

Guide For The Preparation Of Applications For Licenses For The Use Of Sealed Sources In Portable Gauging Devices

Alabama Office of Radiation Control

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ABBREVIATIONS

Agency - The Alabama Office of Radiation Control

ALARA - As low as reasonably achievable

Bq - Becquerel

CFR - Code of Federal Regulations

DOE - United States Department of Energy

DOT - United States Department of Transportation

mrem - Millirem

mSv - Millisievert

NIST - National Institute of Standards and Technology

NRC - United States Nuclear Regulatory Commission

NVLAP - National Voluntary Laboratory Accreditation Program

RQ - Reportable Quantities

RSO - Radiation Safety Officer

SSD - Sealed Source and Device

Sv - Sievert

TEDE - Total effective dose equivalent

TI - Transportation Index

TLD - Thermoluminescent dosimeters

1 PURPOSE OF DOCUMENT

This document provides guidance to an applicant in preparing a portable gauge license application, as well as Agency criteria for evaluating a portable gauge license application. This guidance document is intended for use by applicants and licensees. It is not intended to address the research and development of gauging devices or the commercial aspects of manufacturing, distribution, and service of such devices. This document is not a substitute for the Alabama Rules of the State Board of Health, Radiation Control. Rather this document is intended only as a guide to help the licensee and prospective licensee in setting up and maintaining their radiation safety programs. The approaches and methods described in this document are provided for information only. Methods and solutions different from those described in this document will be acceptable if they provide a basis for the Agency to make the determinations needed to issue or continue a license. Within this document, the phrases “portable gauge” or “gauging devices,” and the term “gauge” may be used interchangeably.

This report addresses the variety of radiation safety issues associated with portable gauges of many designs. As shown in Figure 1.1, portable gauges are of many different designs based, in part, on their intended use (e.g., to measure moisture, density, thickness of asphalt, liquid level). Because of differences in design, manufacturers provide appropriate instructions and recommendations for proper operation and maintenance. In addition, with gauges of varying designs, the sealed sources may be oriented in different locations within the devices, resulting in different radiation safety problems.

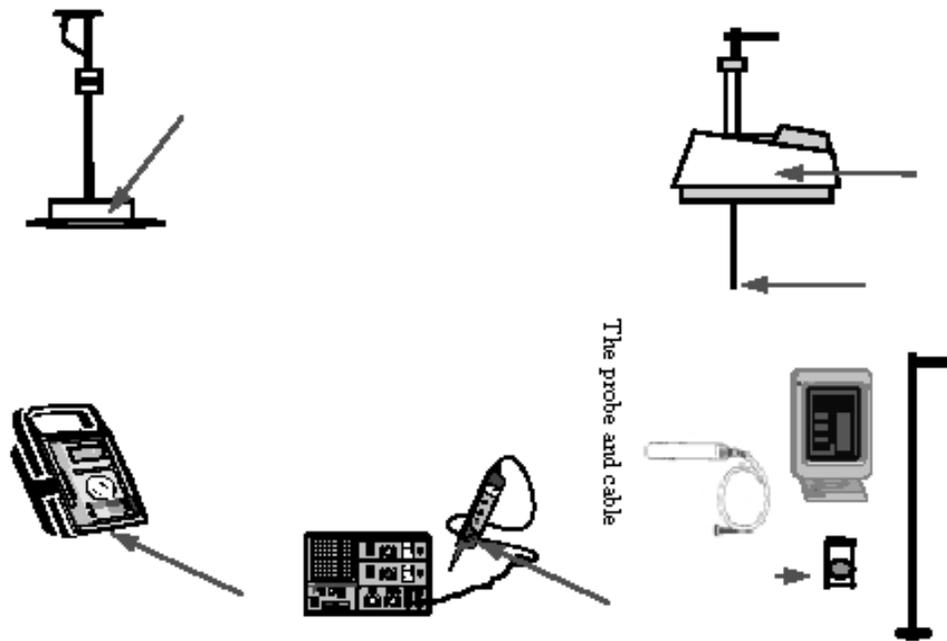


Figure 1.1 Where is the Radioactive Source?

The wide variety of portable gauge designs include placing the sealed source in different locations, resulting in different radiation safety problems.

This report identifies the information needed to complete Agency Form RM (Appendix A), “Application for Material License,” for the use of sealed sources in portable gauging devices.

The format within this document for each item of technical information is as follows:

Regulations – references the regulations applicable to the item;

Criteria – outlines the criteria used to judge the adequacy of the applicant’s response;

Discussion – provides additional information on the topic sufficient to meet the needs of most readers; and

Response from Applicant – provides appropriate response(s), offers the option of an alternative reply, or indicates that no response is needed on that topic during the licensing process.

Notes and References are self-explanatory and may not be found for each item on Agency Form RM.

Form RM does not have sufficient space for applicants to provide full responses to Items 6 through 15; the answers to those items may be provided on separate sheets of paper and submitted with the completed Form RM.

2 NRC AND OTHER AGREEMENT STATE JURISDICTIONS

Certain states, including Alabama, called Agreement States (see Figure 2.1), have entered into agreements with the NRC that give them the authority to license and inspect byproduct, source, or special nuclear materials used or possessed within their borders. Agency material licensees who wish to conduct operations under reciprocity at temporary job sites in another Agreement State or NRC jurisdiction, and who are specifically authorized on their Agency license to conduct such activities, should contact the NRC or State's Radiation Control Program Office for information about regulations. To ensure compliance with NRC and Agreement State reciprocity requirements, licensees should request authorization well in advance of scheduled use.

In the special situation of work at Federally-controlled sites in Agreement States, it is necessary to know the jurisdictional status of the land in order to determine whether the NRC or the Agreement State has regulatory authority. NRC has regulatory authority over land determined to be "exclusive Federal jurisdiction," while the Agreement State has jurisdiction over non-exclusive Federal jurisdiction land. Licensees are responsible for finding out, in advance, the jurisdictional status of the specific areas where they plan to conduct licensed operations. The Agency recommends that licensees ask their local contact for the Federal Agency controlling the site (e.g., contract officer, base environmental health officer, district office staff) to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with NRC or Agreement State regulatory requirements, as appropriate.

Commitment to provide adequate resources (including space, equipment, personnel, time, and, if needed, contractors) to the radiation protection program to ensure that the public and workers are protected from radiation hazards and meticulous compliance with regulations is maintained;

Selection and assignment of a qualified individual to serve as the Radiation Safety Officer (RSO) for licensed activities;

Obtaining the Agency's prior written consent before transferring control of the license; and

Notifying the Agency in writing, immediately following filing of petition for voluntary or involuntary bankruptcy.

4 APPLICABLE REGULATIONS

It is the applicant's or licensee's responsibility to have up-to-date copies of applicable regulations, read them, and abide by each applicable regulation.

The following Parts the Rules of State Board of Health, Radiation Control contain regulations applicable to portable gauging devices:

Rule 420-3-26-.01, "General Provisions";

Rule 420-3-26-.02, "Licensing" ;

Rule 420-3-26-.03, "Standards for Protection Against Radiation"; and,

Rule 420-3-26-.10, Notices, Instructions, and Reports to Workers; Inspections

5 HOW TO FILE

Applicants for a materials license should do the following:

Be sure to use the most recent guidance in preparing an application;

Complete all items on Agency Form RM (Appendix A), using additional sheets if necessary (**If this is a renewal, only Item 8 may be completed by referring to information on file**);

For each separate sheet that is submitted with the application, identify and key it to the

item number on the application or the topic to which it refers;

Submit all documents, typed, on 8-1/2 x 11 inch paper;

Submit an original, signed application;

Retain one copy of the license application for future reference.

As required by 420-3-26-.02(8)(c), applications must be signed by a duly authorized representative; see Section 8 - Item 16, Certification.

6 WHERE TO FILE

All correspondence should be submitted to the Agency at the following addresses:

Mailing Address:

**Alabama Office of Radiation Control
P.O. Box 303017
Montgomery, AL 36130-3017**

Overnight Delivery Address:

**Alabama Office of Radiation Control
201 Monroe Street
Suite 700
Montgomery, AL 36104**

7 LICENSE FEES

Each application for a new license for which a fee is required must be accompanied by the appropriate fee. You may contact the Agency office to determine the amount of the fee.

The Agency will not issue the license before it receives the required fee. Once technical review has begun, no fees will be refunded; application fees will be charged regardless of the Agency's disposition of an application or the withdrawal of an application.

Most Agency licensees are also subject to annual fees. You may contact the Agency office to determine the amount of the fee.

8 CONTENTS OF AN APPLICATION

The following comments apply to the indicated items on Agency Form RM (Appendix A).

8 - ITEM 1(a): APPLICANT'S NAME AND MAILING ADDRESS

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material; a division or department within a legal entity may not be a 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. A Post Office box number is an acceptable mailing address. You must notify the Agency of changes in mailing address; these changes do not require a fee.

Provide the administrative contact's telephone number and e-mail address.

Note: The Agency must be notified before control of the license is transferred and the licensee must receive written consent from the Agency prior to the transfer. The Agency must also be notified when bankruptcy proceedings have been initiated. See Section 8 - Item 11, Waste Management – Gauge Disposal or Transfer for more details. Rule 420-3-26-.02(12) provides additional information about Agency requirements related to bankruptcy considerations.

Timely Notification of Transfer of Control

Regulations: 420-3-26-.02(12)(b).

Criteria: Licensees must provide full information and obtain the Agency's prior written consent before transferring control of the license, or, as some licensees call it, "transferring the license."

Discussion: Transfer of control may be the result of mergers, buyouts, or majority stock transfers. Although it is not the Agency's intent to interfere with the business decisions of licensees, it is necessary for a licensee to obtain the Agency's written consent before the transaction is finalized. This is to ensure the following:

Radioactive materials are possessed, used, or controlled only by persons who have valid Agency licenses;

Materials are properly handled and secured;

Persons using these materials are competent and committed to implementing appropriate radiological controls;

A clear chain of custody is established to identify who is responsible for disposition of records and licensed material; and,

Public health and safety are not compromised by the use of such materials.

Response from Applicant: None from an applicant for a new license.

Notification of Bankruptcy Proceedings

Regulation: 420-3-26-.02(12)(e).

Criteria: Immediately following filing of a voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify the Agency, in writing, identifying the bankruptcy court in which the petition was filed and the date of filing.

Discussion: Even though a licensee may have filed for bankruptcy, the licensee remains responsible for all regulatory requirements. The Agency needs to know when licensees are in bankruptcy proceedings in order to determine whether all licensed material is accounted for and adequately controlled, and whether there are any public health and safety concerns (e.g., contaminated facility). The Agency shares the results of its determinations with other involved entities (e.g., trustee), so that health and safety issues can be resolved before bankruptcy actions are completed.

Response from Applicant: None at time of application for a new license. Generally, licensees should notify the Agency within 24 hours of filing a bankruptcy petition.

8 - ITEM 1(b): ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED

Specify the street address, city, and state or other descriptive address (such as on Highway 10, 5 miles east of the intersection of Highway 10 and State Road 45, Anytown, Alabama) for each permanent facility used as a location of storage or use, and each facility from which the applicant will dispatch gauge users to job sites for more than one customer. If gauges will NOT be stored at a dispatch site, so indicate.

The descriptive address should be sufficient to allow an Agency inspector to find the storage location. **A Post Office Box address is not acceptable.**

The Agency does not consider long-term storage in vehicles or personal residences that are not listed on the license an acceptable practice.

Descriptions of all storage locations, including personal residences where portable gauges may be stored by licensee staff for dispatch to customer job sites should be submitted in Item 13.

An Agency-approved license amendment is required before receiving, using, and storing licensed material at an address or location not included with the application or already listed on the license.

Being granted an Agency license does not relieve a licensee from complying with other

applicable Federal, State, or local regulations (e.g., local zoning requirements for storage locations).

To conduct operations at temporary job sites (i.e., locations where work is conducted for limited periods of time and from which gauge users are NOT dispatched to job sites for other customers), specify “temporary job sites anywhere in the Alabama where the Agency maintains jurisdiction.”

Note: Licensees must maintain permanent records describing where licensed material was used or stored while the license was in force. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). For portable gauge licensees, acceptable records are sketches or written descriptions of storage or use locations specifically listed on the license. Licensees only need to maintain this information for temporary job sites where sources have leaked.

8 - ITEM 2: LOCATION WHERE ALL RECORDS WILL BE KEPT

If a licensee will have two or more physical locations where licensed radioactive material will be used, copies of all required records must be maintained at a single location for review by the Agency. This “records address” will be placed on the license.

Response from Applicant: Both new license applicants and applicants for renewal of an existing license must include the physical address where copies of all required records will be maintained. If only one physical location is specified on the license request (ie: there is only one permanent storage location), and all records will be maintained at this same location, the applicant should state this.

8 - ITEM 3: LICENSE ACTION TYPE

This is an application for (Check and complete appropriate item):

- a. New License
- b. Amendment to License No. _____
- c. Renewal of License No. _____

Check box A if the application is for a new license.

Check box B if the application is for an amendment to an existing license, and provide license number.

Check box C if the application is for the renewal of an existing license, and provide the

license number.

Licensees are required to request and obtain an amendment to the license before making changes in their radiation safety program. Examples of changes that require amendment are:

Change of Radiation Safety Officer (RSO);

Changes in approved radiation safety procedures;

Addition of authorized user(s);

Changes in areas of use; and,

Changes in licensed material, including increases in possession limit of radioactive material. See “Amendments and Renewals to a License” later in this document.

8 - ITEM 4: INDIVIDUAL USER(S)

Identify the name and titles of individual(s) you wish to be named on the license to use or physically supervise the use of licensed radioactive material. You may state that only those individuals who have successfully completed an approved radiation safety training course for the type of radioactive material devices to be listed on the license, and who have been approved by the Radiation Safety Officer, will be allowed to use licensed radioactive material.

8 - ITEM 5: RADIATION SAFETY OFFICER

Criteria: Radiation Safety Officers (RSOs) must have adequate training and experience. In the past, the Agency has found successful completion of one of the following as evidence of adequate training and experience:

Portable gauge manufacturer’s course for users or for RSOs; or

Equivalent course that has been reviewed and approved by the Agency, the NRC or an Agreement State.

Discussion: The person responsible for the radiation protection program is called the RSO. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used in a safe manner. Typical RSO duties are illustrated in Figure 8.1 and described in Appendix B. The Agency requires

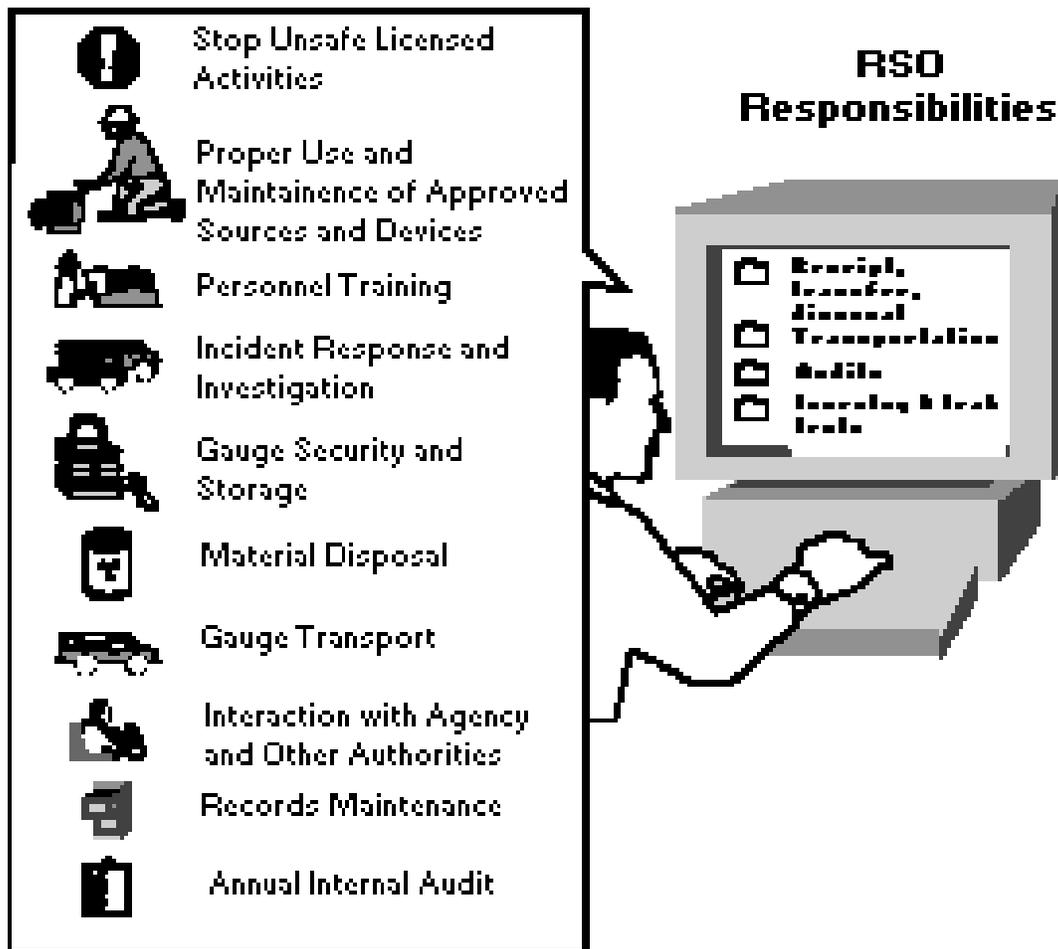


Figure 8.1 RSO Responsibilities. *Typical duties and responsibilities of RSOs*

the name of the RSO on the license to ensure that licensee management always has a responsible, qualified person identified and that the named individual knows of his or her designation as RSO. Include the telephone number and e-mail address of the RSO. The Agency will contact the RSO if there are questions about the application.

Response from Applicant: Provide either of the following:

Name of the proposed RSO;

AND EITHER

A statement that before obtaining licensed materials, the proposed RSO will have successfully completed one of the training courses described in Criteria in the section entitled ‘ Radiation Safety Officer’ in ‘Guide For The Preparation Of Applications For Licenses For The Use Of Sealed Sources In Portable Gauging Devices,’ dated February 2004;

OR

Alternative information demonstrating that the proposed RSO is qualified by training and experience.

Note: It is important to notify the Agency, as soon as possible, of changes in the designation of the RSO. Alternative responses will be reviewed against the criteria listed above.

8 - ITEM 6: RADIOACTIVE MATERIAL

Column a. (Element and Mass Number) should be used to list the radioactive material to be approved on the license (ex: cesium 137, americium 241/beryllium).

Column b. (Chemical and/or Physical Form) should be used to state the form of the radioactive material. For sealed sources, also provide the manufacturer or distributor name and model number for each requested sealed source.

Column c. (Maximum Activity to be Possessed as any Time) should be used to state the maximum activity to be possessed, or the maximum radioactivity per source to be used.

Columns 6.a., 6.b., 6.c., and Item 7. may be listed on separate sheets of paper as attachments.

To help maintain clarity on the application, each separate radioisotope in each model of device should be listed separately in column 6.a. (in A., B., C. or 1., 2., 3. order) and matched to the corresponding entry in columns 6.b., 6.c. and Item 7.

Response from Applicant:

Identify each radionuclide that will be used in each source in the gauging device(s);

Identify the manufacturer or distributor and model number of each type of sealed source and device requested;

Confirm that each sealed source, device, and source/device combination is registered as an approved sealed source or device by NRC or an Agreement State;

Confirm that the activity per source and maximum activity per device will not exceed the maximum activity listed on the approved certificate of registration issued by NRC or by an Agreement State.

Applicants will be authorized to possess and use only those sealed sources and devices specifically approved or registered by the NRC or an Agreement State.

The NRC or an Agreement State performs a safety evaluation of gauges before authorizing a manufacturer or distributor to distribute the gauges to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) Registration Certificate. Before the SSD registration process was formalized, some older gauges may not have been evaluated in a separate document, but they were specifically approved on a license. Licensees can continue to use these gauges that are specifically listed on their licenses.

Consult with the proposed manufacturer or distributor to ensure that requested sources and devices are compatible and conform to the sealed source and device designations registered with the NRC or an Agreement State. Licensees may not make any changes to the sealed source, device, or source/device combination that would alter the description or specifications from those indicated in the respective registration certificates, without obtaining the Agency's prior permission in a license amendment. Such changes may necessitate a custom registration review, increasing the time needed to process a licensing action.

SSD Registration Certificates contain sections on "Conditions of Normal Use" and "Limitations and Other Considerations of Use." These sections may include limitations derived from conditions imposed by the manufacturer or distributor. For example, working life of the device or appropriate temperature and other environmental conditions may be specified. Except as specifically approved by the Agency, licensees are required to use gauges according to their respective SSD Registration Certificates. Accordingly, applicants may want to obtain a copy of the certificate and review it with the manufacturer or distributor or with NRC or the issuing Agreement State to ensure that it correctly reflects the radiation safety properties of the source or device.

Note: You may contact the Agency for more information on SSD registration certificates.

8 - ITEM 7: DESCRIBE PURPOSE FOR WHICH RADIOACTIVE MATERIAL WILL BE USED

Criteria: Proposed activity must be authorized by Rule 420-3-26, Radiation Control, and devices will be used only for the purposes for which they were designed and according to the manufacturer's recommendations for use as specified in an approved SSD Registration Sheet.

Response from Applicant: If the gauging device(s) will be used for the purposes listed on the

SSD Registration Sheet, state the following: “Gauges will be used for the purposes described in their respective SSD Registration Sheets.” If the gauging device(s) will be used for purposes other than those listed on the SSD Registration Sheet, specify these other purposes.

Notes:

The typical portable gauge license authorizes use to measure physical properties of materials. For example, moisture and/or density of construction materials, or lead in paint analysis.

Unusual uses will be evaluated on a case-by-case basis and the authorized use condition will reflect approved uses.

8 - ITEM 8: TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS (INSTRUCTIONS TO OCCUPATIONALLY EXPOSED WORKERS AND ANCILLARY PERSONNEL)

Regulations: 420-3-26-.10(3), 420-3-26-.10(4).

Criteria: Authorized users must have adequate training and experience. In the past, the Agency has found successful completion of one of the following as evidence of adequate training and experience:

Portable gauge manufacturer’s course for users; or

Equivalent course that has been reviewed and approved by the Agency, the NRC or an Agreement State.

Discussion: The individuals using the gauges are usually referred to as authorized users. Authorized users have the responsibility to ensure the surveillance, proper use, security, and routine maintenance of portable gauges containing licensed material.

Response from Applicant: Provide either of the following:

A statement that before using licensed materials, authorized users will have successfully completed one of the training courses described in Criteria in the section entitled ‘Training for Individuals Working in or Frequenting Restricted Areas (Instructions to Occupationally Exposed Workers and Ancillary Personnel)’ in ‘Guide For The Preparation Of Applications For Licenses For The Use Of Sealed Sources In Portable Gauging Devices,’ dated February 2004;

OR

A description of the training and experience for proposed gauge users.

Notes:

Records of training should be maintained.

Alternative responses will be evaluated against the criteria listed above.

8 - ITEM 9: RADIATION DETECTION INSTRUMENTS

Regulations: 420-3-26-.03(17)(a), 49 CFR 171.2(a).

Criteria: A radiation survey meter should:

Be capable of detecting gamma radiation; and

Be checked for functionality before use (e.g., with the gauge or a check source).

Discussion: Each year there are a number of incidents involving gauges at construction sites (e.g., construction equipment running over the gauge). It is important to determine as soon as possible after an incident, by the use of a radiation survey meter, whether the shielding and source are intact. In addition, U.S. Department of Transportation regulations require that any package containing radioactive material offered for transport (both to and from a job site) be properly classed, described, packaged, marked, labeled, and in condition for shipment. This includes that the radiation exposure from the package is in accordance with the required shipping papers. Applicants should pre-plan how they will immediately obtain an instrument (e.g., use an instrument located on site or obtain one from the applicant's home office).

Response from Applicant: Provide the following:

A statement that: "We will either possess and use, or have immediate access to and use, a radiation survey meter that meets the criteria in the section entitled 'Radiation Detection Instruments' in 'Guide For The Preparation Of Applications For Licenses For The Use Of Sealed Sources In Portable Gauging Devices,' dated February 2004;

A list of available instruments should be included with the application.

Notes:

Alternative responses will be reviewed against the criteria listed above.

8 - ITEM 10: CALIBRATION OF THE RADIATION DETECTION INSTRUMENTS

Regulations: 420-3-26-.03(17)(b).

Criteria: Instruments and equipment used to determine dose rate (mR/hr) must be calibrated at intervals not to exceed 12 months for the radiation measured.

Discussion: Any radiation detection instruments that are to be used to determine the proper marking and labeling of a package for transport or shipment, or for emergency incidents must be calibrated at intervals not to exceed 12 months. An acceptable calibration must include exposure of the meter and its detector to a known radiation field from a source of radiation whose output is traceable to a National Institutes of Standards and Technology (NIST) standard. Calibration using only an electronic pulser is not acceptable because it does not calibrate both the meter and its detector. Calibration must be performed by a licensee authorized by the Agency, an Agreement State or the NRC to perform meter calibrations.

Response from Applicant: Provide the following:

Either a statement that survey meters will be calibrated by an entity licensed to provide such a service; or

Procedures to be used to perform calibrations on survey meters.

Notes:

If you intend to perform your own calibrations, you must license the radiation source to be used.

If you intend to offer calibration services to other licensees, you may be required to pay a separate annual licensing fee. Contact the Agency for more information.

8 - ITEM 11: OCCUPATIONAL DOSIMETRY

Regulations: 420-3-26-.03(18), 420-3-26-.03(6), 420-3-26-.03(12), 420-3-26-.03(13).

Criteria: Applicants must do either of the following:

Maintain, for inspection by the Agency, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose¹ in excess of 10 percent of the allowable limits as shown in Figure 8.3;

¹In this document, dose or radiation dose is a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent, or total effective dose equivalent. These terms are defined in 420-3-20-.02(3).

OR

Provide dosimetry processed and evaluated by a National Voluntary Laboratory Accreditation Program (NVLAP) approved processor that is exchanged at a frequency recommended by the processor.

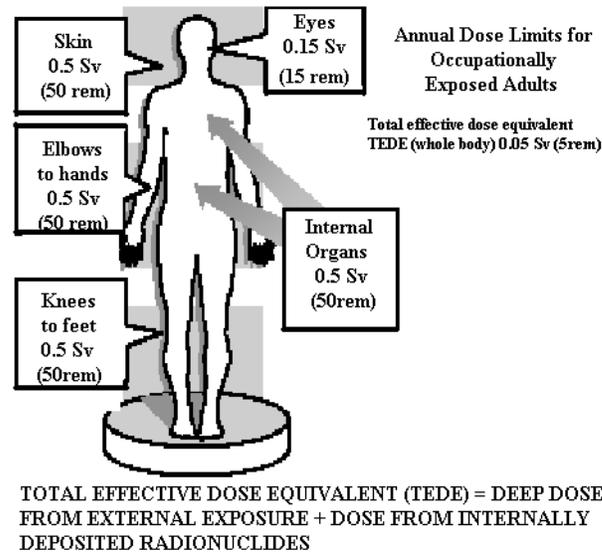


Figure 8.2 Annual Dose Limits for Radiation Workers.

Discussion: Under conditions of routine use, the typical portable gauge user does not require a personnel monitoring device (dosimetry). In most (but not all) accidents where a gauge has been run over and has been damaged, the shielding of the source remains intact. A gauge user also does not require dosimetry when proper emergency procedures are used.

When personnel monitoring is needed, licensees must use dosimeters that are supplied by an NVLAP-approved processor. The exchange frequency for film badges is usually monthly because of technical concerns about film fading. The exchange frequency for other types of dosimeters might be bi-monthly or quarterly. Applicants should verify that the processor is NVLAP-approved. Consult the NVLAP-approved processor for its recommendations for exchange frequency and proper use.

Response from Applicant: Provide either of the following:

A statement that: "Either we will maintain, for inspection by the Agency, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits in 420-3-26-

.03, or we will provide dosimetry processed and evaluated by an NVLAP-approved processor that is exchanged at a frequency recommended by the processor.”

OR

A description of an alternative method for demonstrating compliance with the referenced regulations.

Notes:

Alternative responses will be evaluated against the criteria listed above.

Many licensees choose to provide personnel dosimetry to their workers for reasons other than compliance with Agency requirements (e.g., to respond to worker requests).

Reference: National Institute of Standards and Technology (NIST) Publication 810, “National Voluntary Laboratory Accreditation Program Directory,” is published annually and is available for purchase from GPO and on the Internet at the following address: <<http://ts.nist.gov/ts/htdocs/210/214/214.htm>>.

8 - ITEM 12: BIOASSAYS

No information need be submitted in response to this item.

8 - ITEM 13: FACILITIES AND EQUIPMENT

Licensees should submit a description of permanent storage and use areas, paying particular attention to possible radiation doses and security of radioactive materials. The key elements for portable gauge applicants are ensuring compliance with public dose limits and maintaining adequate security and control over the gauges. These issues are covered under Section 8 -14.3, “Radiation Protection Program – Public Dose” and Section 8 - 14.4 , “Radiation Protection Program – Operating and Emergency Procedures.” Licensees should also submit a diagram of permanent storage locations, including all areas surrounding the storage area, and indicating physical barriers such as fences and locked gates, doors and storage cabinets.

8 - ITEM 14: RADIATION PROTECTION PROGRAM

8 - 14.1 - AUDIT PROGRAM

Regulations: 420-3-26-.03(5), 420-3-26-.03(41).

Criteria: Licensees must review the content and implementation of their radiation protection

programs annually to ensure the following:

Compliance with Agency and DOT regulations, and the terms and conditions of the license;

Occupational doses and doses to members of the public are as low as reasonably achievable (ALARA) (420-3-26-.03(5)); and

Records of audits and other reviews of program content are maintained for 3 years.

Discussion: Appendix C contains a sample audit program that is specific to the use of portable gauges. All areas indicated in Appendix C may not be applicable to every licensee and may not need to be addressed during each audit. Currently, the Agency's emphasis in inspections is to perform actual observations of work in progress. As part of their audit programs, applicants should consider performing unannounced audits of gauge users in the field to determine if, for example, Operating and Emergency Procedures are available, are being followed, etc. It is essential that, once identified, problems be corrected comprehensively and in a timely manner. The Agency will review the licensee's audit results and determine if corrective actions are thorough, timely, and sufficient to prevent recurrence. If the licensee identifies violations and takes these corrective steps, the Agency can exercise discretion and may elect not to cite a violation. The Agency's goal is to encourage prompt identification and prompt, comprehensive correction of violations and deficiencies. For additional information on the Agency's use of discretion on issuing violations, refer to "General Statement of Policy and Procedures for Enforcement Actions," (Appendix A of 420-3-26-.13).

With regard to audit records, 420-3-26-.03(41)(a) requires licensees to maintain records of "... Audits and other reviews of program content and implementation." The Agency has found audit records that contain the following information to be acceptable: date of audit, name of person(s) who conducted audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions, and follow-up.

Response From Applicant: The applicant is not required to submit its audit program to The Agency for review during the licensing phase. However the licensee should be aware that they are responsible for meeting the above referenced rule requirements, and take appropriate actions.

8 - 14.2 - MATERIAL RECEIPT AND ACCOUNTABILITY

Regulations: 420-3-26-.02(18), 420-3-26-.02(30).

Cradle to Grave Accountability

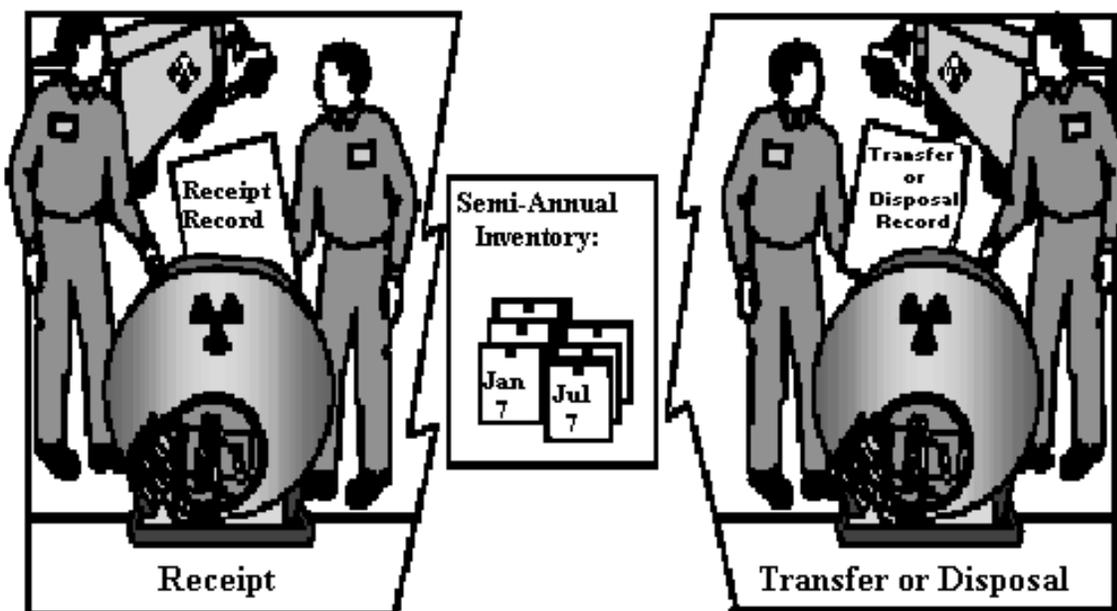


Figure 8.3 Material Receipt and Accountability. Licensees must maintain records of receipt and disposal and conduct semiannual inventories.

Criteria: Licensees must do the following:

Maintain records of receipt, transfer, and disposal of gauges; and

Conduct physical inventories at intervals not to exceed 6 months (or some other interval justified by the applicant) to account for all sealed sources.

Discussion: As Figure 8.3 illustrates, licensed materials must be tracked “from cradle to grave” in order to ensure gauge accountability, identify when gauges could be lost, stolen, or misplaced, and ensure that, if the licensee possesses gauges exceeding threshold amounts, the licensee complies with financial assurance requirements in 420-3-26-.02(26). Many licensees record daily use of gauges in a log book as part of their accountability program; see the sample Operating Procedures in Appendix D.

Response from Applicant: Provide either of the following:

A statement that: “Physical inventories will be conducted at intervals not to exceed 6 months, to account for all sealed sources and devices received and possessed under the

license.”

OR

A description of the frequency and procedures for ensuring that no gauge has been lost, stolen, or misplaced and that, if the licensee possesses gauges exceeding threshold amounts, the licensee complies with financial assurance requirements in 420-3-26-.02(26).

Notes:

Alternative responses will be evaluated against the criteria listed above.

Inventory records should be maintained and should contain the following types of information:

Radionuclide and amount (in units of becquerels or curies) of radioactive material in each sealed source;

Manufacturer’s name, model number, and serial number (if appropriate) of each device containing radioactive material;

Location of each sealed source and device;

Date of the inventory.

8 - 14.3 - PUBLIC DOSE

Regulations: 420-3-26-.03(14), 420-3-26-.03(15), 10 CFR 20.1003, 420-3-26-.03(25), 420-3-26-.03(26), 420-3-26-.03(47).

Criteria: Licensees must do the following:

Ensure that licensed gauges will be used, transported, and stored in such a way that members of the public will not receive more than 1 millisievert (1 mSv) [100 millirem (100 mrem)] in one year, and the dose in any unrestricted area will not exceed 0.02 millisievert (mSv) [2 millirem (2 mrem)] in any one hour, from licensed operations;

Control and maintain constant surveillance over gauges that are not in storage and secure stored gauges from unauthorized removal or use.

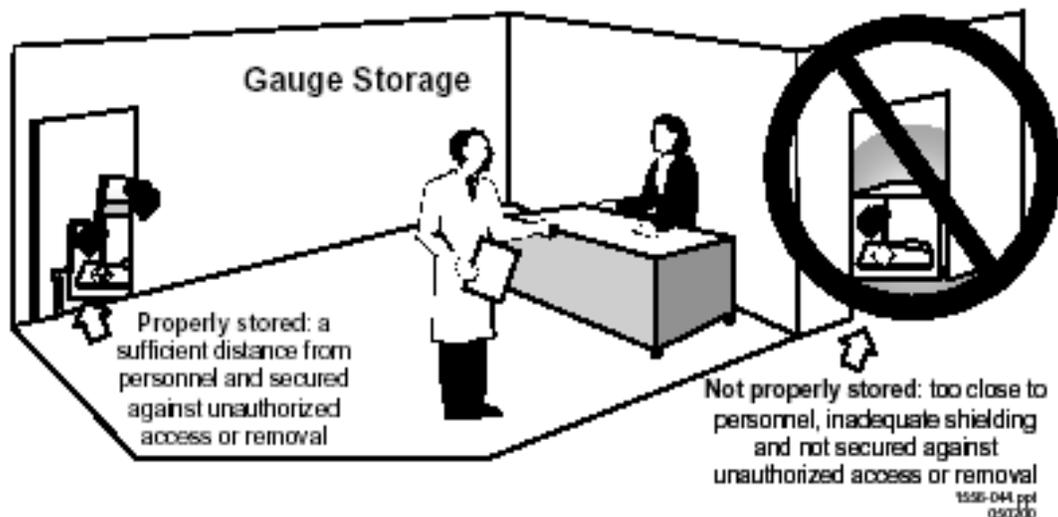


Figure 8.4 Storing Gauges. *Gauges should be stored away from occupied areas and secured against unauthorized removal.*

Discussion: Members of the public include persons who live, work, or may be near locations where portable gauges are used or stored and employees whose assigned duties do not include the use of licensed materials and who work in the vicinity where gauges are used or stored. Operating and emergency procedures regarding security and surveillance specified under that section of this document should be sufficient to limit the exposure to the public during use or storage and after accidents. Public dose is controlled, in part, by ensuring that gauges not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use (see Figure 8.4). If gauges are not in storage, then authorized users must maintain constant surveillance to ensure that members of the public, who could be co-workers, cannot get near the gauges or use them, and thus receive unneeded radiation exposure.

Public dose is also affected by the choice of storage location and conditions. Because a gauge presents a radiation field during storage, it must be stored so that the radiation level in an unrestricted area (e.g., an office, the exterior surface of an outside wall, or occupied areas of a personal residence) does not exceed 1 mSv (100 mrem) in a year or 0.02 mSv (2 mrem) in any one hour. Licensees should take time, distance, and shielding into consideration when choosing a permanent or temporary storage location. Decreasing the time spent near a gauge, increasing the distance from the gauge, and using shielding (i.e., brick, concrete, lead, or other solid walls) will reduce radiation exposure. As a rule of thumb, gauges should be stored as far away as possible from areas that are occupied by other employees and members of the public. Licensees can determine the radiation levels adjacent to the storage location either by calculations or a combination of direct measurements and calculations using some or all of the

following: typical known radiation levels provided by the manufacturer, the “inverse square” law to evaluate the effect of distance on radiation levels, and occupancy factors to account for the actual presence of the member of the public and of the gauge(s). If, after making an initial evaluation, a licensee makes changes affecting the 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), then the licensee must ensure that gauges are properly secured, perform a new evaluation to ensure that the public dose limits are not exceeded, and take corrective action, as needed. If the licensee is changing a previously approved location of storage, they must submit an amended diagram to the Agency for review.

Response from Applicant: Submit a diagram of the permanent storage locations you wish to use. In this diagram, include all areas surrounding the storage location, and location of door and gate locks.

8 - 14.4 - OPERATING AND EMERGENCY PROCEDURES

Regulations: 420-3-26-.02(11)(b), 420-3-26-.03(5), 420-3-26-.03(25), 420-3-26-.03(26), 420-3-26-.03(51), 420-3-26-.03(52), 420-3-26-.03(53), 420-3-26-.02(29).

Criteria: Each applicant must do the following:

Develop, implement, and maintain operating and emergency procedures containing the following elements:

Instructions for using the portable gauge and performing routine maintenance, according to the manufacturer’s recommendations and instructions;

Instructions for maintaining security during storage and transportation;

Instructions to keep the gauge under control and immediate surveillance during use;

Steps to take to keep radiation exposures ALARA;

Steps to maintain accountability during use;

Steps to control access to a damaged gauge; and

Steps to take, and whom to contact, when a gauge has been damaged.

If gauges are used for measurements with the unshielded source extended more than 3 feet beneath the surface, licensees must do the following:

Require use of surface casing or alternative procedures to ensure the source can move freely in the hole;

Provide instructions for procedures to follow to retrieve a stuck source; and

Require reporting to the Agency, pursuant to 420-3-26-.02(29)(b)2., when a stuck source cannot be retrieved.

Provide copies of operating and emergency procedures to all gauge users and at each job site.

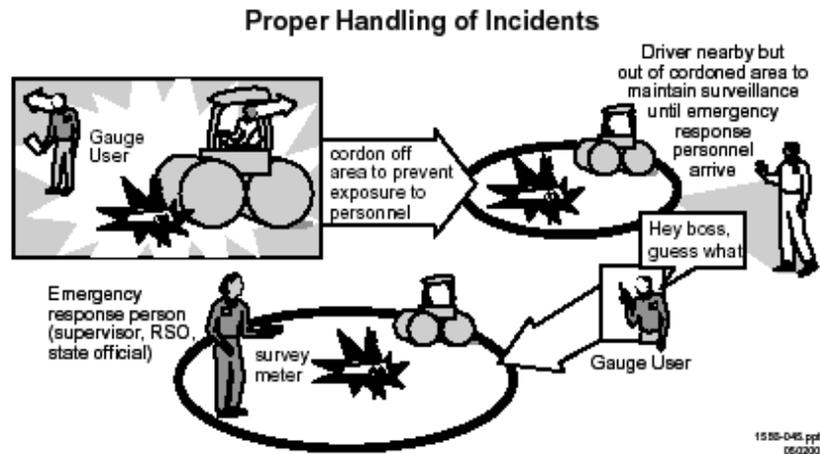


Figure 8.5 Proper Handling. *Gauges are often damaged by heavy equipment at job sites and emergency procedures need to minimize radiation safety risk.*

Discussion: Lost or stolen gauges and, as illustrated in Figure 8.5, gauges damaged by heavy equipment during use at job sites are the most common occurrences that present a potentially significant radiation safety risk. Operating and emergency procedures should be developed to minimize these risks. See Appendix D for sample procedures. Certain portable gauges are used to make measurements with the unshielded source extended more than 3 feet beneath the surface. Unless precautionary measures are taken, it is possible for the source to be buried under dirt or concrete that collapses around the source during the measurements.

Precautionary measures need to be planned in advance to prevent these sources from being buried and to recover sources should they become stuck. To ensure that 1) the hole is free of debris; 2) it is not likely that debris will re-enter the cased hole; and 3) the source will be able to move freely, the Agency will normally require the use of surface casing from the lowest depth to 12 inches above the surface. If it is not feasible to extend the casing 12 inches above the surface, licensees may cap the hole and use dummy probes before making measurements with an unshielded source to ensure that the hole is free of obstructions.

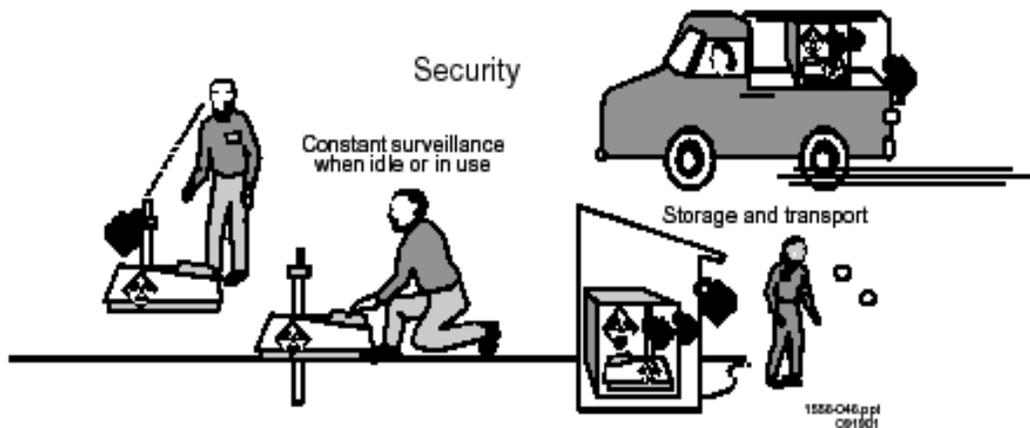


Figure 8.6 Security. *To avoid lost or stolen gauges, licensees must keep the gauges under constant surveillance, or secured against unauthorized use or removal.*

Notify the Agency when gauges are lost, stolen, or certain other conditions are met. Refer to the regulations for a description of when and where notifications are required.

The Agency considers security of gauges extremely important, and lack of security is a significant violation for which gauge licensees can be assessed civil penalties. Figure 8.6 illustrates steps that should be taken to prevent loss, theft, or unauthorized use. Whenever a portable gauge is in a controlled or unrestricted area and is not in storage, the licensee must control and maintain constant surveillance of the gauge.

Licensees are required to use a minimum of two independent physical controls to secure the gauge. Some examples of two independent physical controls for long term storage in a licensed facility are:

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.

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.

The portable gauge or transportation case containing the portable gauge is stored in a locked room, with a locked door, within a secured building for which the licensee controls access by lock and key or a security guard.

When a portable gauge is in transit, or stored in a vehicle incidental to transit, licensees may not use a lock on the transportation case or a lock on the source rod handle as one of the two independent physical controls. This is because the gauge case itself is portable. Some examples of two independent physical controls for gauges that are in transport, or stored in a vehicle incidental to transportation are:

The portable gauge or transportation case containing the portable gauge is stored in a box physically attached to the vehicle, and the box is secured with:

Two independent locks; or,

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,

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.

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 is portable and could be easily removed.

When a job requires storage of a portable gauge at temporary job sites or at locations other than an authorized facility, the licensee should use a permanent structure for storage if practicable to do so. When storing a portable gauge in temporary or permanent residential quarters incidental to transportation, the licensee should limit access by storing the gauge in a separate room away from members of the public, and must also meet radiation exposure limits specified in 420-3-26-.03. Some examples of two independent physical controls for gauges that are stored at a temporary job site or at locations other than an authorized facility include:

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), 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.

The portable gauge or transportation case containing the portable gauge is stored inside a locked room within a temporary or permanent residential quarters, 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.

The portable gauge or transportation case containing the portable gauge is stored inside 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.

Response from Applicant: Do one of the following:

State: “We will implement and maintain the operating and emergency procedures in Appendix D of ‘Guide For The Preparation Of Applications For Licenses For The Use Of Sealed Sources In Portable Gauging Devices’, dated February 2004, and provide copies of these procedures to all gauge users and at each job site.”, or,

Submit alternative procedures.

Note: Alternative procedures will be reviewed against the criteria listed above.

8 - 14.5 - LEAK TESTS

Regulations: 420-3-26-.03(16).

Criteria: The Agency requires testing to determine whether there is any radioactive leakage from the source in the device. The Agency finds testing to be acceptable if it is conducted by an organization approved by the Agency, the NRC or another Agreement State or according to procedures approved by the Agency, the NRC or another Agreement State. Records of test results must be maintained.

Discussion: When issued, a license will require performance of leak tests at intervals approved by the Agency, the NRC or another Agreement State and specified in the SSD Registration Sheet. The measurement of the leak test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bqs (0.005 microcurie) of radioactivity (37 Bqs or 0.001 microcurie for radium 226). Manufacturers, consultants, and other organizations may be authorized by the Agency, the NRC or another Agreement State to either perform the entire leak test sequence for other licensees or provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the gauge manufacturer’s and the kit supplier’s instructions and return it to the kit supplier for evaluation and reporting results. Leak test samples should be collected at the most accessible area where contamination would accumulate if the sealed source were leaking. Licensees may also be authorized to conduct the entire leak test sequence themselves.

Response from Applicant: Do either of the following:

State: “Leak tests will be performed at intervals approved by the Agency, the NRC or an Agreement State and specified in the Sealed Source and Device Registration Sheet. Leak tests will be performed by an organization authorized by the Agency, the NRC or an Agreement State to provide leak testing services to other licensees or using a leak test kit supplied by an organization authorized by the Agency, the NRC or an Agreement State to provide leak test kits to other licensees and according to the kit supplier’s instructions.”

OR

Provide information supporting a request to perform leak testing and sample analysis. Appendix E offers a sample procedure for performing leak tests and sample analysis.

Note: Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, Agency staff will authorize via a license condition.

8 - 14.6 - TRANSPORTATION

Regulations: 420-3-26-.02(24), 49 CFR Parts 171-178, 420-3-26-.03(5).

Criteria: Applicants must develop, implement, and maintain safety programs for public transport of radioactive material to ensure compliance with DOT regulations.

Discussion: Some DOT requirements are often overlooked by portable gauge licensees. For example, the labeling of the transport container must be maintained in a legible condition. With regard to blocking and bracing, the licensee must assure that the transport container does not shift during transport. A minimum of two independent physical controls must be used to maintain security of the devices. During an inspection, the Agency uses the provisions of 420-3-26-.02(24) to examine and enforce transportation requirements applicable to portable gauge licensees. Appendix F lists major DOT regulations and provides a sample shipping paper.

Response from Applicant: No response is needed from applicants during the licensing process. This issue will be reviewed during inspection.

References: “Radioactive Material Regulations Review,” RAMREG-001-98 (1998 revision) can be obtained by calling DOT’s Office of Hazardous Material Initiatives and Training at (202) 366-4900.

8 - 14.7 - TERMINATION OF ACTIVITIES

Regulations: 420-3-26-.02(12)(b), 420-3-26-.02(26)(h)3.(i), 420-3-26-.02(13), 420-3-26-

.02(30)(f).

Criteria: The licensee must do the following:

Notify Agency, in writing, within 60 days, when principal activities have not been conducted for a period of 24 months or a decision is made to permanently cease licensed activities;

Certify the disposition of licensed materials by submitting Agency Form DRM, "Certificate of Disposition of Materials," available from the Agency upon request;

Before a license is terminated, send the records important to decommissioning (as required by 420-3-26-.02(26)(h)3.(i)) to the Agency. If licensed activities are transferred or assigned in accordance with 420-3-26-.02(12)(b), transfer records important to decommissioning to the new licensee.

Discussion: For guidance on the disposition of licensed material, see the Section 8 - Item 15, Waste Management – Gauge Disposal and Transfer. For guidance on decommissioning records, see section 12, Radioactive Materials – Financial Assurance and Recordkeeping for Decommissioning.

Response from Applicant: The applicant is not required to submit a response to Agency during the initial application. However, when the license expires or when the licensee ceases operations, then Agency Form DRM, "Certificate of Disposition of Materials" must be submitted.

8 - ITEM 15: WASTE MANAGEMENT – GAUGE DISPOSAL AND TRANSFER

Regulations: 420-3-26-.03(33), 420-3-26-.02(18), 420-3-26-.01(4).

Criteria: Licensed materials must be disposed of in accordance with Agency requirements by transfer to an authorized recipient. Appropriate records must be maintained.

Discussion: Significant problems can arise from improper gauge transfer or failure to dispose of gauges in a proper and timely manner. Such problems include the possession of radioactive materials by unauthorized individuals which could result in exposures to members of the general public. When disposing of portable gauges, licensees must transfer them to an authorized recipient. Authorized recipients are the original manufacturer of the device, a commercial firm licensed by the Agency, the NRC or another Agreement State to accept radioactive waste from other persons, or another specific licensee authorized to possess the licensed material (i.e., their license specifically authorizes the type, form, and quantity of the radioactive material). Before transferring radioactive material, a licensee must verify that the recipient is properly authorized to receive it using one of the methods described in 420-3-26-

.02(18). In addition, all packages containing radioactive sources must be prepared and shipped in accordance with Agency and DOT regulations. Records of the transfer must be maintained as required by 420-3-26-.01(4).

Response from Applicant: The applicant does not need to provide a response to this item during the licensing process. However, the licensee should establish and include waste disposal procedures in its radiation safety program. Because of the difficulties and costs associated with disposal of americium-241 sealed neutron sources, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the source supplier as part of a purchase agreement.

8 - ITEM 16: CERTIFICATION

Individuals acting in a private capacity are required to date and sign Agency Form RM. Otherwise, a representative of the corporation or legal entity filing the application must sign and date Agency Form RM. The representative signing the application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. As discussed previously in “Management Responsibility,” signing the application acknowledges management’s commitment to and responsibility for the radiation protection program. The Agency will return all unsigned applications for proper signature.

Notes:

It is a criminal offense to make a willful false statement or representation on applications or correspondence.

When the application references commitments, those items become binding and are part of the license conditions and regulatory requirements.

9 FEES

Each application for a new license must be accompanied by the appropriate fee. Application and annual licensing fees are set, by law, at 75% of the comparable fee charged by the U.S. Nuclear Regulatory Commission. Since fees are subject to change on a yearly basis, please contact the Agency to obtain the current fees. The Agency will not issue a new license before it receives the application fee. Once technical review has begun, no fees will be refunded; application fees are charged regardless of the Agency’s disposition of an application or the withdrawal of an application.

10 APPLICATIONS FOR EXEMPTIONS

Regulations: 420-3-26-.01(3).

Licensees may request exemptions to regulations. The regulations state that the Agency may

grant an exemption, acting on its own initiative or on an application from an interested person. Exemptions are not intended to revise regulations, are not intended for large classes of licensees, and are generally limited to unique situations. Exemption requests must be accompanied by descriptions of the following:

The exemption requested and a justification of why it is needed;

Proposed compensatory safety measures intended to provide a level of health and safety equivalent to the regulation for which the exemption is being requested;

Alternative methods for complying with the regulation and why compliance with the existing regulation is not feasible.

Until the Agency grants an exemption in writing, strict compliance with all applicable regulations is required.

11 AMENDMENTS AND RENEWALS TO A LICENSE

It is the licensee's obligation to keep the license current. If any information in the original application is to be modified or changed, the licensee must submit an application for a license amendment before the change takes place. Also, to continue the license after its expiration date, the licensee must submit an application for a license renewal at least 30 days before the expiration date (420-3-26-.02(14)(b)).

For renewal and amendment requests, applicants must do the following:

Be sure to use the most recent guidance in preparing an amendment or renewal request;

Submit either an Agency Form RM or a letter requesting amendment or renewal;

Provide the license number;

For renewals, only Item 8 may be completed by referring to information on file.

12 FINANCIAL ASSURANCE AND RECORDKEEPING FOR DECOMMISSIONING

Regulations: 420-3-26-.02(12)(b), 420-3-26-.02(26).

Criteria: Portable gauge licensees possessing sealed sources containing radioactive material in excess of the limits specified in 420-3-26-.02(26) must provide evidence of financial assurance for decommissioning. Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where gauges are used or stored and to leaking sources. Licensees must transfer these records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with 420-3-26-.02(12)(b).

Discussion: The requirements for financial assurance are specific to the types and quantities of radioactive material authorized on a license. Most portable gauge applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources are 3.7×10^6 gigabecquerels (100,000 curies) of cesium-137 or 3.7×10^3 gigabecquerels (100 curies) of americium-241 or californium-252. Thus, a licensee would need to possess hundreds of gauges (typically containing about 0.30 gigabecquerels (8 millicuries) of cesium-137 and 1.5 gigabecquerels (40 millicuries) of americium-241) before the financial assurance requirements would apply. Standard portable gauge licenses do not specify the maximum number of gauges that the licensee may possess (allowing the licensee flexibility in obtaining gauges as needed without amending its license). Applicants and licensees desiring to possess gauges exceeding the threshold amounts must submit evidence of financial assurance. The same regulation also requires that licensees maintain records important to decommissioning in an identified location. All portable gauge licensees need to maintain records of structures and equipment where gauges are used or stored at locations specifically listed on the license. As built drawings with modifications of structures and equipment shown, as appropriate, fulfill this requirement. If drawings are not available, licensees may substitute appropriate records concerning the areas and locations. In addition, if portable gauge licensees have experienced unusual occurrences (e.g., leaking sources, other incidents that involve spread of contamination), they also need to maintain records about contamination that remains after cleanup or that may have spread to inaccessible areas. For portable gauge licensees whose sources have never leaked, acceptable records important to decommissioning are sketches or written descriptions of portable gauge storage or use locations specifically listed on the license. Similar information need not be maintained for temporary job sites unless a source leaked at a particular site.

Response from Applicants: No response is needed from most applicants. If financial assurance is required, submit evidence.

ALABAMA DEPARTMENT OF PUBLIC HEALTH APPLICATION FOR A RADIOACTIVE MATERIAL LICENSE

Instructions - Complete all items (1-16). If application is for renewal of a license, only Item 8. may be completed by referring to information on file. Use supplemental sheets where necessary. Mail the original to: Alabama Office of Radiation Control, P.O. Box 303017, Montgomery, Alabama, 36130-3017. Upon approval of this application, the applicant will receive an Alabama Radioactive Materials License. An Alabama Radioactive Materials License is issued in accordance with the general requirements contained in Rule 420-3-26-.02 of Chapter 420-3-26, and the licensee is subject to other applicable parts of the same rules, as well as any applicable fees.

<p>1(a). Name, mailing address of applicant (Institution, firm, hospital, persons, etc.)</p> <p>Adm. Telephone No: Area Code () _____</p> <p>Adm. E-mail Address: _____</p>	<p>1(b). Street address(es) at which radioactive material will be used</p> 	
<p>2. Location where all records will be kept</p> 	<p>3. This is an application for (check and complete appropriate items):</p> <p style="margin-left: 40px;">_____ a. New License</p> <p style="margin-left: 40px;">_____ b. Amendment to License No. _____</p> <p style="margin-left: 40px;">_____ c. Renewal of License No. _____</p>	
<p>4. Individual user(s) (Name and title of person(s) requested to be named on the license to use or physically supervise the use of radioactive material. Give training and experience in Item 8.)</p> 	<p>5. Radiation Safety Officer (Name of person to be designated as the Radiation Safety Officer. Attach resume of training and experience.)</p> <p>RSO Telephone No: Area Code () _____</p> <p>RSO Fax No: Area Code () _____</p> <p>RSO E-mail Address: _____</p>	
<p>6. Radioactive Material</p>		
<p>a. Element and Mass Number</p> 	<p>b. Chemical and/or Physical Form (If sealed sources, also state manufacturer's name and model number)</p> 	<p>c. Maximum Activity to be Possessed at any Time (If sealed sources, number of sources, and maximum activity per source.)</p>

7. Describe purpose for which radioactive material will be used. (If radioactive material is for “human use”, supplement A (Form RM-HU) must be completed and submitted. If the radioactive material is in the form of sealed sources, include the make and model number of the storage container(s) and/or device(s) in which the source(s) will be stored and/or used.)

8. Training and Experience in Radiation Safety

- a. Formal Training in Radiation Safety: Attach a resumé for each individual named in Items 4 and 5. Describe each individual’s formal training in the principles and practices of radiation protection; radioactivity measurement standardization and monitoring techniques and use of instruments; mathematics and calculations basic to the use and measurement of radioactivity; and biological effects of radiation. Include the name of the person or institution providing the training, duration of training and when training was received. Attach a copy of a training certificate from an approved training course, where applicable.
- b. Experience: Attach a resumé for each individual named in Items 4 and 5. Describe each individual’s work experience with radiation, including where the experience was obtained. Include a list of radioisotopes and the maximum activity of each use.
- c. Are medical use physicians listed as individual users in Item 4 licensed to practice medicine in Alabama? **YES**____ **NO**____

9. Radiation detection instruments (Use supplemental sheets if necessary)

Type of instruments (make and model # of each)	Number available	Radiation Detected	Sensitivity Range (mR/hr)	Use (monitoring, surveying, measuring)

10. Calibration of the radiation detection instruments (specify the frequency and methods to be used in calibrating radiation detection instruments)

Submit Items 11 through 15 on supplemental sheets and attach all supplemental sheets to this application

- 11. Describe what personal dosimetry, if any, will be used. Specify the type (film badge, TLD, OSL, etc.), frequency of change, and supplier.
- 12. Describe what, if any, bio-assay procedures will be used. Submit the frequency at which bio-assays will be performed, and the calibration and analysis procedures to be used.
- 13. Describe facilities and equipment (including storage containers, shielding, fume hoods, etc.). Attach an explanatory sketch or diagram of the areas of use and/or storage, including adjacent areas.
- 14. Describe the radiation protection program as appropriate for the material to be used. Include methods and procedures for receiving handling, servicing, using and storing radioactive material as well as emergency procedures. If the application includes a request for sealed sources, submit leak testing procedures. If leak test kits will be used, include the manufacturer’s name and model number of the kit, and the name of the individual or company that will perform analysis of the leak test sample.
- 15. Submit a detailed description of methods that will be used for disposing of radioactive wastes, and estimates of the type and amount of activity involved. If a commercial waste disposal service is to be employed, specify the name of the company.

16. Certification: The applicant and any official executing this certificate on behalf of the applicant named in Item 1, certifies that this application is prepared in conformity with Chapter 420-3-26, and that all information contained herein, including any supplements attached hereto, is true and correct to the best of our knowledge and belief.

Signature of Certifying Official

Printed Name and Title of Certifying Official

Date

Appendix B

Typical Duties and Responsibilities of the Radiation Safety Officer

The RSO's duties and responsibilities are illustrated in Figure 8.1 and typically include ensuring the following:

- Licensed activities that the RSO considers unsafe are stopped;
- Possession, use, storage, and maintenance of sources and gauges are consistent with the limitations in the license, the Sealed Source and Device Registration sheet(s), and the manufacturer's recommendations and instructions;
- Individuals who use gauges are properly trained;
- When necessary, personnel monitoring devices are used and exchanged at the proper intervals; records of the results of such monitoring are maintained;
- Gauges are properly secured;
- 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 and documented, and corrective actions are taken;
- Licensed material is transported in accordance with all applicable DOT requirements;
- Licensed material is disposed of properly;
- Appropriate records are maintained;
- An up-to-date license is maintained and amendment and renewal requests are submitted in a timely manner;
- Up-to-date operating and emergency procedures are developed, maintained, distributed, and implemented;
- Non-routine operations are performed by the manufacturer, distributor, or person specifically authorized by the Agency, the NRC or an Agreement State;
- Documentation is maintained to demonstrate, by measurement or calculation, that the TEDE to the individual member of the public likely to receive the highest dose from the licensed operation does not exceed the annual limit in 420-3-26-.03(14);
- When the licensee identifies violations of regulations or license conditions or program weaknesses, corrective actions are developed, implemented, and documented;
- Posting of documents required by 420-3-26-.10(2) (420-3-26-.03 and 420-3-26-.10, license documents, operating procedures, Agency Form X, "Notice to Employees") or posting a notice indicating where these documents can be examined.

Appendix C

Sample Portable Gauge Audit Checklist

Note: All areas indicated in audit notes may not be applicable to every license and may not need to be addressed during each audit.

Licensee's Name: _____ License No.: _____

Auditor: _____ Date of Audit: _____ Telephone No.: _____

(Signature)

1. AUDIT HISTORY

- a. Last audit of this location conducted on (date) _____.
- b. Were previous audits conducted yearly? [420-3-26-.03(5)]
- c. Were records of previous audits maintained? [420-3-26-.03(41)]
- d. Were any deficiencies identified during the last two audits or two years, whichever is longer?
- e. Were corrective actions taken? (Look for repeated deficiencies).

2. ORGANIZATION AND SCOPE OF PROGRAM

- a. If the mailing address or places of use changed, was the license amended?
- b. If ownership changed or bankruptcy was filed, was prior Agency consent obtained or was the Agency notified?
- c. If the RSO was changed, was the license amended? Does the new RSO meet Agency training requirements?
- d. If the designated contact person for the Agency changed, was the Agency notified?
- e. Does the license authorize all of the regulated radionuclides contained in the gauges possessed?
- f. Are the gauges as they are described in the Sealed Source and Device (SSD) Registration Certificate or Sheet? Are copies of (or access to) SSD Certificates available? Does the licensee have the manufacturers' manuals for operation and maintenance?
- g. Are the actual uses of gauges consistent with the authorized uses listed on the license?
- h. Is the RSO fulfilling his/her duties?

3. TRAINING AND INSTRUCTIONS TO WORKERS

- a. Were all individuals working in or frequenting any portion of a restricted area instructed per 420-3-26-.10(3)? Was refresher training provided, as needed?
- b. Did each gauge operator attend an approved course before using the gauges?
- c. Are training records maintained for each gauge operator?
- d. Did interviews with operators reveal that they know the emergency procedures?
- e. Did this audit include observation of operators using the gauge in a field situation?
Operating gauge? Transporting gauge? Storing gauge?
- f. Did the operator demonstrate safe handling and security during transportation, use, and storage?
- g. Was HAZMAT training (required at least once every three years) provided as required? [49 CFR 172.700, 49 CFR 172.701, CFR 172.702, 49 CFR 172.703, 49 CFR 172.704]

4. RADIATION SURVEY INSTRUMENTS

- a. If the licensee possesses its own survey meter, does the survey meter meet the Agency's criteria?
- b. Is a calibrated, operable survey meter available?

c. Are calibration records maintained? [420-3-26-.03(42)(a)]

5. GAUGE INVENTORY

- a. Is a record kept showing the receipt of each gauge?
- b. Are all gauges received physically inventoried every 6 months?
- c. Are records of inventory results with appropriate information maintained?

6. PERSONNEL RADIATION PROTECTION

- a. Are ALARA considerations incorporated into the radiation protection program? [420-3-26-.03(5)(b)]
- b. Is documentation kept showing that unmonitored users receive less than 10 percent of limit?
- c. Did unmonitored users' activities change during the year which could put them over 10 percent of limit?
- d. If yes to c. above, was a new evaluation performed?
- e. Is external dosimetry required (user receiving greater than 10 percent of limit)? Is dosimetry provided to users?
 - i. Is the dosimetry supplier NVLAP-approved? [420-3-26-.03(17)(c)]
 - ii. Are the dosimeters exchanged monthly for film badges and at the industry-recommended frequency for TLDs?
 - iii. Are dosimetry reports reviewed by the RSO when they are received?
 - iv. Are the records NRC forms or equivalent? [420-3-26-.03(10)(d), 420-3-26-.03(44)(a)]
 - Agency Form Y, "Cumulative Occupational Exposure History" completed?
 - Agency Form Z, "Occupational Exposure Record for a Monitoring Period" completed?
 - v. If a worker declared her pregnancy, did licensee comply with 420-3-26-.03(13)? Were records kept of embryo/fetus dose per 420-3-26-.03(46)(d)?
- f. Are records of exposures, surveys, monitoring, and evaluations maintained?

7. PUBLIC DOSE

- a. Are gauges stored in a manner to keep doses below 100 mrem in a year? [420-3-26-.03(14)(a)(1)]
- b. Has a survey or evaluation been performed per 420-3-26-.03(17)(a)? Have there been any additions or changes to the storage, security, or use of surrounding areas that would necessitate a new survey or evaluation?
- c. Do unrestricted area radiation levels exceed 2 mrem in any one hour? [420-3-26-.03(14)(a)(2)]
- d. Are gauges being stored in a manner that would prevent unauthorized use or removal? [420-3-26-.03(25)]
- e. Are records maintained? [420-3-26-.03(42), 420-3-26-.03(47)]

8. OPERATING AND EMERGENCY PROCEDURES

- a. Have operating and emergency procedures been developed?
- b. Do they contain the required elements?
- c. Does each operator have a current copy of the operating and emergency procedures, including current telephone numbers?

9. LEAK TESTS

- a. Was each sealed source leak tested every 6 months or at other prescribed intervals?
- b. Was the leak test performed as described in correspondence with the Agency and according to the license?
- c. Are records of results retained with the appropriate information included?
- d. Were any sources found leaking and if yes, was the Agency notified?

10. MAINTENANCE OF GAUGES (IF APPLICABLE)

- a. Are manufacturer's procedures followed for routine cleaning and lubrication of the gauge?
- b. Does the source or source rod remain attached to the gauge during cleaning?
- c. Is non-routine maintenance performed where the source or source rod is detached from the gauge? If yes, was it performed according to license requirements (e.g., extent of work, individuals performing the work,

procedures, dosimetry, survey instrument, compliance with 420-3-26-.03(14) limits)?

11. TRANSPORTATION

- a. Were DOT-7A or other authorized packages used? [49 CFR 173.415, 49 CFR 173.416(b)]
- b. Are package performance test records on file?
- c. Are special form sources documented? [49 CFR 173.476(a)]
- d. Did the package have 2 labels (ex. Yellow-II) with TI, Nuclide, Activity, and Hazard Class? [49 CFR 172.403, 49 CFR 173.441]
- e. Was the package properly marked? [49 CFR 172.301, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324]
- f. Was the package closed and sealed during transport? [49 CFR 173.475(f)]
- g. Were shipping papers prepared and used? [49 CFR 172.200(a)]
- h. Did the shipping papers contain proper entries (Shipping name, Hazard Class, Identification Number (UN Number), Total Quantity, Package Type, Nuclide, RQ, Radioactive Material, Physical and Chemical Form, Activity, Category of Label, TI, Shipper's Name, Certification and Signature, Emergency Response Phone Number, Cargo Aircraft Only [if applicable])? [49 CFR 172.200, 49 CFR 72.201, 49 CFR 172.202, 49 CFR 172.203, 49 CFR 172.204, 49CFR 172.604]
- i. Were the shipping papers within the driver's reach and readily accessible during transport? [49 CFR 177.817(e)]
- j. Was the package secured against movement? [49 CFR 177.834]
- k. Were two physical barriers used to secure the gauge?
- L. Was the vehicle placarded, if needed? [49 CFR 172.504]
- m. Were overpacks, if needed, used properly? [49 CFR 173.25]
- n. Were any incidents reported to DOT? [49 CFR 171.15, 16]

12. AUDITOR'S INDEPENDENT SURVEY MEASUREMENTS (IF MADE)

- a. Describe the type, location, and results of measurements. Do any radiation levels exceed regulatory limits?

13. NOTIFICATION AND REPORTS

- a. Was any radioactive material lost or stolen? Were reports made? [420-3-26-.03(51)]
- b. Did any reportable incidents occur? Were reports made? [420-3-26-.03(52)]
- c. Did any overexposures and high radiation levels occur? Were they reported? [420-3-26-.03(53)]
- d. If any events (as described in items a through c above) did occur, what was the root cause? Were the corrective actions appropriate?
- e. Is the licensee aware of the emergency telephone numbers for the Agency?

14. POSTING AND LABELING

- a. Is Agency Form X "Notice to Workers" posted? [420-3-26-.10(2)(c)]
- b. Are Agency regulations and license documents posted or is a notice posted stating where these documents are located? [420-3-26-.10(2)]
- c. Is there any other posting and labeling? [420-3-26-.03(28), 420-3-26-.03(30)]

15. RECORDKEEPING FOR DECOMMISSIONING

- a. Are records kept of information important to decommissioning? [420-3-26-.02(26)(g)]
- b. Do records include all information outlined? [420-3-26-.02(26)(g)]

16. SPECIAL LICENSE CONDITIONS OR ISSUES

- a. Did the auditor review special license conditions or other issues (e.g., non-routine maintenance)?

17. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS

- a. Summarize problems and/or deficiencies identified during the audit.
- b. If problems and/or deficiencies were identified in this audit, describe the corrective actions planned or taken.

Are corrective actions planned or taken at ALL licensed locations (not just location audited)?

c. Provide any other recommendations for improvement.

18. EVALUATION OF OTHER FACTORS

a. Is senior licensee management appropriately involved with the radiation protection program and/or RSO oversight?

b. Does the RSO have sufficient time to perform his/her radiation safety duties?

c. Does the licensee have sufficient staff to support the radiation protection program?

Appendix D

Sample Operating and Emergency Procedures

Operating Procedures

If personnel dosimetry is provided:

- Always wear your assigned thermoluminescent dosimeter (TLD) or film badge when using the gauge;
- Never wear another person's TLD or film badge;
- Never store your TLD or film badge near the gauge.

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.

Sign out the gauge in a 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 job site(s) where the gauge will be used.

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.

Use the gauge according to the manufacturer's instructions and recommendations.

Do not touch the unshielded source rod with your fingers, hands, or any part of your body.

Do not place hands, fingers, feet, or other body parts in the radiation field from an unshielded source.

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.

After completing each measurement in which the source is unshielded, immediately return the source to the shielded position.

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 action necessary to protect the gauge and yourself from danger of moving heavy equipment.

Always keep unauthorized persons away from the gauge.

Perform routine cleaning and maintenance according to the manufacturer's instructions and recommendations.

When the gauge is not in use at a temporary job site, place the gauge in a secured storage location (e.g., locked in the trunk of a car or locked in a storage shed).

Before 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, preferably in a closed compartment.

Return the gauge to its proper locked storage location at the end of the work shift.

Log the gauge into the daily use log when it is returned to storage.

If gauges are used for measurements with the unshielded source extended more than 3 feet beneath the surface, use piping, tubing, or other casing material to line the hole from the lowest depth to 12 inches above the surface. If the piping, tubing, or other casing material cannot extend 12 inches above the surface, cap the hole liner or take other steps to ensure that the hole is free of debris (and it is unlikely that debris will re-enter the cased hole) so that the unshielded source can move freely (e.g., use a dummy probe to verify that the hole is free of obstructions).

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.

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, is in a vehicle involved in an accident):

Immediately secure the area and keep people 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.

If any heavy equipment is involved, detain the equipment and operator until it is determined there is no contamination present.¹

Gauge users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives.

Notify the following persons, in the order listed below, of the situation:

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

NAME ₂	WORK PHONE NUMBER ₂	HOME PHONE NUMBER ¹
_____	_____	_____
_____	_____	_____
_____	_____	_____

Follow the directions provided by the person contacted above.

RSO and Licensee Management

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 to the Agency as required (Even if it is not required, you may report *any* incident to the Agency using the current emergency call list.). Agency notification is required when gauges containing licensed material are lost or stolen, when gauges are damaged or involved in incidents that result in doses in excess of 420-3-26-.03(53) limits, and when it becomes apparent that attempts to recover a source stuck below the surface will be unsuccessful.

Reports to the Agency must be made within the reporting time frames specified by the regulations.

Reporting requirements are found in 420-3-26-.03(51), 420-3-26-.03(52) and 420-3-26-.03(53).

¹Fill in with (and update, as needed) the names and telephone numbers of appropriate personnel (e.g., the RSO or other knowledgeable licensee staff, licensee's consultant, gauge manufacturer) to be contacted in case of emergency.

Appendix E

Requests to Perform Leak Testing and Sample Analysis

Sample Leak Test Program

Training

Before allowing an individual to perform leak testing, the RSO will ensure that he or she has sufficient classroom and on-the-job training to show competency in performing leak tests independently. Classroom training may be in the form of lecture, videotape, or self-study, and will cover the following subject areas:

- Principles and practices of radiation protection;
- Radioactivity measurements, monitoring techniques, and the use of instruments;
- Mathematics and calculations basic to the use and measurement of radioactivity;
- Biological effects of radiation.

Appropriate on-the-job-training consists of:

- Observing authorized personnel collecting and analyzing leak test samples;
- Collecting and analyzing leak test samples under the supervision and in the physical presence of an individual authorized to perform leak tests.

Facilities and Equipment

To ensure achieving the required sensitivity of measurements, leak tests will be analyzed in a low-background area.

Individuals conducting leak tests will use a calibrated and operable survey instrument to check leak test samples for gross contamination before they are analyzed.

An NaI(Tl) well counter system with a single or multichannel analyzer will be used to count samples from gauges containing gamma-emitters (e.g., Cs-137, Co-60).

A liquid scintillation or gas-flow proportional counting system will be used to count samples from gauges containing beta-emitters (e.g., Sr-90) or alpha emitters (e.g., Am-241).

Frequency for Conducting Leak Tests of Sealed Sources

Leak tests will be conducted at the frequency specified in the respective SSD Registration Certificate.

Procedure for Performing Leak Testing and Analysis

For each source to be tested, list identifying information such as gauge serial number, radionuclide, activity.

Use a survey meter to monitor exposure.

Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.

Number each wipe to correlate with identifying information for each source.

Wipe the most accessible area where contamination would accumulate if the sealed source were leaking.

Select an instrument that is sensitive enough to detect 185 Bq (0.005 microcurie) of the radionuclide contained in the gauge.

Using the selected instrument, count and record background count rate.

Check the instrument's counting efficiency using standard source of the same radionuclide as the source being tested or one with similar energy characteristics. Accuracy of standards should be within +/-5 percent of the stated value and traceable to a primary radiation standard such as those maintained by the National

Institutes of Standards and Technology (NIST).

Calculate efficiency.

For example: $[(\text{cpm from std}) - (\text{cpm from bkg})] = \text{efficiency in cpm/Bq activity of std in Bq where:}$

cpm = counts per minute

std = standard

bkg = background

Bq = Becquerel

Count each wipe sample; determine net count rate.

For each sample, calculate and record activity in Bq (or microcuries).

For example: $[(\text{cpm from wipe sample}) - (\text{cpm from bkg})] = \text{Bq on wipe sample}$

efficiency in cpm/Bq

Sign and date the list of sources, data, and calculations. Retain records for 3 years.

If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the RSO so that the source can be withdrawn from use and disposed of properly, and in addition, notify the Agency.

Appendix F

Major DOT Regulations; Sample Bill of Lading

The major areas in the DOT regulations that are most relevant for transportation of typical portable gauges shipped as Type A quantities are as follows:

Table of Hazardous Materials and Special Provisions 49 CFR 172.101, and App. A, Table 2: Hazardous materials table, list of hazardous substances and reportable quantities;

Shipping Papers 49 CFR 172.200-204: General entries, description, additional description requirements, shipper's certification;

Package Markings 49 CFR 172.300, 49 CFR 172.301, 49 CFR 172.303, 49 CFR 172.304, 49 CFR 172.310, 49 CFR 172.324: General marking requirements for non-bulk packagings, prohibited marking, marking requirements, radioactive material, hazardous substances in non-bulk packaging;

Package Labeling 49 CFR 172.400, 49 CFR 172.401, 49 CFR 172.403, 49 CFR 172.406, 49 CFR 172.407, 49 CFR 172.436, 49 CFR 172.438, 49 CFR 172.440: General labeling requirements, prohibited labeling, radioactive materials, placement of labels, specifications for radioactive labels;

Placarding of Vehicles 49 CFR 172.500, 49 CFR 172.502, 49 CFR 172.504, 49 CFR 172.506, 49 CFR 172.516, 49 CFR 172.519, 49 CFR 172.556: Applicability, prohibited and permissive placarding, general placarding requirements, providing and affixing placards, highway, visibility and display of placards, RADIOACTIVE placard;

Emergency Response Information, Subpart G, 49 CFR 172.600, 49 CFR 172.602, 49 CFR 172.604: Applicability and general requirements, emergency response information, emergency response telephone number;

Training, Subpart H, 49 CFR 172.702, 49 CFR 172.704: Applicability and responsibility for training and testing, training requirements;

Radiation Protection Program for Shippers and Carriers, Subpart I, 49 CFR 172.800, etc.;

Shippers - General Requirements for Shipments and Packaging, Subpart I, 49 CFR 173.403, 49 CFR 173.410, 49 CFR 173.412, 49 CFR 173.415, 49 CFR 173.433, 49 CFR 173.435, 49 CFR 173.441, 49 CFR 173.475, 49 CFR 173.476: Definitions, general design requirements, additional design requirements for Type A packages, authorized Type A packages, requirement for determining A1 and A2, table of A1 and A2 values for radionuclides, radiation level limit, quality control requirements prior to each shipment, approval of special form radioactive materials;

Carriage by Public Highway 49 CFR 177.816, 49 CFR 177.817, 49 CFR 177.834(a), 49 CFR 177.842: Driver training, shipping paper, general requirements (secured against movement), Class 7 (radioactive) material.

Minimum Required Packaging For Class 7 (Radioactive) Materials				
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Quantity:	< 70 Bq/g ($< 0.002 \mu\text{Ci/g}$)	Limited Quantity (\$173.421)	A ₁ /A ₂ value (\$173.435)	1 rem/hr at 3 m, un-shielded (\$173.427)
Non-LSA/SCO:	Excepted	Type A	Type B ³	
Domestic or International LSA/SCO: • LSA-I solid, (liquid) ¹ • SCO-I	Excepted	IP-I	Type B ³	
• LSA-I Liquid • LSA-II Solid, (liquid or gas) ¹ • (LSA-III) ¹ • SCO-II		IP-II	Type B ³	
• LSA-II Liquid or Gas • LSA-III		IP-III	Type B ³	
Domestic (only) LSA/SCO: • LSA-I, II, III; SCO-I, II	Excepted	Strong-tight ²	DOT Spec. 7A Type A	Type B ³ NRC Type A LSA ^{3,4}

- For entries in parentheses, exclusive use is required for shipment in an IP (e.g., shipment of LSA-I liquid in an IP-I packaging would require exclusive-use consignment)
- Exclusive use required for strong-tight container shipments made pursuant to §173.427(b)(2)
- Subject to conditions in Certificate, if NRC package
- Exclusive use required, see §173.427(b)(4). Use of these packages expires on 4/1/99 (10 CFR 71.52)

Package and Vehicle Radiation Level Limits (49 CFR 173.441) ^A				
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials				
Transport Vehicle Use:	Non-Exclusive	Exclusive		
Transport Vehicle Type:	Open or Closed	Open (flat-bed)	Open w/Enclosure ^B	Closed
Package (or freight container) Limits:				
External Surface	2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	10 mSv/hr (1000 mrem/hr)	10 mSv/hr (1000 mrem/hr)
Transport Index (TI) ^C	10	no limit		
Roadway or Railway Vehicle (or freight container) Limits:				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr (200 mrem/hr)
Vertical planes projected from outer edges		2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	N/A
Top of . . .		load: (200 mrem/hr)	enclosure: 2 mSv/hr (200 mrem/hr)	vehicle: 2 mSv/hr (200 mrem/hr)
2 meters from. . .		vertical planes: 0.1 mSv/hr (10 mrem/hr)	vertical planes: 0.1 mSv/hr (10 mrem/hr)	outer lateral surfaces: 0.1 mSv/hr (10 mrem/hr)
Underside		2 mSv/hr (200 mrem/hr)		
Occupied position	N/A ^D	0.02 mSv/hr (2 mrem/hr) ^E		
Sum of package TI's	50	no limit ^F		

- The limits in this table do not apply to excepted packages - see 49 CFR 173.421-426.
- Securely attached (to vehicle), access-limiting enclosure; package personnel barriers are considered as enclosures.
- For nonfissile radioactive materials packages, the dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour.
- No dose limit is specified, but separation distances apply to Radioactive Yellow-II or Radioactive Yellow-III labeled packages.
- This does not apply to private carrier wearing dosimetry if under radiation protection program satisfying 10 CFR 20 or 49 CFR 172 Subpart I.
- Some fissile shipments may have combined conveyance TI limit of 100 - see 10 CFR 71.59 and 49 CFR 173.457.

Hazard Communications for Class 7 (Radioactive) Materials

DOT Shipping Papers (49 CFR 172.200-205)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Entries Always Required Unless Excepted	Additional Entries Sometimes Required	Optional Entries
<ul style="list-style-type: none"> ● The basic description, in sequence: Proper Shipping Name, Hazard Class (7), U.N. Identification Number ● 24 hour emergency response telephone number ● Name of shipper ● Proper page numbering (Page 1 of 4) ● Except for empty and bulk packages, the total quantity (mass, or volume for liquid), in appropriate units (lbs, mL....) ● If not special form, chemical and physical form ● The name of each radionuclide (95 percent rule) and total package activity. The activity must be in SI units (e.g., Bq, TBq), or both SI units and customary units (e.g., Ci, mCi). However, for <u>domestic shipments</u>, the activity <i>may</i> be expressed in terms of customary units only, until 4/1/97. ● For each labeled package: <ul style="list-style-type: none"> - The category of label used; - The transport index of each package with a Yellow-II or Yellow-III label - Shipper's certification (not required of private carriers) 	<p>Materials-Based Requirements</p> <ul style="list-style-type: none"> ● If hazardous substance, "RQ" as part of the basic description ● The LSA or SCO group (e.g., LSA-II) ● "Highway Route Controlled Quantity" as part of the basic description, if HRCQ ● Fissile material information (e.g., "Fissile Exempt," controlled shipment statement [see §172.203(d)(7)]) ● If the material is considered hazardous waste and the word waste does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive Material, nos, UN2982) ● "Radioactive Material" if not in proper shipping name <p>Package-Based Requirements</p> <ul style="list-style-type: none"> ● Package identification for DOT Type B or NRC certified packages ● IAEA CoC ID number for export shipments or shipments using foreign-made packaging (see §173.473) <p>Administrative-Based Requirements</p> <ul style="list-style-type: none"> ● "Exclusive Use-Shipment" ● Instructions for maintenance of exclusive use-shipment controls for LSA/SCO strong-tight or NRC certified LSA (§ 173.427) ● If a DOT exemption is being used, "DOT-E" followed by the exemption number 	<ul style="list-style-type: none"> ● The type of packaging (e.g., Type A, Type B, IP-1,) ● The technical/chemical name may be included (if listed in §172.203(k), in parentheses between the proper shipping name and hazard class; otherwise inserted in parenthesis after the basic description) ● Other information is permitted (e.g., functional description of the product), provided it does not confuse or detract from the proper shipping name or other required information ● For fissile radionuclides, except Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may be used <i>in place of</i> activity units. For Pu-238, Pu-239, and Pu-241, the weight in grams or kilograms may optionally be entered <i>in addition to</i> activity units [see §172.203(d)(4)] ● Emergency response hazards and guidance information (§§172.600-604) may be entered on the shipping papers, or may be carried with the shipping papers [§172.602(b)]

Some Special Considerations/Exceptions for Shipping Paper Requirements

- Shipments of Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from shipping papers. For limited quantities (§173.421), this is only true if the limited quantity is not a hazardous substance (RQ) or hazardous waste (40 CFR 262).
- Shipping papers must be in the pocket on the left door, or readily visible to a person entering the driver's compartment and within arm's reach of the driver.
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column, or be highlighted in a contrasting color.

Hazard Communications for Class 7 (Radioactive) Materials

Marking Packages (49 CFR 172.300-338)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Markings Always Required Unless Excepted	Additional Markings Sometimes Required	Optional Markings
<p>Non-Bulk Packages</p> <ul style="list-style-type: none"> Proper shipping name U.N. identification number Name and address of consignor or consignee, <i>unless</i>: <ol style="list-style-type: none"> highway only and no motor carrier transfers; or part of carload or truckload lot or freight container load, and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee [see §172.301(d)] <hr/> <p>Bulk Packages (i.e., net capacity greater than 119 gallons as a receptacle for liquid, or 119 gallons and 882 pounds as a receptacle for solid, or water capacity greater than 1000 lbs. with no consideration of intermediate forms of containment)</p> <ul style="list-style-type: none"> U.N. identification number, on orange, rectangular panel (see §172.332) - some exceptions exist 	<p>Materials-Based Requirements</p> <ul style="list-style-type: none"> If in excess of 110 lbs (50 kg), Gross Weight If non-bulk <i>liquid</i> package, underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 780-1985 marking] <div style="text-align: center; margin: 5px 0;">  </div> If a Hazardous substance in non-bulk package, the letters "RQ" in association with the proper shipping name <p>Package-Based Requirements</p> <ul style="list-style-type: none"> The package type if Type A or Type B (½" or greater letters) The specification-required markings [e.g., for Spec. 7A packages: "DOT 7A Type A" and "Radioactive Material" (see §178.350-353)] For approved packages, the certificate ID number (e.g., USA/9166/B(U), USA/9150/B(U)-85, ...) If Type B, the trefoil (radiation) symbol per Part 172 App. B [size: outer radius ≥ 20 mm (0.8 in)] For NRC certified packages, the model number, gross weight, and package ID number (10 CFR 71.85) <p>Administrative-Based Requirements</p> <ul style="list-style-type: none"> If a DOT exemption is being used, "DOT-E" followed by the exemption number If an export shipment, "USA" in conjunction with the specification markings or certificate markings 	<ul style="list-style-type: none"> "IP-1," "IP-2," or "IP-3" on industrial packaging is recommended Both the name and address of consignor and consignee are recommended Other markings (e.g., advertising) are permitted, but must be sufficiently away from required markings and labeling

Some Special Considerations/Exceptions for Marking Requirements

- Marking is required to be: (1) durable, (2) printed on a package, label, tag, or sign, (3) unobscured by labels or attachments, (4) isolated from other marks, and (5) be representative of the hazmat contents of the package.
- Limited Quantity (§173.421) packages and Articles Containing Natural Uranium and Thorium (§173.426) must bear the marking "radioactive" on the outside of the inner package or the outer package itself, and are excepted from other marking. The excepted packages shipped under UN 2910 must also have the accompanying statement that is required by §173.422.
- Empty (§173.428) and Radioactive Instrument and Article (§173.424) packages are excepted from marking.
- Shipment of LSA or SCO required by §173.427 to be consigned as exclusive use are excepted from marking except that the exterior of each nonbulk package must be marked "Radioactive-LSA" or "Radioactive-SCO," as appropriate. Examples of this category are domestic, strong-tight containers with less than an A₂ quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52.
- For bulk packages, marking may be required on more than one side of the package (see 49 CFR 172.302(a)).

Hazard Communications for Class 7 (Radioactive) Materials

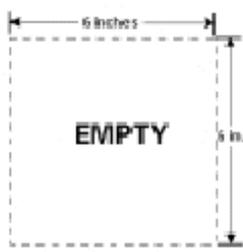
Labeling Packages (49 CFR 172.400-450)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

Placement of Radioactive Labels

- Labeling is required to be: (1) placed near the required marking of the proper shipping name, (2) printed or affixed to the package surface (not the bottom), (3) in contrast with its background, (4) unobscured by markings or attachments, (5) within color, design, and size tolerance, and (6) representative of the HAZMAT contents of the package.
- For labeling of radioactive materials packages, two labels are required on opposite sides excluding the bottom.

Determination of Required Label

<p>Size:</p> <p><i>Sides:</i> ≥ 100 mm (3.9 in.)</p> <p><i>Border:</i> 5-6.3 mm (0.2-0.25 in.)</p>	 <p>49 CFR 172.436</p>	 <p>49 CFR 172.438</p>	 <p>49 CFR 172.440</p>	 <p>49 CFR 172.450</p>
Label	WHITE-I	YELLOW-II	YELLOW-III	EMPTY LABEL
Required when:	Surface radiation level < 0.005 mSv/hr (0.5 mrem/hr)	0.005 mSv/hr (0.5 mrem/hr) < surface radiation level ≤ 0.5 mSv/hr (50 mrem/hr)	0.5 mSv/hr (50 mrem/hr) < surface radiation level ≤ 2 mSv/hr (200 mrem/h) [Note: 10 mSv/hr (1000 mrem/hr) for exclusive-use closed vehicle (§173.441(b))]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to §173.428. It must cover any previous labels, or they must be removed or obliterated.
Or:	TI = 0 [1 meter dose rate < 0.0005 mSv/hr (0.05 mrem/hr)]	TI ≤ 1 [1 meter dose rate < 0.01 mSv/hr (1 mrem/hr)]	TI ≤ 10 [1 meter dose rate < 0.1 mSv/hr (10 mrem/hr)] [Note: There is no package TI limit for exclusive-use]	
Notes:	<ul style="list-style-type: none"> Any package containing a Highway Route Controlled Quantity (HRCQ) must bear YELLOW-III label Although radiation level transport indices (TIs) are shown above, for fissile material, the TI is typically determined on the basis of criticality control 			

Content on Radioactive Labels

- RADIOACTIVE Label must contain (entered using a durable, weather-resistant means):
 - The radionuclides in the package (with consideration of available space). Symbols (e.g., Co-60) are acceptable.
 - The activity in SI units (e.g., Bq, TBq), or both SI units with customary units (e.g., Ci, mCi) in parenthesis. However, for domestic shipments, the activity *may* be expressed in terms of customary units only, until 4/1/97.
 - The Transport Index (TI) in the supplied box. The TI is entered *only* on YELLOW-II and YELLOW-III labels.

Some Special Considerations/Exceptions for Labeling Requirements

- For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, and must not display the hazard class number.
- Radioactive Material, excepted packages, under UN2910 (e.g., Limited Quantity, Empty packages, and Radioactive Instrument and Article), are excepted from labeling. However, if the excepted quantity meets the definition for another hazard class, it is re-classed for that hazard. Hazard communication requirements for the other class are required.
- Labeling exceptions exist for shipment of LSA or SCO required by § 173.427 to be consigned as exclusive use.
- The "Cargo Aircraft Only" label is typically required for radioactive materials packages shipped by air [§ 172.402(c)].

Hazard Communications for Class 7 (Radioactive) Materials

Placarding Vehicles (49 CFR 172.500-560)

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments
This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials.

Visibility and Display of Radioactive Placard

- Placards are required to be displayed:
 - On four sides of the vehicle;
 - Visible from the direction they face, (for the front side of trucks, tractor-front, trailer, or both are authorized);
 - Clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins);
 - At least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness;
 - Upright and on-point such that the words read horizontally;
 - In contrast with the background, or have a lined-border which contrasts with the background;
 - Such that dirt or water from the transport vehicle's wheels will not strike them;
 - Securely attached or affixed to the vehicle, or in a holder.
- Placard must be maintained by carrier to keep color, legibility, and visibility.

Conditions Requiring Placarding

- Placards are required for any vehicle containing a package with a RADIOACTIVE Yellow-III label.
- Placards are required for shipment of LSA or SCO required by §173.427 to be consigned as exclusive use. Examples of this category are domestic, strong-tight containers with less than an A₂ quantity, and domestic NRC certified LSA/SCO packages using 10 CFR 71.52. Also, for bulk packages of these materials, the orange panel marking with the UN Identification number is not required.
- Placards are required for any vehicle containing a package with a Highway Route Controlled Quantity (HRCQ). In this case, the placard must be placed in a square background as shown below (see §173.507(a)).

Radioactive Placard

<p>Size Specs:</p> <p>Sides: ≥ 273 mm (10.8 in.)</p> <p>Solid line Inner border: About 12.7 mm (0.5 in.) from edges</p> <p>Lettering: ≥ 41 mm (1.6 in.)</p> <p>Square for HRCQ: 387mm (15.25 in.) outside length by 25.4 mm (1 in.) thick</p>			
	49 CFR 172.556	IAEA SS 6 (1985) paras. 443-444	See 49 CFR 172.527 AND 556
	<p>RADIOACTIVE PLACARD (Domestic)</p> <p>Base of yellow solid area: 29 ± 5 mm (1.1 ± 0.2 in.) above horizontal centerline</p>	<p>RADIOACTIVE PLACARD (International)</p>	<p>RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY (either domestic or international placard could be in middle)</p>

Some Special Considerations/Exceptions for Placarding Requirements

- Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials. However, some import shipments may have this substitution in accordance with international regulations.
- Bulk packages require the orange, rectangular panel marking containing the UN ID number, which must be placed adjacent to the placard (see §172.332) [NOTE: except for LSA/SCO exclusive use under §173.427, as above].
- If placarding for more than one hazard class, subsidiary placards must not display the hazard class number. Uranium Hexafluoride (UF₆) shipments \geq 454 kg (1001 lbs) require both RADIOACTIVE and CORROSIVE (Class 8) placarding.
- For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE – YELLOW III label, vehicle placarding is not required (regardless of the label which must be placed on the camera).

Package and Vehicle Contamination Limits (49 CFR 173.443)

This table must not be used as a substitute for the DOT and NRC regulations on the transportation of radioactive materials

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm²
Sufficient measurements must be taken in the appropriate locations to yield representative assessments

$\beta\gamma$ means the sum of beta emitters, gamma emitters, and low-toxicity alpha emitters
* means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters)

*The Basic Contamination Limits
for All Packages:
49 CFR 173.443(a), Table 11*

General Requirement: Non-fixed (removable) contamination must be kept as low as reasonably achievable (ALARA)

$\beta\gamma$: 0.4 Bq/cm² = 40 Bq/100 cm² = 1x10⁻⁵ μCi/cm² = 2200 dpm/100 cm²

α : 0.04 Bq/cm² = 4 Bq/100 cm² = 1x10⁻⁶ μCi/cm² = 220 dpm/100 cm²

The following exceptions and deviations from the above basic limits exist:

Deviation from Basic Limits	Regulation 49 CFR §§	Applicable Location and Conditions Which must Be Met:
10 times the basic limits	173.443(b) and 173.443(c) Also see 177.843 (highway)	On any external surface of a package in an exclusive use shipment, during transport including end of transport. Conditions include: <ul style="list-style-type: none"> Contamination levels at beginning of transport must be below the basic limits. Vehicle must not be returned to service until radiation level is shown to be \leq 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.
10 times the basic limits	173.443(d) Also see 177.843 (highway)	On any external surface of a package, at the beginning or end of transport, if a closed transport vehicle is used, solely for transporting radioactive materials packages. Conditions include: <ul style="list-style-type: none"> A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft). Exterior of vehicle must be conspicuously stenciled, "For Radioactive Materials Use Only" in letters at least 76 mm (3 inches) high, on both sides. Vehicle must be kept closed except when loading and unloading.
100 times the basic limits	173.428	Internal contamination limit for excepted package-empty packaging, Class 7 (Radioactive) Material, shipped in accordance with 49 CFR 173.428. Conditions include: <ol style="list-style-type: none"> The basic contamination limits (above) apply to external surfaces of package. Radiation level must be \leq 0.005 mSv/hr (0.5 mrem/hr) at any external surface. Notice in § 173.422(a)(4) must accompany shipment. Package is in unimpaired condition & securely closed to prevent leakage. Labels are removed, obliterated, or covered, and the "empty" label (§172.450) is affixed to the package.

In addition, after any incident involving spillage, breakage, or suspected contamination, the modal-specific DOT regulations (§177.861(a), highway; §174.750(a), railway; and §175.700(b), air) specify that vehicles, buildings, areas, or equipment have "no significant removable surface contamination" before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after incident.

STRAIGHT BILL OF LADING
ORIGINAL - NOT NEGOTIABLE

Appendix K ---

Shipper No. _____

Carrier No. _____

Page 1 of 1

(Type of Bill)

(Date)

Date _____

TO: Builders, Inc. ** <small>On Order or Delivery slip, the latest "CO" must appear before signature & name of an authorized person in type 424, 425.</small>	FROM: Moisture Density Measurements, Inc. ** <small>Shipper</small>
Addr: 5678 Jefferson Davis Highway **	Street: 1234 A Street, NW **
City: Arlington, VA ** Zip Code: 22222**	City: Washington, DC 20000**

No. of Units & Container Type	HM	BASIC DESCRIPTION <small>From Shipping Paper Hazard Class</small>	TOTAL QUANTITY <small>(Weight, Volume, Cubic, etc.)</small>	WEIGHT <small>(Gross or Net)</small>	RATE	CHARGES <small>(Per Unit or per Container)</small>
1	RQ	Radioactive material, special form n.o.s. 7 UN2974 0.41GBq (11 mCi) Cs-137 and 1.9GBq (50 mCi) Am-241:Bz RADIOACTIVE - YELLOW II PI = 0.4 ** USDOT 2A TYPE A Emergency Response Telephone No.: 1-800-000-0000 (24 hrs)**	2.31 GBq (61 mCi)			
** SUBSTITUTE APPROPRIATE INFORMATION FOR YOUR GAUGE AND YOUR SHIPMENT						

PLACARDS TENDERED: YES <input type="checkbox"/> NO <input type="checkbox"/>	PERMIT CODE TO ADDRESS	COD AMT: 1	C.O.D. FEE: PREPAID <input type="checkbox"/> COLLECT <input type="checkbox"/>
<small>Place - Where the goods are to be delivered, if other than the place of origin, the shipper is responsible for the accuracy of the address.</small> <small>The shipper is responsible for the accuracy of the address.</small>	<small>I hereby declare the contents of this shipment to be as shown on this bill of lading, and I warrant that the goods are as described and are in conformity with the weight and quantity shown hereon.</small> <i>John General</i>	<small>When a bill of lading is issued, it is the responsibility of the shipper to ensure that the information is correct and complete. The carrier shall not be responsible for any loss or damage to the goods if the information is incorrect or incomplete.</small>	TOTAL CHARGES \$ PREPAID CHARGES \$ RECEIVED BY: _____

SHIPPER PER _____	CARRIER PER _____ DATE _____
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Partners and office address of SHIPPER: _____ OFFICE FOR LADINGS: 1234 Main Street, Chicago, IL 60601 (312) 475-8900