMENTS

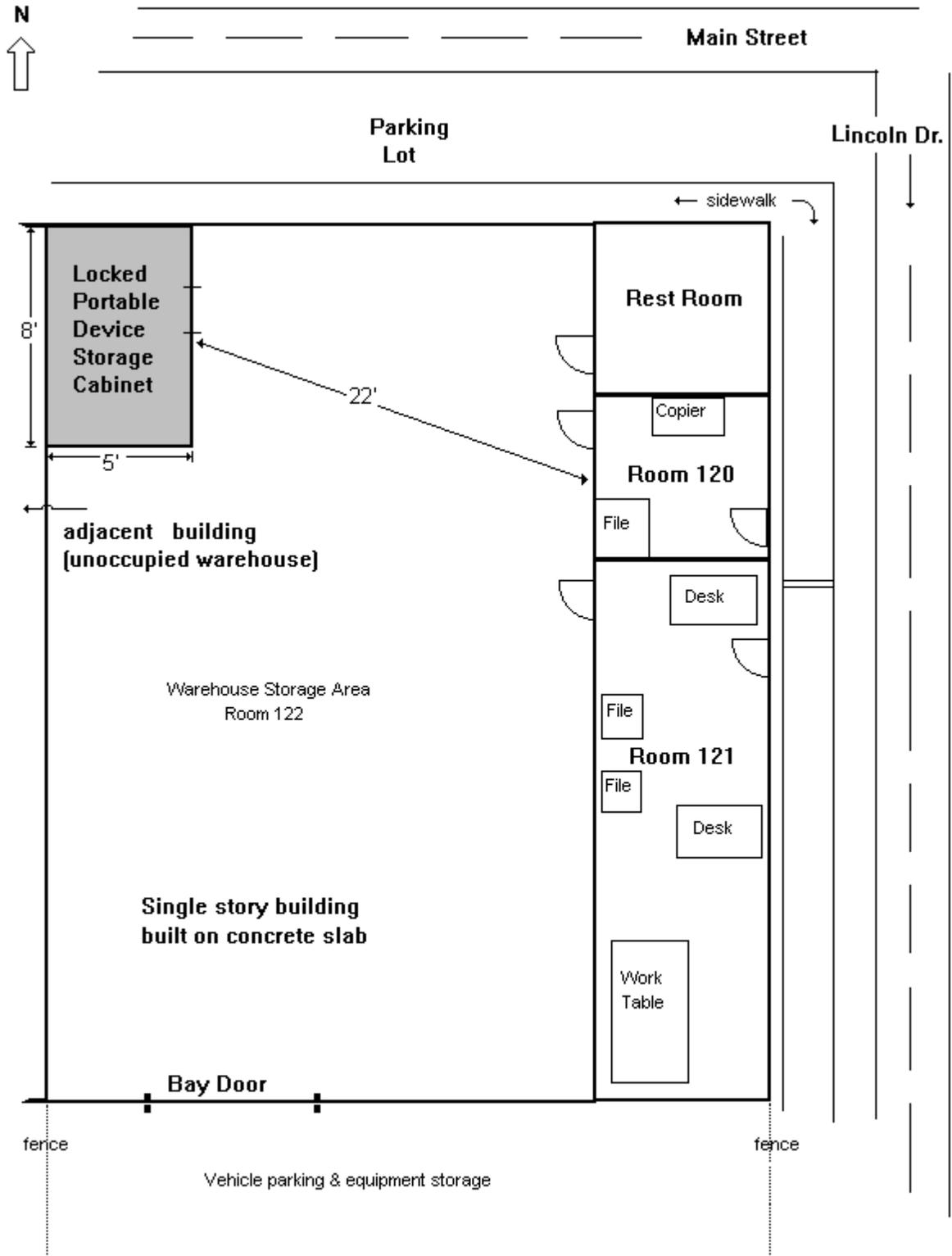
Each of the following paragraphs of the Rules and Regulations for Control of Sources of Ionizing Radiation must be read and understood and incorporated into the Radiation Safety Program. Compliance with these regulations is mandatory. The Rules and Regulations may be found on the Internet at:

<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 FACILITY DRAWING



Not to Scale

EXHIBIT D-1

EXAMPLE SHIPPING PAPER-EXCLUSIVE USE SHIPMENTS

BILL OF LADING

RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM

RQ, HAZARD CLASS 7, UN 3332

Package contains:

Cs-137, ___ GBq (___ mCi)

Am-241:Be, ___ GBq (___ mCi)

RADIOACTIVE YELLOW II Label

Transport Index (TI) = _____

EMERGENCY RESPONSE INFORMATION CONTACT NO.: ()

EXHIBIT D-2

EXAMPLE SHIPPING PAPER-COMMON CARRIER SHIPMENTS

BILL OF LADING

Shipper: _____

Address: _____

RADIOACTIVE MATERIAL, TYPE A PACKAGE, SPECIAL FORM

RQ, HAZARD CLASS 7, UN 3332

Package contains:

Cs-137, ___ GBq (___ mCi)

Am-241:Be, ___ GBq (___ mCi)

RADIOACTIVE YELLOW II Label

Transport Index (TI) = _____

EMERGENCY RESPONSE INFORMATION CONTACT NO.: ())

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

Shipper: _____

(Signature)

EXHIBIT E
EMERGENCY RESPONSE INFORMATION

1) **SHIPPING NAME & HAZARD CLASS:** Radioactive Material, Type A Package, Special Form, RQ, Hazard Class 7, UN 3332

POTENTIAL HAZARDS

2) **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.

3) **FIRE OR EXPLOSION**

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

EMERGENCY PROCEDURES

4) **IMMEDIATE PRECAUTIONS**

- Isolate hazard area to within a 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

5) **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).

6) **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.

7) **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.....**_____

EXHIBIT F

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 its effectiveness in complying with regulatory requirements and keeping radiation exposures to workers and the general public as low as reasonably achievable (ALARA). Records of the annual review shall be maintained for inspection purposes and shall be retained for at least 3 years following the date the record was created.

License Name: _____

License No.: _____ Review Date _____

Auditor: _____

(name, title)

(signature)

Management Review: _____

(name, title)

(signature)

2. REVIEW HISTORY

A. Last review conducted on (date): _____

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

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

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

3. 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
- D. Field observations of gauges operators demonstrate use of safe work practices and compliance with regulatory requirements?N/A 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 ≤ 500 mrem/yr? Yes No

7. POSTING AND LABELING

A. Following documents posted at permanent facility:

- 1. Emergency proceduresYes 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 job sites 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. Each gauge provided a storage/transport container equipped with lock?Yes No

B. Minimum of three locks always used to prevent access to gauges?..... Yes No

C. Gauges kept secured against unauthorized access/removal when not under direct surveillance?Yes No

D. Extra precautions used to deter theft (e.g., concealing gauges from view during transport/storage, maintaining elevated level of awareness, minimizing time that temporary storage is used rather than permanent storage)?..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. Gauges transported to job sites are prepared and transported in same manner as when offered to third party for shipment?Yes No

- B. Only DOT-7A or other authorized packages used to transport gauges?Yes No
- C. Packages used to ship gauges properly marked and labeled per 49 CFR Part 172, Subparts D and E?Yes No
- D. Shipping containers properly locked, blocked and braced prior to transport?Yes No
- E. Prior to shipment, transport containers inspected to ensure proper packaging, unimpaired physical condition of container and closure devices?Yes No
- F. Properly completed bill of lading and emergency response information provided for each gauge shipment?Yes No
- G. Shipping papers and emergency response information immediately accessible to driver during shipment of gauges?Yes No
- H. Devices classified as excepted instruments/articles (e.g., XRF analyzers) have notice included with package listing consignor/consignee name and conformity statement per 49 CFR 173.422?Yes No

11. GENERAL RULES OF USE

- A. Management and RSO emphasize to workers importance of maintaining doses ALARA?Yes No
- B. Field 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. The survey meter:
 - 1. Has been approved by the Department?.....Yes No
 - 2. Is calibrated annually and after repair by a licensed vendor, and calibration records are maintained?.....Yes No
- B. Is there access to an equivalent back-up meter when the primary meter is out for calibration/repair?.....Yes No

16. RADIATION SURVEYS

- A. Survey of Permanent Storage
 - 1. InitialYes No
 - 2. Annual.....Yes No
 - 3. Following Increase in number of gauges stored.....Yes No
- B. Survey of Temporary Storage
 - 1. InitialYes No
 - 2. Following Increase in number of gauges stored.....Yes No
- C. Required transportation surveys.....Yes No
- D. Required transportation surveys.....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 _____

19. AUDIT DEFICIENCIES AND CORRECTIVE ACTIONS

- A. Summary of problems/deficiencies identified during this _____

- B. Description of corrective actions planned or _____

C. Description of other recommendations for _____
