ILLINOIS EMERGENCY MANAGEMENT AGENCY
DIVISION OF NUCLEAR SAFETY

INSTRUCTIONAL SET NO. 65.0 **REVISION 3**
March 2023

Instructions for Preparing Applications
for Radioactive Material Licenses Authorizing the

USE OF SEALED SOURCES IN PORTABLE DEVICES

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I. INTRODUCTION

A. General

The Illinois Emergency Management Agency (herein referred to as IEMA or the Agency) regulates the possession and use of radioactive material. Certain uses of radioactive material require a radioactive materials license to be issued by the Agency pursuant to Part 330 of 32 Illinois Administrative Code Chapter II (herein referred to as 32 Ill. Adm. Code or the regulations).

The Agency issues a single radioactive material license to cover an entire radioactive material program. Separate licenses are not normally issued to different departments of a facility, nor are they issued to individuals associated with the facility. Facilities with more than one license may wish to combine those licenses when the storage and use of radioactive material are under the same administrative control.

B. Purpose of Instructions

This instructional set contains information intended to provide program-specific guidance and assist applicants and licensees in preparing applications for the possession and use of radioactive material in the form of sealed sources in portable gauging devices and portable x-ray fluorescence analyzers (XRF), herein referred to as portable devices. In particular, it describes the types of information needed to complete an "Application Form for the Use of Sealed Radioactive Materials Source in Portable Devices License". Note there are certain requirements listed in this guidance document that pertain only to portable gauge licensees and not to XRF licensees. These requirements will be referred to as portable gauges in the guidance. 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.

Prior to applying for portable device use, the applicant should carefully study these instructions and applicable regulations. Radioactive Materials Branch staff may need to request additional information when necessary to ensure that the applicant has established an adequate radiation protection program (See 32 Ill. Adm. Code 330.240, 330.250 and 340.110). Such requests for additional information will delay approval of the application. This may be avoided by a thorough study of the regulations and instructions prior to completing and submitting the application.

This instructional set is not a substitute for IEMA regulations or the applicant's careful evaluation of the proposed use of radioactive material. The approaches and methods described in this report are provided for information only. Methods and solutions different from those described in this instructional set may be acceptable, if they include a basis for the staff to make the determinations needed to issue or renew a license. Applicants must assure

the application correctly and adequately describes the procedures that will be followed day-to-day for radioactive material use and implementation of the radiation protection program.

After a license is issued, the licensee must conduct its program in accordance with the following:

- Statements, representations, and procedures contained in the application and in correspondence with IEMA, when incorporated into a license by reference
- Terms and conditions of the license
- IEMA regulations

C. Purpose of Appendices to these Instructions

The regulations require licensees to develop and implement written policies and procedures, which ensure compliance with the regulations. This instructional set's appendices provide sample radiation safety procedures, which the licensee may choose to use in their radiation safety program. Applicants should carefully read the applicable regulations and sample procedures and then decide if the sample procedures are appropriate for their specific radiation safety needs. While the appendices represent one means acceptable to IEMA staff of complying with applicable regulations; they are not intended to be the only means of satisfying requirements for a license.

In the application, applicants may certify that they will commit to the sample procedures or develop and submit an equivalent procedure for Agency review. If a sample procedure is followed, applicants must ensure that references to that procedure are clear and specific (e.g., references should include instructional set number, revision number, revision date, and appendix identification). If applicants choose to develop their own equivalent procedure(s), IEMA staff will evaluate the equivalent procedure against applicable regulations and the guidance in these instructions.

D. Regulatory Jurisdiction

An Illinois radioactive materials license is required for applicants who request to possess or use licensed radioactive material within the State of Illinois in areas not under exclusive federal jurisdiction.

An Agreement State (such as Illinois) is a state that has entered into a formal agreement with the U.S. NRC that gives them the authority to license and inspect byproduct, source, and special nuclear materials, in quantities not sufficient to form a critical mass, that are used or possessed within their borders. Any applicant, other than a Federal entity, who wishes to possess or use licensed material in one of these Agreement States should contact the responsible officials in that State for guidance on preparing an application. These

applications should be filed with State officials, not with the U.S. NRC. In areas under exclusive Federal jurisdiction within an Agreement State, the U.S. NRC continues to be the regulatory authority. A list of Agreement States can be found at the U.S. NRC website along with additional information about their State and Tribal Programs.

For the special situation of performing work at Federally controlled sites in Agreement States, it is necessary to know the jurisdictional status of the land in order to determine whether U.S. NRC or the Agreement State has regulatory authority. U.S. NRC has regulatory authority over land determined to be, "exclusive Federal Jurisdiction," while Agreement States have 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. IEMA recommends that licensees ask their local contact for the Federal Agency controlling the site to help determine the jurisdictional status of the land and to provide the information in writing, so that licensees can comply with IEMA, Agreement State or U.S. NRC regulatory requirements.

Performing licensed activities in other jurisdictions is possible through reciprocal recognition of specific licenses (i.e., reciprocity). Agreement States and the U.S. NRC have reciprocity provisions that permit IEMA licensees to perform licensed activities under circumstances when another Agreement State or the U.S. NRC is the regulatory authority. U.S. NRC licensees and Agreement State licensees are subject to the regulations of the regulatory authority. To ensure compliance with reciprocity requirements, licensees are advised to request authorization from the appropriate Agreement State or U.S. NRC radiation control program office well in advance of the scheduled use of licensed material.

U.S. NRC and Agreement State licensees that wish to conduct licensed activities in areas under IEMA's jurisdiction must either obtain a specific IEMA license or file for reciprocity as detailed in 32 Ill. Adm. Code 330.900. Consult the IEMA website for FAQs and the appropriate form to file for reciprocity. Failure to file for reciprocity or obtain a specific IEMA license before working in areas under IEMA jurisdiction can result in IEMA enforcement action, which may include civil penalties. The reciprocity filing must be renewed annually.

E. Applicable Regulations

It is the applicant's or licensee's responsibility to obtain and have available up-to-date copies of applicable regulations, to read and understand the requirements of each of these regulations, and to comply with each applicable regulation. The following parts of 32 Illinois Administrative Code contain regulations applicable to licensing medical use of radioactive material. Some of these parts are specific to one type of license, while others are general and will apply to many, if not all, licensees. Current regulations are publicly available at IEMA's website or the Illinois State Register.

- 32 Ill. Adm. Code 310 "General Provisions for Radiation Protection"
- 32 Ill. Adm. Code 326 "Financial Assurance Requirements"
- 32 Ill. Adm. Code 330 "Licensing of Radioactive Material"
- 32 Ill. Adm. Code 331 "Fees for Radioactive Material Licenses"
- 32 Ill. Adm. Code 337 "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material"
- 32 Ill. Adm. Code 340 "Standards for Protection Against Radiation"
- 32 Ill. Adm. Code 341 "Radioactive Materials Transportation"
- 32 Ill. Adm. Code 400 "Notices, Instruction and Reports to Workers; Inspections"

The Agency may amend regulations periodically to remain compatible with current standards and federal regulations. IEMA (as well as all other State agencies) is required to publish notice of such amendments in the Illinois State Register.

Transportation Regulations

IEMA uses the provisions of 32 Ill. Adm. Code Part 341, "Radioactive Materials Transportation," to examine and enforce the applicable requirements of the United States Department of Transportation (DOT) that are found in 49 CFR Parts 171-180. Copies of DOT regulations can be found on the DOT website or can be ordered from the Government Printing Office (GPO) Bookstore in Washington, DC. Although not likely applicable to most portable devices, in accordance with 32 Ill. Adm. Code Part 337 (Subpart D), licensees must also preplan, coordinate, and provide advance notification of the shipment of Category 1 quantities of radioactive material and coordinate the shipment of Category 2 quantities of radioactive material.

Appendix R of this instructional set lists applicable DOT regulations. Some DOT requirements that are applicable to portable device licensees include:

- The labeling of the transport container must be in accordance with the requirements in 49 CFR 172.407 and in a legible condition per 49 CFR 172.403(g).
- The licensee must properly block and brace the transportation case to ensure that the material does not shift during transport, per the requirement in 49 CFR 177.842(d).
- While in transit on a public highway, transportation papers must be kept within the immediate reach of the driver, pursuant to 49 CFR 177.817(e)(2)(i)(A) and other applicable 49 CFR Part 177 requirements.
- The licensee must have emergency response information, including current emergency response telephone numbers that meet the requirements of Subpart G, "Emergency Response Information," of 49 CFR Part 172, "Hazardous Materials Table, Special

Provisions, Hazardous Materials Communications, Emergency Response Information, Training Requirements, and Security Plans."

- Initial and recurrent training must be given to all HAZMAT employees who perform transport functions for portable devices, per the requirements of Subpart H, "Training," of 49 CFR Part 172.
- The licensee shall maintain transportation shipping records in accordance with the requirements of Subpart C, "Shipping Papers," of 49 CFR Part 172, including the proper shipping name, hazard class (Class 7), United Nations identification number, the name of the shipper, and the name and activity of each radionuclide.

F. Retention of Records

Licensees must maintain certain records to comply with IEMA regulations and the conditions of the license. The retention requirements have been established in order for inspection staff and other authorized entities to have access to these documents as required by the regulations. Operating procedures should identify which individuals in the organization are responsible for maintaining specific records. Appendix A of this instructional set contains a summary of the retention requirements for these records.

G. Radiation Protection Program

As specified in 32 Ill. Adm. Code 340.110, the licensee must develop, document and implement a radiation protection program. In developing this program, the licensee should consider the size of the facility, potential hazards associated with radiation exposure, and the physical characteristics of the radionuclides. Specifically, the program should include provisions to ensure compliance with the regulations, the license and all commitments made therein. It should describe the procedures and engineering controls in place to keep occupational and public doses As Low As Reasonably Achievable (ALARA), and the annual auditing of the program (see below). The commitments made to the Agency, which lead to the issuance of the license, in conjunction with the regulations and the complete license document are considered the applicant's radiation protection program.

Active control over the radiation protection program should be exercised by management personnel in positions of authority. In addition, management should be aware that the assignment of duties to individuals (e.g., the Radiation Safety Officer (RSO)) does not relieve management of the responsibilities to review and control the licensed activities. The licensee is responsible for the conduct of all licensed activities and the acts and omissions of individuals handling licensed material.

H. Audit Program

Under 32 Ill. Adm. Code 340.110(c), all licensees must review the content and implementation of the radiation protection program annually. The program reviews should ensure compliance with IEMA and applicable U.S. Department of Transportation (DOT) regulations and the terms and conditions of the license. Occupational doses and doses to members of the public should be reviewed for compliance with the applicable limits in 32 Ill. Adm. Code Part 340. IEMA encourages licensee management to conduct performance-based reviews by observing work in progress, interviewing staff, and spot-checking required records. As part of the review or audit programs, licensees should consider including unannounced audits of authorized and supervised users to observe whether radiation safety procedures are being followed.

It is essential that once problems are identified, comprehensive corrective actions are taken in a timely manner. Information Notice (IN) 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," dated May 1, 1996, provides guidance on this subject. IEMA routinely reviews licensee's records to verify whether appropriate corrective actions were implemented in a timely manner to address recurrence. It is in the best interest of the licensee to identify potential violations of regulatory requirements and take necessary steps to correct them. IEMA can opt to exercise discretion and may elect not to cite the licensee for these violations if prompt and effective corrective actions are implemented.

Appendix B of this instructional set contains a suggested annual audit program that is specific to portable device licensees. Since all areas indicated in Appendix B may not be applicable to every licensee and all items may not need to be addressed during each audit, licensees may wish to develop a program-specific audit checklist. Records of audits and other reviews of program content and implementation are specified in 32 Ill. Adm. Code 340.1120 and must be maintained for 5 years after the record is made.

Note: The licensee is not required to submit its audit program to IEMA for review during the licensing phase.

I. Management Responsibility

IEMA recognizes that effective radiation protection program management is vital to achieving safe, secure, and compliant operations. Consistent compliance with the regulations provides reasonable assurance that licensed activities will be conducted safely, and that effective management will result in increased safety, security, and compliance.

To ensure adequate management involvement, a senior-level management representative must sign the submitted application acknowledging management's commitments and responsibility for the following:

a. Radiation safety, security, and control of radioactive materials.

b. Completeness and accuracy of records and all information provided to IEMA.

c. Knowledge regarding the contents of the license and application.

d. Compliance with current IEMA and U.S. Department of Transportation regulations.

e. Compliance with the licensee's operating, emergency, and security procedures, and IEMA license commitments.

f. Commitment to provide adequate financial and other 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 that compliance with regulations is maintained.

g. Selection and assignment of a qualified individual to serve as the radiation safety officer (RSO), who agrees, in writing, to be responsible for implementing the radiation protection program. The RSO shall have independent authority to stop unsafe operations and will be given sufficient time to fulfill radiation safety duties and responsibilities.

h. Commitment to report defects, noncompliance, or reportable events, including lost or stolen devices in accordance with regulations.

i. Commitment to ensure that radiation workers have adequate training.

j. Obtaining IEMA's prior written consent before making any changes to the licensee's commitments under the license, including locations of storage.

k. Prevention of discrimination of employees engaged in protected activities and commitment to provide information to employees about employee protection provisions (32 Ill. Adm. Code 400.160(c)).

l. Commitment to provide information to employees about deliberate misconduct provisions (32 Ill. Adm. Code 310.78 "Deliberate Misconduct").

m. Commitment to obtain IEMA's prior written consent before transferring control of the license (see Section VII.A, "Transfer of Control," of this Instructional Set.)

n. Notification of IEMA, in writing, immediately following the filing of petition for voluntary or involuntary bankruptcy (32 Ill. Adm. Code 330.310(j), as discussed further in Section VII.B, "Notification of Bankruptcy Proceedings," of this Instructional Set.

J. As Low as Reasonably Achievable (ALARA)

Persons engaged in activities authorized by radioactive material licenses issued by the Agency must, to the extent practicable, make every reasonable effort to maintain the release of radioactive material and the total effective dose equivalent (TEDE), ALARA for both workers and members of the public. License applicants must consider the ALARA philosophy when designing facilities, procuring equipment and for developing procedures for work with radioactive material. The ALARA concept is a key element in establishing any radiation protection program as described above. The definition of ALARA may be found in 32 Ill. Adm. Code 310.20 and requirements for implementation in 32 Ill. Adm. Code 340.110.

A particularly important aspect of ALARA incorporation into a licensee's radiation protection program is the establishment of 'investigational levels' for both occupational and public doses. These investigational levels are not new dose limits but, as noted in ICRP Report No. 26, "Recommendations of the International Commission on Radiological Protection," serve as check points above which the results are considered sufficiently important to justify investigations. If a dosimetry program is required, refer to Appendix R of this instructional set for further details on establishing investigational levels.

K. Safety Culture

The Illinois Emergency Management Agency (IEMA) recognizes the importance of individuals at organizations performing or overseeing regulated activities establishing and maintaining a strong safety culture – a work environment where management and employees are dedicated to putting safety first. An active and positive safety culture within IEMA and at regulated facilities is a key element in IEMA's mission to protect public health and safety.

The safety culture policy statement defines radiation safety culture as the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety over competing goals to ensure protection of people and the environment.

See the U.S. NRC's NUREG 1556 Vol. 1, Rev. 2; Section 3.2 for additional information on Safety Culture. Refer to Appendix K of NRC's NUREG 1556, Volume 1, Rev. 2 for their Safety Culture Policy Statement. More information on U.S. NRC activities relating to safety culture can be found on the U.S. NRC Safety Culture Web site.

L. Security

IEMA, together with the U.S NRC and other state and federal partners, places an emphasis on the security of radioactive material to prevent malicious use. 32 Ill. Adm. Code 340.810

requires that licensees secure licensed radioactive material from unauthorized access or removal. Moreover, 32 Ill. Adm. Code 330.810(g) contains specific security requirements for portable gauges by requiring each licensee to use a minimum of two independent physical controls to secure portable gauges from unauthorized removal (i.e., the "two lock rule"). These requirements, along with those for semi-annual inventories and use logs, will be routinely assessed during inspections.

During the application process, IEMA may review procedures and equipment employed by licensees to ensure the security and accountability of portable devices. Additionally, persons not otherwise listed on an existing license or unknown IEMA, may be asked to complete a "Release and Authorization Full Due Diligence Form". A copy of this form, titled "Background Check" is available at https://iema.illinois.gov/nrs/radsafety/guidance.html and as Exhibit A to this instructional set. IEMA appreciates your cooperation in this matter. Your efforts to ensure devices are used and secured in accordance with your license and the regulations are extremely important for protecting public health and safety in Illinois.

M. Reporting

Licensees are required to report to IEMA via telephone, written report, or both, incidents in which the safety or security of radioactive material may be compromised. The specific events that require reporting are explained in 32 Ill. Adm. Code Part 340 Subpart M. The timing and type of report are specified within these parts. The reporting timeline begins at discovery of the incident, not when the licensee confirms or completes an investigation. If the incident is found to be not reportable, it can be retracted. 32 Ill. Adm. Code 330.310 also requires licensees to notify IEMA in the event they discontinue the use of radioactive materials or declare bankruptcy. See Appendix Q of this Instructional Set for common reporting requirements.

II. How to File

A. Application Preparation

Applicants wishing to possess or use licensed portable devices should do the following:

a. Use the **most recent guidance and current regulations** to prepare the application.

b. Complete "Application Form for a Portable Device Radioactive Materials License", in accordance with 32 Ill. Adm. Code 330.240(a).

c. All items on the application form must be completed in sufficient detail for the Agency to determine that the applicant's equipment, facilities, training, experience and radiation protection program are adequate to protect health, safety, and minimize danger to life and property.

d. Each appended sheet submitted with the application should be identified with the item number, page number, applicant's name, and application date in the lower right corner to which it refers.

e. Avoid submitting proprietary information and personally identifiable information (PII). PII examples include personal home address, home telephone number, social security number, date of birth, and radiation dose information and should not be submitted unless specifically requested by the Agency. If submitted, proprietary information and other sensitive information (e.g., personal privacy and security-related) should be clearly identified as such by visibly marking, "Public inspections, exemptions, requests for withholding." Public inspection of applications and other documents submitted to the Agency pursuant to 32 Ill. Adm. Code 330.240, shall be handled in accordance with 2 Ill. Adm. Code 1800 and the requirements of the Freedom of Information Act (5 ILCS 140). As such, all license applications may be available for review by the general public. (see Section C of this Section, "Identifying and Protecting Sensitive Information.").

B. Where to File

Paper applications received by IEMA will be scanned and converted to an electronic format. To ensure a timely transfer to the electronic format, applicants should do the following:

- Ensure print is clear and sharp
- Ensure each page of the copy is legible
- Each application and each request for amendment is signed (physical or verifiable electronic) by the applicant, licensee, or a person duly authorized in writing to act for and on the licensee or applicant's behalf.

Paper copies need not be submitted in duplicate, but the licensee is responsible for maintaining a copy of all applications and correspondence related to the license.

The original may be mailed to:

Illinois Emergency Management Agency
Division of Nuclear Safety
Radioactive Materials Licensing
1035 Outer Park Drive
Springfield, Illinois 62704

The Agency will accept applications and requests for amendments electronically. These submittals may be directed to ema.speclic@illinois.gov.

Electronic applications are accepted under the following conditions:

a. The applicant utilizes an electronic signature that is secure and verifiable,

b. The body of the email identifies the licensee and the intent to the Agency,

c. Forms and documents are attached as necessary,

d. Documents are submitted in common file formats (e.g. .pdf, .doc, .xls etc.),

e. Standard naming conventions are used for documents attached, and

f. The submittals are be directed to ema.speclic@illinois.gov.

NOTE: Licensees and applicants should never submit PII, security-sensitive or proprietary information via email as this is not an encrypted portal. Emails and attachments must NOT contain:

a. Classified, proprietary information

b. Payment information

c. Financial assurance documents

d. Personal Identifiable Information (PII)

e. Embedded macros or hyperlinks

f. Security related diagrams with explicit instructions to access materials such as access codes or key locations

g. Documents that require an affirmation, oath, or notary

h. Do NOT send initial reports or notifications required by regulations to this email

C. Identifying and Protecting Sensitive Information

Public inspection of all licensing applications and other documents submitted to the Agency pursuant to 32 Ill. Adm. Code 330.240 shall be in accordance with 2 Ill. Adm. Code 1800 and the requirements of the Freedom of Information Act [5 ILCS 140]. Due to the personal and security-sensitive nature of information submitted to and maintained by the Radioactive Materials Section, not all data is appropriate for public disclosure. Although there is no guarantee that the information will always be withheld, in order to assist the Agency in recognizing information identified as security-sensitive or containing personally identifiable information (PII), the applicant or licensee should identify and mark the information accordingly before it is submitted to IEMA. Key examples are as follows:

a. Proprietary Information and Trade Secrets: It is the responsibility of the licensee to pre-identify proprietary information (clearly marked and identified as proprietary, privileged, trade secret, business confidential etc.). If it is necessary to submit proprietary information or trade secrets, the licensee or applicant should incorporate a stamp or marking prominently on the page(s) that reads “proprietary information” or similar.

Failure to follow this procedure could result in disclosure of the proprietary information to the public or substantial delays in processing the application.

b. Personally Identifiable Information: Personally identifiable information (PII) about employees or other individuals should not be submitted unless specifically requested by IEMA. Examples of PII are social security number, home address, home telephone number, date of birth, and radiation dose information. If PII is submitted, a cover letter should clearly state that the attached documents contain PII, and the top of every page of a document that contains PII should be clearly marked as follows: "Personally Identifiable Information." For further information, see the U.S. NRC's Regulatory Issue Summary (RIS) 2007-04, "Personally Identifiable Information Submitted to the U.S. Nuclear Regulatory Commission," dated March 9, 2007, and Information Notice 2013-22, "Recent Licensing Submittals Containing Personally Identifiable Information," dated November 15, 2013, which can be found on the U.S. NRC's Generic Communications Web page.

c. Security-Related Sensitive Information: Following the events of September 11, 2001, IEMA changed its procedures to avoid the release of information that terrorists could use to plan or execute an attack against facilities or citizens in the U.S. As a result, certain types of information are no longer routinely released and are treated as sensitive unclassified information. For example, certain information about the quantities and locations of radioactive material at licensed facilities, and associated security measures, are no longer released to the public. Therefore, a cover letter should clearly state that the attached documents contain security-related sensitive information and the top of every page of a document that contains such information should be clearly marked: "Security-Related Information." For the pages having security-related sensitive information, an additional marking should be included (e.g., an editorial note box) adjacent to that material. For further information, see RIS 2005-31, Rev. 1, "Control of Security-Related Sensitive Unclassified Non-Safeguards Information Handled by Individuals, Firms, and Entities Subject to U.S. NRC Regulation of the Use of Source, Byproduct, and Special Nuclear Material," December 26, 2017. Additional information on procedures and any updates are available in the U.S. NRC Library on the Withholding of Sensitive Information page.

D. Application and License Fees

Each application for which a fee is specified will be invoiced after initial processing at IEMA. Please do not submit your fee payment with the application. New applicants will be billed a prorated fee for the portion of the billing year remaining from the date the application is received. By regulation, the billing year means "the period of time from October 1 of one year to September 30 of the following year". Refer to 32 Ill. Adm. Code 331, Appendix F, "Fee Schedule for Radioactive Materials Licensees" to determine the amount of the fee. Consult 32 Ill. Adm. Code 331.120 on payment of fees, remote site costs, recovery and

remediation assessments and details pertaining to full cost recovery. In accordance with this part, the annual and remote site fees listed in Appendix F are nonrefundable and are assessed based on a 12-month period. Consult 32 Ill. Adm. Code 331.110, "Exemptions," for information on exemptions from these fees. Application fees will be charged regardless of IEMA's disposition of an application or the withdrawal of an application.

Most IEMA licensees are also subject to annual fees; which are addressed in the regulatory references above.

Direct all questions about IEMA's fees or completion of "License Fees" item of the application form to the Supervisor of Licensing, 217-785-9947. The e-mail address is ema.speclic@illinois.gov.

III. CONTENTS OF AN APPLICATION

The following paragraphs explain the information requested on the "Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Portable Devices" and the "Expedited Renewal Application Form for a Radioactive Material License Authorizing the Use of Sealed Sources in Portable Devices".

Please review each item carefully and complete each section on the application in its entirety as to not impede the Agency licensing staff review process. Agency staff are available to answer questions regarding application content requirements and new applicants are encouraged to contact the Agency to discuss their licensing needs.

All items in the application should be completed in enough detail for IEMA to determine whether the proposed equipment, facilities, training and experience, and the radiation safety program satisfy regulatory requirements and are adequate to protect public health and safety and minimize danger to life and property. Consideration should be given, when developing the application, to the concepts of keeping exposure as low as is reasonably achievable (ALARA), minimizing contamination, and maintaining control of radioactive materials.

32 Ill. Adm. Code 340.110 states: "The licensee or registrant shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA)." Regulatory Guide (RG) 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable," discusses the ALARA concept and philosophy. The application should document ALARA considerations, including establishing administrative action levels and monitoring programs.

The application should include information on how the licensee will implement the security requirements in 32 Ill. Adm. Code 340.810, "Security and Control of Licensed or Registered Sources of Radiation."

All supplemental information should be provided as an attachment to the applicant's signed and dated application. Several appendices in this instructional set present sample procedures that applicants may use in developing their procedures.

All information submitted to IEMA during the licensing process may be incorporated as part of the license and will be subject to review during inspection.

Item 1. Type of Application

Indicate by checking the appropriate box, if the application is for a new license, an amendment to an existing license, or a renewal. A shortened form exists for expedited renewals. Expedited renewals are typically only offered to a licensee whose previous renewal was not expedited, has no significant noncompliance or enforcement history, the management and scope of operations have not substantively changed, and the procedures and facilities utilized by the licensee are expected to remain the same. If the application is for amendment, renewal or expedited renewal of an existing license, specify the license number in the space provided.

Item 2. Applicant's Name and Mailing Address

List the legal entity name of the applicant's corporation or other legal entity with day-to-day control over use of the radioactive material. A division or department within a legal entity may not be a licensee. In order to validate the legal entity, the applicant/licensee may provide documentation of current registration with the Illinois Secretary of State to conduct business within Illinois, *or a similar registration in another state.* An individual may be designated as the applicant only if the individual is acting in the private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Each applicant must submit their federal tax identification number (FEIN). Applicants that are individuals must provide their social security number.

Provide the mailing address where correspondence should be sent. The applicant's mailing address may or may not be the same as the address where radioactive material will be used. Enter the name, mailing address, telephone number and email address of the applicant in the space provided.

NOTE: In accordance with 32 Ill. Adm. Code 330.400, if a change of ownership occurs, IEMA must be notified of and licensees must have prior written consent of the change of ownership or control **prior to** transferring ownership or control of licensed material. If

personnel and procedures are changing with the new ownership, the new owners must apply for and obtain a new license. If the personnel and procedures remain the same, the license may be transferable. Information required for a Transfer of Control Application is discussed in Section VII and further detailed in Appendix D. To facilitate submittal of this information, a fillable form is available on the Agency's website: https://iema.illinois.gov/nrs/radsafety/guidance.html

IEMA must be notified in the event of bankruptcy proceedings in accordance with 32 Ill. Adm. Code 330.310(j). Even though a licensee may have filed for bankruptcy, the licensee remains responsible for all regulatory requirements. IEMA needs to know when licenses 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, etc.). Any health and safety issues must be resolved before bankruptcy actions are completed.

Item 3. Person to Contact Regarding this Application

The applicant should name a qualified individual who is authorized by the applicant's management to answer questions and make commitments regarding this application and the radiation protection program. This individual, usually the Radiation Safety Officer (RSO) or a principal radioactive material user, will serve as the point of contact during the application review. In the space provided, enter the name, address, telephone number and email address of the individual to be contacted regarding this application. Email addresses are important as the Agency distributes numerous items of interest to affected licensees via email, including notices of proposed rules that could affect the licensee's operations or fees.

If this individual is not a full-time employee of the licensed entity, his or her position and relationship to the licensee should be specified. IEMA should be notified if the person assigned to this function changes or if his or her telephone number, cell phone number, or e-mail address changes. Notification of a contact change is only provided for informational purposes and would not be considered an application for license amendment, unless the notification involves a change in the contact person who is also the RSO.

IEMA recognizes that licensees may contract with a consultant or consultant group to help prepare the license application and provide support to the radiation protection program. However, IEMA reminds licensees that regardless of the role of the consultant in radiation protection program management, the licensee remains responsible for all aspects of the licensed program, including the services performed by the consultant.

NOTE: If the individual(s) listed in Item 3 are unknown to the Agency and/or have never been associated with a radioactive materials license, the Agency may seek additional information on an individual's background to ensure that radioactive materials will be used

as intended. In order to expedite the review process, the applicant or licensee may wish to submit the "Release and Authorization Full Due Diligence Investigation" form with the application. A fillable form is available on the Agency's website https://iema.illinois.gov/nrs/radsafety/guidance.html and is included as Exhibit A.

Item 4. Address(es) Where Radioactive Material will be Used and/or Stored

Most applicants need to provide two types of information in response to Item 4:

- The address(es) where the gauges will be stored when gauges are not in the field; and
- Specification of whether they intend to use the portable gauge at temporary jobsites

Specify all the addresses and physical locations where licensed radioactive material will be used and/or stored. Each location description should include the street address, city and other descriptive information (e.g., building name/number, suite, room or floor number) to allow specific facility identification. If multiple facilities will be used, specify the extent of use, storage or both at each location. Do not specify a post office box number as a use location. Locations where radioactive material is received and eventually redistributed or taken to other sites for use are typically included as permanent jobsites on specific licenses. If more than one permanent facility is used, specify where records will be maintained for each facility. Indicate if the licensee anticipates intermittently declaring any area of use as an unrestricted area. A license amendment is required before receiving, using, or storing licensed material at an address or location not already listed on the license.

If an applicant submits documents that identify the exact location of use and storage for any amount of radioactive material, the applicant should mark these documents as "Security-Related Information". See Chapter II.C, "Identifying and Protecting Sensitive Information," for more details.

Illinois law [420 ILCS 40/10(11)] requires IEMA to notify a local government of each listed location of storage or use of radioactive material. This allows local officials, fire and police the opportunity to review local ordinances and prepare for emergencies. An IEMA license does not relieve a licensee from complying with other applicable Federal, State, or local regulations (e.g., local zoning requirements).

If the applicant does not own the use/storage locations(s), submit confirmation that the owner of the property/facility has been notified in writing of the use/storage of radioactive material on this property in accordance with 32 Ill. Adm. Code 330.240(a) (9). This can be a letter from the facility/property owner acknowledging radioactive materials will be used and/or stored at this location.

NOTE: Personal residences are generally not considered ideal locations for storage of radioactive material because of local ordinances and access restrictions for public dose and security.

Temporary Jobsites

Permanent facilities are address locations where radioactive material can be used or stored for more than 180 days in a 12-month period. If the applicant is proposing to use or store radioactive material authorized under the license at other temporary locations for periods less than 180 days per year, than 'Use of radioactive material at temporary job sites' should be requested by checking off the box provided under Item 4 on the application. Use of licensed material at temporary job sites will become part of the license conditions and each separate address does not need to be specified so long as the licensee does not use, receive or store radioactive material at any one site for more than 180 days during any 12-month period.

NOTE: Being granted an IEMA license does not relieve a licensee from complying with other applicable Federal, State, or local regulations (e.g., local zoning requirements for storage locations).

Item 5. Individual(s) Who Will Use Radioactive Materials and Training Program

List the full name of at least one individual who will use or directly supervise the use of radioactive material in portable devices and submit evidence of their training and experience.

NOTE: Additional information on an individual's background and training may be requested to ensure that radioactive materials will be used as intended. See Exhibit A for a Release and Authorization Full Due Diligence Investigation form.

All additional personnel who will independently use portable devices containing radioactive material do not have to be designated by name. However, if the applicant does not specifically identify all individuals who should be authorized to use radioactive material independently and include training and experience for each individual identified, then the applicant must provide a commitment that all authorized users will complete either:

a. An approved device manufacturer's training program supplemented by documented hands-on experience with portable devices. If applicable, training must also include completion of the United States Department of Transportation (DOT) hazardous materials training (49 CFR 172, Subpart H),

   OR

b. An Agency-approved training program equivalent to the device manufacturer's training program, supplemented by documented hands-on experience with portable devices. If applicable, DOT hazardous materials training must be included;

OR

c. An Agency-approved in-house training program. If this option is chosen, the information specified below for an "In-house Training Program" must be submitted for evaluation. If applicable, include for evaluation the information required under "Hazardous Materials Training" and "Training for Individuals Working in or Frequenting Restricted Areas".

In-house Training Program

Appendix E provides criteria for acceptable training courses. The applicant may commit to an in-house training program meeting the criteria in Appendix E, or submit a description of the training, which includes the following:

a. The form of training (e.g., online course work, lecture, on-the-job training, including use of the device, etc.),

b. If online training is utilized, the completed course should be supplemented by documentation of the individual's hands-on portable device training

c. A list of topics covered in the training (See Appendix E.),

d. The means used to evaluate the training (e.g., submit a copy of the exam and answer key and specify the minimum passing criteria),

e. The duration of training. Initial training for device users should be a minimum of 3-4 hours in duration including classroom and hands-on training.

f. Submit a sample of the training record to be maintained, which includes, the date of training, the outline of training, the individual completing the training, a statement that they passed, name and signature of RSO and instructor.

g. Confirm that the instructor will be an individual who has completed an approved device training program, successful completion of an 8-hour radiation safety course or RSO training course, and documentation of least 8 hours of actual use of the same type of device they are training new users on.

h. For individuals who transport licensed radioactive material or who may offer such material to a carrier for transport, training must include the applicable requirements of the United States Department of Transportation (DOT) as described in 49 CFR 172, Subpart H (see below).

i. In addition, for individuals who may not use the portable devices, but who have access to any portion of a restricted area must receive instruction as specified in 32 Ill. Adm. Code 400.120 (see below).

Hazardous Materials Training

In accordance with 49 CFR Part 172.702(b), and except as provided in 49 CFR 172.704(c)(1), an employee may not perform any hazmat function unless instructed in the requirements of this subchapter that apply to that function. 'Hazmat functions', or more formally, the duties that would require hazmat training, are detailed in 49 CFR Part 171.1(b). If applicable, licensees may be required under 32 Ill. Adm. Code 341.10, to provide hazardous material employee training that meets the requirements of 49 CFR 172, Subpart H. If applicable, detail how the licensee's training program will meet this requirement. Include a commitment to conduct DOT training within 90 days after employment or change in job duties and at least once every three years thereafter.

Training for Individuals Working in or Frequenting Restricted Areas

As outlined in 32 Ill. Adm. Code 400.120, radiation safety training is required for workers any time they are working in, or the performance of whose duties requires access to, any portion of a 'restricted area' or who frequent areas where radioactive material is used or stored (i.e., 'areas of use'). Therefore, radiation safety training is required for workers in all 'areas of use', regardless of 'restricted' or 'unrestricted' status. "Worker" is defined in 32 Ill. Adm. Code 310.20.

This means all individuals working with or around licensed materials should receive safety instructions commensurate with their assigned duties and as specified by 32 Ill. Adm. Code 400.120. For example, housekeeping staff, should be informed of the nature of the licensed material and the meaning of the radiation symbol and instructed not to touch the licensed material and to remain out of the room if the door to the licensed material storage location is open. Providing minimal instruction to ancillary staff (e.g., housekeeping, security) may assist in controlling abnormal events, such as loss of radioactive material. In addition, licensees should ensure that contractor staff receive safety instructions.

The radiation safety training must be provided initially before the individuals perform assigned duties and refresher training conducted at intervals not to exceed 12 months. The minimum topics to be covered are detailed in 32 Ill. Adm. Code 400.120.

Item 6. Radiation Safety Officer (RSO)

Submit the name, contact information, supporting training and experience documentation, and job title of the RSO when appointing or changing an RSO. This person is designated by,

and responsible to, the applicant's management for the coordination of the applicant's radiation safety program and for ensuring compliance with the applicable regulations and license provisions.

In addition, the duties and responsibilities of the RSO must be submitted. Typical RSO duties are described in Appendix F of this instructional set. IEMA requires the name of the RSO to be listed 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. Appendix F of this instructional set also provides a model Delegation of Authority, which should be used to further emphasize the agreement on duties and responsibilities of the RSO by management and the designated RSO. Indicate that the RSO will commit to these duties and responsibilities or submit an alternate document for Agency review. The Delegation of Authority document must be countersigned by an individual who has active management over the radiation protection program, submitted with the application and maintained for the duration of the license. A completed template from Appendix F or equivalent may be used when submitting this information to the Agency.

The individual responsible for the radiation safety program should, at a minimum, have completed the training requirements listed in Item 5 of this Instructional Set. The RSO should be an on-site individual designated to assume the responsibilities of the office, to advise on the establishment of safe working conditions and to assure that the licensee complies with all pertinent federal, state and local regulations. The RSO needs independent authority to stop operations that he/she considers unsafe. Formal documentation to this effect may be accomplished with the use of the "Delegation of Authority" form in Appendix F.2 of this Instructional Set. The RSO must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure that radioactive materials are used and stored in a safe manner. The RSO should be familiar with the basic principles of radiation protection in order to properly fulfill the responsibilities, although for details the RSO may consult with appropriate qualified experts.

The RSO may delegate certain duties to qualified individuals provided the terms of said designation are specifically outlined in the applicant's written procedures. The applicant must request the option of delegating duties and must receive permission from the Agency prior to initiation of this procedure. The condition listed in Appendix F.1. can be listed on the license if the applicant requests to delegate RSO duties.

Off-site Personnel and Consultant

The RSO should be a full-time employee of the licensed facility. However, IEMA has authorized individuals who are not directly employed by the licensee, such as consultants, to fulfill the role of RSO or to provide support to the facility RSO. The Agency generally does not recommend utilizing off-site personnel and consultants in the position of RSO unless

there is a significant lack of experience for on-site staff that could otherwise assume RSO duties. To fulfill the duties and responsibilities, an on-site RSO is more suitable to address incidents, emergencies, and to accommodate unannounced inspections.

If the RSO is not an on-site individual, then in addition to RSO training and experience requirements, information as to the availability of the RSO and the means of contacting the RSO when they are not on-site, including response time for emergencies, must be submitted.

Consultants may be useful in an oversight role for the RPP if the facility has persistent enforcement concerns. If the applicant employs a consultant to support the RSO, the licensee is still responsible for assuring the RPP is in accordance with licensee-approved procedures and regulatory requirements. Routine duties such as training, leak testing, calibrations, close-out surveys, and RPP reviews or audits may continue to be performed by consultants as RSO designees, with periodic review of this work by the RSO.

Item 7. Radioactive Material

IEMA, the NRC or an Agreement State will perform safety evaluations of portable gauges before distribution of the devices to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) registration certificate issued to the manufacturer. Licensees will only be authorized for sealed sources and devices registered by NRC or an Agreement State and documented in a SSD registration certificate. Manufacturers and distributors of the devices can confirm this registration. 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 IEMA'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 "Limitation and Other Considerations of Use." These sections may include limitations derived from, conditions imposed by the manufacturer or distributor, particular conditions of use that would reduce the radiation safety of the device, or circumstances unique to the sealed source and device. For example, the working life of the device or the appropriate temperature and other environmental conditions may be specified. Except as specifically approved by IEMA, licensees are required to use portable gauges according to their respective SSD registration certificates. Accordingly, applicants should obtain a copy of the certificate from the manufacturer or distributor. If the manufacturer and distributor are no longer in service, a copy of the SSD registration certificate may be requested from IEMA, the NRC or the issuing Agreement State. The applicant should review the provisions of the SSD registration certificate with the manufacturer or distributor, IEMA, the NRC, or the issuing Agreement State.

Generally, portable gauge licensees possess small quantities of radioactive material below the Category 2 quantities described in 32 Ill. Adm. Code Part 337 "Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material." Portable gauge licensees that possess an aggregated Category 1 or Category 2 quantity of radioactive material must implement the requirements in 32 Ill. Adm. Code Part 337. For additional guidance on implementing the 32 Ill. Adm. Code Part 337 requirements, see NUREG-2155, "Implementation Guidance for 10 CFR Part 37, 'Physical Protection of Category 1 and Category 2 Quantities of Radioactive Material.'" Category 1 and Category 2 sources regulated by IEMA, the NRC and Agreement States must be tracked in the National Source Tracking System (NSTS) in accordance with 32 Ill. Adm. Code 330.950.

Submit a description of the radioactive material and portable device for which a license is requested. The description should include the following:

a. Identify the manufacturer (or distributor) and model number of each type of portable gauge.

b. State the number of each type of portable device requested. Note that the applicant can request more devices than they actually possess so that they can order additional devices in the future without first obtaining an amendment to do so. (e.g., they currently will use one device, but request possession of 3 devices.)

c. Identify each radionuclide and nominal activity in each portable device (include units. e.g., millicuries)

d. Identify the manufacturer and model of the Sealed Source(s). This will typically be identified in the SSD registration certificate.

e. Provide a brief description of the use of each device (e.g., moisture density measurements, XRF device, calibrations, etc.)

For licensees who request to perform instrument calibrations within their facility as described in Item 9 of this instructional set, specify the radionuclides, activity, make and models of the calibration sources and the make and model of the calibration instrument requested for use for performing radiation monitoring instrument calibration.

For licensees who request to perform their own leak test analysis within their facility as described in Item 16. of this instructional set specify the radionuclides, activity, make and models of the sources requested for use as calibration or reference standards.

For licensees who request uses other than those listed in the SSD registration certificate, the application must provide sufficient information to demonstrate that the proposed use will not compromise the source integrity or shielding, or other components of the device critical to radiation safety. These requests are evaluated on a case-by-case basis. IEMA will evaluate the radiation safety program for each type and use of gauge requested. Specifically describe how each device will be used. If the gauging device(s) will be used for the purposes listed on

the SSD registration certificate, or as recommended by the manufacturer, the applicant may so state. If the gauging device(s) will be used for purposes other than those listed on the SSD registration certificate, specify these other purposes and include a safety analysis supporting the request.

Item 8. Instrumentation

Radiation monitoring instruments are not normally required for most licensees if the portable devices are used for their intended purpose, transported in U.S. Department of Transportation (DOT) approved containers and no maintenance procedures involving access to the sources or source holders are performed. There are situations (e.g., receipt of damaged packages, incidents involving portable devices being run over at construction sites, auto accidents, etc.) where a monitoring instrument is needed to determine whether the radioactive source has been breached. In most cases the portable device is damaged, but the source remains intact. Accordingly, the licensee should implement their emergency procedures and obtain technical assistance from the Agency and arrange for a timely evaluation of the source integrity following receipt of a damaged package or an incident.

Non-Routine Maintenance

Nonroutine maintenance or repair (beyond routine cleaning and lubrication) that involves detaching the source or source rod from the device, and any other activities during which personnel could receive radiation doses exceeding IEMA limits, must be performed by the gauge manufacturer or a person specifically authorized by IEMA, the NRC or an Agreement State. Figure 8-1 illustrates routine cleaning and lubrication and nonroutine maintenance. Generally, IEMA permits portable gauge licensees to perform routine maintenance of the devices, provided they follow the gauge manufacturer's recommendations and instructions. Although manufacturers may use different terms, "routine maintenance" includes, but is not limited to, cleaning, lubrication, changing batteries or fuses, and repairing or replacing a handle containing a sealed source. Routine maintenance does not include any activities that require removing the sealed source or source rod from the gauge.

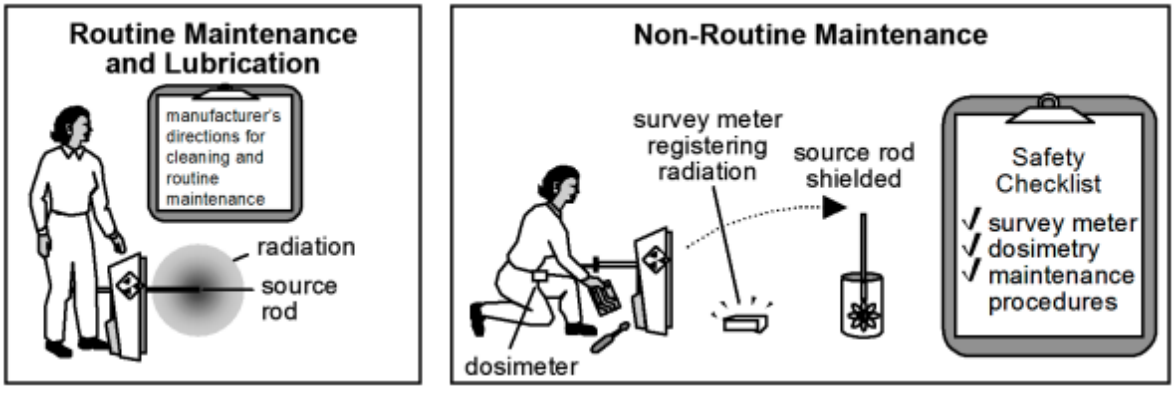


Figure 8.1 Maintenance. *All licensees should perform routine cleaning and lubrication to ensure proper operation of the gauge. Most licensees rely on the gauge manufacturer or other service provider companies to perform nonroutine maintenance.*

Most licensees do not perform nonroutine maintenance or repair operations that require detaching the source or source rod from the gauge; they usually return the gauge to the manufacturer. Applicants seeking authorization to detach the source or source rod from the device must submit specific procedures for review. The licensee must also have at least one low range beta-gamma (0-50 mR/hr or 0-200 mR/hr) monitoring instrument available at each maintenance area for monitoring during and upon completion of the maintenance procedures. Applicants wishing to obtain authorization to perform nonroutine maintenance should provide detailed procedures for review and consult, at a minimum, Appendix F of NRC NUREG 1556, Vol. 1, Revision 2, for more information.

Leak Test Analysis

If the licensee requests to analyze samples for leakage and/or contamination (leak/wipe tests), a radiation measurement instrument that is sufficiently sensitive to detect 185 Bq (0.005 μCi) is also required. The applicant must submit the minimum detectable activity (MDA) calculations for each instrument used for leak/wipe test analysis. Appendix G contains sample MDA calculations. An MDA calculation is used to determine if a measurement instrument is sufficiently sensitive to measure 185 Bq for the analyses of leak test wipes. Appendix O of this Instructional Set details additional information that will be required for Agency evaluation as well as template procedures.

Exhibit B is a form that may be used to describe the applicant's instrumentation. If this form is not used, then submit equivalent information for Agency review.

For applicants who wish to perform their own nonroutine maintenance, repair devices or perform analysis of samples for leakage and/or contamination (leak/wipe tests); submit a procedure for performing periodic radiation monitoring and contamination monitoring. The procedure must describe the routine monitoring program, including the areas to be monitored, frequency of the monitoring, action levels initiating decontamination procedures and provisions for maintaining records of monitoring. Either submit the procedure with the application or indicate that instrumentation and monitoring is not applicable.

Item 9. Instrument Calibration and Operability Checks

NOTE: If Item 8 is marked as not applicable, then Item 9 should also be not applicable.

If radiation monitoring instruments are required (see Item 8), the licensee must ensure that the monitoring instruments used to demonstrate compliance with 32 Ill. Adm. Code 340 are

calibrated prior to first use, at intervals not to exceed 12 months thereafter and also following repair.

Radiation survey meter calibrations must be performed by persons, including licensed personnel, who are qualified to perform calibrations. Specify if monitoring instruments will be calibrated by a service company specifically licensed to perform monitoring instrument calibrations as a customer service or by the applicant using specified procedures.

If monitoring instruments are to be calibrated by the applicant, then the applicant must submit the information requested in Appendix H. Additionally, specify in Item 7 above, the manufacturer, model, radionuclide and activity of the sources and the manufacturer and model of the devices used for performing instrument calibrations. Reference NUREG 1556 Vol. 7, Rev. 1, for the minimum source strength required to achieve an adequate calibration field. The sources should be strong enough to give an exposure rate of at least 7.7 microcoulomb per kilogram per hour [30 milliroentgen per hour] at 100 centimeters (e.g., 3.1 gigabecquerels [85 millicuries] of cesium-137 or 780 megabecquerels [21 millicuries] of cobalt-60).

If a consultant or other licensed firm will perform the calibration of the monitoring instruments, then the applicant must determine if the service vendor is qualified to perform these activities by requesting and maintaining a copy of their IEMA, U.S. NRC or equivalent Agreement State license.

Regardless of whether an applicant is authorized to calibrate radiation survey meters or contracts an authorized vendor to perform calibrations, the licensee must retain records of the calibration of instruments and equipment used for quantitative radiation measurements for 5 years after the record is made in accordance with 32 Ill. Adm. Code 340.1130(b). If any reading varies greater than 20% from the reading measured immediately after calibration, the licensee shall require that the instrument be repaired or recalibrated before use for monitoring required to maintain compliance with 32 Ill. Adm. Code 340.540(b).

Operability Checks

In accordance with 32 Ill. Adm. Code 340.510(c), the Agency requires the licensee to check instrument operability by using a source of radiation. These instrument operability checks are required to be performed each day that the instrument is used; and a record maintained for 5 years under 32 Ill. Adm. Code 340.1130.

Item 10. Facilities and Equipment

To issue a license, IEMA must find that the facilities and equipment are adequate to protect health and minimize danger to life or property. Portable devices must be stored and secured in such a manner as to prevent unauthorized removal, access or use as required by 32 Ill. Adm. Code 340.810. Furthermore, 32 Ill. Adm. Code 340.810(g) requires the use minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal whenever they are not under the control and constant surveillance of the licensee.

Applicants must describe the proposed facilities and equipment, as required by 32 Ill. Adm. Code 330.250(a)(3).

The facility diagram should identify the floor and the room or rooms where portable devices are prepared, used, administered, and stored, at a level of detail that is sufficient to demonstrate that the facilities and equipment are adequate to protect health and minimize danger to life or property.

Storage/use areas should not include areas used as residential quarters, motel rooms, etc. Submit diagrams of all areas in which radioactive material will be permanently stored or used (e.g., closets, rooms, cabinets, etc.). Drawings and diagrams that provide the exact location of materials or depict specific locations of safety or security equipment should be marked as "Security-Related Information" See Section II.C, "Identifying and Protecting Sensitive Information." The submitted diagrams and additional information should include the following:

a. Facility diagrams should be to scale with the scale indicated, or the dimensions provided. The direction of north must be indicated.

b. Clearly mark or identify all areas adjacent (e.g., beside, above and below) to radioactive material storage/use rooms or areas (e.g., offices, hallways, outside walls, etc.). Specify the distance of the closest routinely occupied workstation to the radioactive material storage/use area.

c. Specify the building, floor, room number and principal use (e.g., for storage only or for storage and use of the device) of each room or area.

d. Indicate all lockable doors, cabinets, lockers and storage containers for all storage/use locations for radioactive material.

e. Provide a description of the security measures implemented to limit access to the storage/use areas to authorized personnel only (e.g., areas locked when not in use and only accessible by authorized users). There must be two independent means of security provided for radioactive sources while at the storage facility and while in the field, including during transportation (two-lock rule).

f. Submit a description of the storage containers (e.g., manufacturer's shipping container, etc.) used for the portable devices. Specify if the devices will be stored in the manufacturer's shipping container or outside of the shipping container. Verify that the storage area can physically accommodate the devices you are requesting.

g. For each permanent storage or use location, if the applicant does not own the use/storage facility/property, submit a signed acknowledgement from the owner of the facility/property verifying the owner is aware of the use/storage of radioactive material on this property or a copy of a letter or statement from the facility owner or authorized representative of the owner indicating the owner is aware that the of the use/storage of radioactive material within their facility. If the facility/property is owned by the applicant, so indicate.

h. See information in Item 11 and submit a copy of the information in Attachment I. for determining public dose rates if more than a total of 2 portable gauges or 10 portable XRFs are requested for the same storage location and to ensure public doses do not exceed the limits.

Appendix J contains a sample facility diagram.

Item 11. Public Dose

Licensees must do the following:

a. Ensure that portable devices 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 mSv (2 mrem) in any one hour, from licensed operations, and

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

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

Operating and emergency procedures regarding security and surveillance should be sufficient to limit the exposure to the public ALARA during use or storage and after accidents. Public dose is controlled, in part, by ensuring that devices not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use (see Figure 11.1). If devices are not in storage, then authorized users must maintain constant surveillance to ensure that members of the public, who could be co-workers or workers in an adjoining work location, cannot get near the portable devices or use them, and thus receive unneeded radiation exposure.

Figure 11.1 Storing Gauges or XRFs. *Devices should be stored away from occupied areas and secured against unauthorized removal.*

Public dose is also affected by the choice of storage location and conditions. Because a portable device has a radiation field, it must be stored so that the radiation level in an unrestricted area (e.g., an office, the exterior surface of an outside wall, a neighboring facility not controlled by the licensee, etc.) 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 portable device, increasing the distance from the device, and using shielding (i.e., brick, concrete, lead or other solid walls) will reduce radiation exposure. As a rule of thumb, portable devices should be stored as far away as possible from areas that are occupied by other employees and members of the public. Storing the device in its transportation case and in the gauges upright position will also reduce exposure rates.

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 device(s). See Appendix I of this Instructional Set for examples.

If, after making an initial evaluation, a licensee makes changes affecting the storage area (e.g., changing the location of portable devices within the storage area, removing shielding external to the gauge or storing the portable devices outside of the manufacturer's transportation case, adding devices, changing the occupancy of adjacent areas, moving the storage area to a new location), then the licensee must ensure that portable devices are properly secured, perform a new evaluation to ensure that the public dose limits are not exceeded and take corrective action, as needed.

Appendix I may be used to demonstrate compliance with public dose limits. This information will be evaluated during the license application (or amendment) process.

NOTE: The license must be amended prior to permanently moving the storage area, including the movement of a storage cabinet.

Item 12. Procedures for Ordering and Receiving Radioactive Material and Opening Radioactive Material Packages

Licensed materials must be tracked from "cradle to grave," from receipt (from another licensee or from its own radionuclide production facility) to its eventual transfer/disposal. This is done to ensure accountability at all times; prevent the loss or theft of licensed material; and ensure that the possession limits listed on the license are not exceeded. Many licensees record daily use of gauges in a log book as part of their accountability program. Appendix M of this Instructional Set provides a template use log. Note that a log meeting the requirements of 49 CFR 172.201 is required if making multiple shipments using one shipping paper.

The requirements for receiving packages containing licensed material are found in 32 Ill. Adm. Code 340.960, "Procedures for Receiving and Opening Packages." Additionally, the security of licensed material, required by 32 Ill. Adm. Code 340.810, must be considered for all receiving areas. Licensees must ensure that the type and quantity of licensed material possessed is in accordance with the license. Additionally, licensees must ensure that packages are secured and radiation exposure from packages is minimized. To maintain accountability of licensed material, licensees must do the following:

a. Secure licensed material. (32 Ill. Adm. Code 340.810)

b. Maintain records of receipt, transfer, and disposal of licensed material to indicate the current inventory of sources at the licensee's facility. (32 Ill. Adm. Code 310.40, 32 Ill. Adm. Code 340.810, and 32 Ill. Adm. Code 340.1180)

c. Ensure that material received does not exceed license possession limits. (32 Ill. Adm. Code 330.310(e))

d. If applicable, update transactions in the NSTS, including an annual inventory reconciliation. (32 Ill. Adm. Code 330.950)

e. Conduct physical inventories at required frequencies to account for all sealed sources containing radioactive material and retain records for 5 years. (32 Ill. Adm. Code 340.810)

f. If applicable, Category 1 and Category 2 quantities of radioactive material are subject to the additional requirements in 32 Ill. Adm. Code Part 337.

Submit a description of procedures for ordering, receiving radioactive material and safely opening radioactive material packages, including receipt during off-duty hours and for notification of responsible persons upon receipt of radioactive material. This procedure should be adequate to address the items bulleted above as well as the requirements in 32 Ill. Adm. Code 340.960 for safely opening, and if necessary, monitoring packages. The procedure should also be adequate to ensure radiation levels in unrestricted areas do not exceed the limits specified in 32 Ill. Adm. Code 340.310 and damaged packages are promptly evaluated.

If packages are only received during normal working hours, so indicate. Security personnel or any other individuals who receive packages of radioactive material during off-duty hours shall be issued written procedures; which detail receipt, examination and required security of packages. Radiation safety training provided under 32 Ill. Adm. Code 400.120 to these staff should include training on these procedures. Procedures required under this section should include:

a. Notification procedures to be followed for packages that are missing, found or suspected to be damaged, contaminated or leaking. Indicate the immediate steps to be taken to prevent the spread of contamination.

b. Procedures or methods for verifying the contents of packages of radioactive material, not only against the packing slip, but also against the amount, type and form of material ordered and against the license to ensure that possession limits are not exceeded.

c. Procedures or methods to ensure that radioactive material is secured at all times against unauthorized removal.

d. Procedures or methods to ensure that receipt of radioactive material is properly documented.

Appendix K contains a sample procedure and instructions for ordering, receiving and opening radioactive material packages.

Item 13. General Rules for the Safe Use of Radioactive Material and Security Requirements

In accordance with 32 Ill. Adm. Code 340.110, licensees are responsible for developing, documenting, and implementing procedures to ensure the security and safe use of all licensed material, from the time it arrives at their facilities until it is used, transferred, and disposed of. The written procedures should provide reasonable assurance that only appropriately trained personnel will handle and use licensed material without undue hazard to themselves, other workers, or members of the public. In addition, these procedures should contain protective measures for occupational workers to maintain their doses as low as reasonably achievable

(ALARA). These procedures should include general safety instructions to be followed by all personnel while working with portable devices and may include the following:

a. Provisions that only qualified individuals will use the portable device(s).

b. Instructions for securing the portable device(s) prior to relocation or transport of the device, including who maintains control of keys.

c. Provisions for maintaining doses ALARA.

d. Instructions for using the portable device and performing routine maintenance and cleaning, according to the manufacturer's recommendations and instructions.

e. Procedures to be followed for records regarding receipt, use and transfer of radioactive material and for accountability of radioactive material. Note that a physical inventory of the sealed sources is required to be performed at frequencies not to exceed six months. A sample utilization log is contained in Appendix M. This log can be used on a daily basis for accountability and can be used for the physical inventory required to be performed at frequencies not to exceed six months.

f. Safety measures to be used when transporting the portable device(s) in a vehicle. Transportation activities must be carried out in accordance with 32 Ill. Adm. Code 341 and the requirements of the U.S. Department of Transportation regulations.

g. Procedures or methods for preventing unauthorized access, use or removal of the portable device(s) at permanent and temporary job sites or storage locations and during transportation. See the two-lock provisions in Item l (below).

h. Procedures for use and care of personnel monitoring devices, if assigned.

i. Specific instructions to the users informing them that:

   1. The source holder shall be locked in the "off" or closed position when the device is not in use.

   2. Sealed sources shall not be opened or removed from their source holders by the licensee.

   3. Current copies of the following documents shall be maintained at temporary job sites for Agency inspection:

      a) The license, including all active amendments.
      b) Manufacturer's instruction manual for the sealed sources and devices at the temporary job site.
      c) The licensee's emergency procedures.
      d) The results of the latest test for leakage and/or contamination performed on the sealed source.

j. Specific instructions to users informing them that any nonroutine maintenance, beyond the manufacturers training, and repair on the portable device(s) is prohibited, unless authorized by the license. Routine maintenance typically covers cleaning of the bottom surface and shutter or shield movement area, but no other maintenance or repair involving access to the source or source holders or dismantling of the shielding or shutter devices.

NOTE: If the applicant desires authorization to perform nonroutine maintenance and repair on portable devices involving access to the source or source holders and/or dismantling of the shielding or shutter devices, specific step-by-step procedures, including radiation safety precautions, survey instrumentation and provision for personnel dosimeters must be submitted to the Agency for review. In addition, the names and qualifications of personnel who will perform such maintenance and repair must be submitted.

k. Certain portable gauges are used to make measurements with the unshielded source extended more than three feet beneath the surface. Unless precautionary measures are taken, it is possible for the source to be buried under dirt or other media 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 reenter the cased hole; and (3) the source will be able to move freely, IEMA will usually, through standard license conditions, 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. Therefore, for portable gauging devices used when procedures require lowering the sealed source into the ground more than three feet, submit procedures for use of the portable gauging device in this manner and procedures to minimize the possibility of the source being stuck or lost "down hole" due to collapse of dirt or concrete around the source, including procedures requiring the use of piping, tubing or other casing material to line the hole from the lowest depth to 12 inches above the surface. Otherwise, specify that this type of use is not applicable.

l. Provisions for the security of portable devices, regardless of the location, situation and activities involving the portable gauge. Security procedures should address storage on vehicles, at temporary job sites and at permanent facilities. Detailed discussion to assist in the development of appropriate security procedures is provided below.

Security Procedures.

The following section contains detailed guidance on 32 Ill. Adm. Code 340.810(g) (e.g., the "*Two Lock Rule*"). The objective of the additional security measures is to reduce the opportunity for unauthorized removal and/or theft by providing a delay and deterrent mechanism. By following this guidance, it will become more difficult and time-consuming to defeat security measures.

The following security requirements apply to portable gauge licensees regardless of the location, situation and activities involving the portable gauge. **The security requirements apply to 1) storage on vehicles; 2) storage at temporary job sites and 3) storage at permanent facilities.**

At all times, the gauge must be:

- Under the control and constant surveillance of the gauge user;

  OR

- secured with a minimum of two independent physical controls that form tangible barriers to secure gauges from unauthorized removal. This requirement must be met at all times when in storage, including storage at permanent storage locations, temporary jobsites, and when stored in the vehicle (e.g., when in a convenience store, restaurant, or restroom while the gauge is in the vehicle).

Methods to Meet the Security Requirements

Different licensees have developed various methods of complying with 32 Ill. Adm. Code 340.810(g) requirements. The following information provides guidance to assist the licensee in developing security procedures. IEMA regulations require a portable gauge licensee to use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal whenever the portable gauge is not under the control and constant surveillance of the licensee.

NOTE: "Control and maintain constant surveillance" of portable gauges means being immediately present or in close proximity to the portable gauge so as to be able to prevent unauthorized removal of the portable gauge.

The physical controls used must be designed and constructed of materials suitable for securing the portable gauge from unauthorized removal and both physical controls must be defeated in order for the portable gauge to be removed. The construction and design of the physical controls used must be such that they will deter theft by requiring a more determined effort to remove the portable gauge. The security procedures used must ensure that the two physical barriers chosen clearly increase the deterrence value over that of a

single barrier and the two physical barriers would make unauthorized removal of the portable gauge more difficult.

To provide adequate security, licensees are encouraged to use combinations of physical controls. 32 Ill. Adm. Code 340.810(g) requires that each portable gauge licensee shall use a minimum of two independent physical controls. For example, if two chains are used, each chain and lock combination should be physically robust enough to provide both a deterrent and a reasonable delay mechanism. Although not required by regulation, when two chains or cables are used, the second chain or cable should be substantially more robust and more difficult to cut than the first chain or cable.

If possible, the licensee should consider storing its portable gauges inside a locked facility or other nonportable structure overnight, instead of storing them in a vehicle.

As long as the licensee maintains constant control and surveillance while transporting the portable gauges, the licensee need only comply with the DOT requirements for transportation (e.g., placarding, labeling, shipping papers, blocking and bracing). However, if the licensee leaves the vehicle and portable gauge unattended (e.g., while visiting a gas station, restaurant, store), the portable gauge must be secured by two independent controls, as required by 32 Ill. Adm. Code 340.810(g).

While transporting a portable gauge, a licensee should not modify the transportation case if it is being used as the Type A container for transporting the device. This includes, but is not limited to, drilling holes to mount the case to the vehicle or to mount brackets or other devices used for securing the case to the vehicle. In the event the package is modified, the modified package must be reevaluated by any of the methods described in 49 CFR 178.350, “Specification 7A; General Packaging, Type A,” or 49 CFR 173.461(a). The reevaluation must be documented and maintained on file in accordance with DOT regulations.

Physical controls may include, but are not limited to, a metal chain with a lock, a steel cable with a lock, a secured enclosure, a locked tool box, a locked camper, a locked trailer, a locked trunk of a car, inside a locked vehicle, a locked shelter, a secured fenced-in area, a locked garage, a locked nonportable cabinet, a locked room, or a secured building. To assist licensees, the list below provides some common examples of the use of two independent physical controls.

Securing a Portable Gauge at a Licensed Facility

Long-term storage of a portable gauge is usually at a permanent facility listed in the license or license application. Routine storage of a portable gauge in a vehicle or at temporary or

permanent residential quarters will be reviewed by IEMA and may be authorized during the licensing process. In accordance with IEMA security regulations, when a portable gauge is stored at a licensed facility, the licensee would be specifically required to use a minimum of two independent physical controls to secure the gauge.

The following are examples of how two independent physical controls can be used to secure a portable gauge when it is stored at a licensed facility:

a. The portable gauge or transportation case containing the portable gauge is stored inside a locked storage shed within a secured outdoor area, such as a fenced parking area with a locked gate.

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

c. The portable gauge or transportation case containing the portable gauge is stored inside a locked, nonportable cabinet inside a room with a locked door, if the building is not secured.

d. The portable gauge or transportation case containing the portable gauge is stored in a separate secured area inside a secured mini-warehouse or storage facility.

e. The portable gauge or transportation case containing the portable gauge is physically secured to the inside structure of a secured mini-warehouse or storage facility.

Securing a Portable Gauge in a Vehicle

The regulations in 32 Ill. Adm. Code Part 341, "Radioactive Materials Transportation" require that licensees who transport licensed material, or who may offer such material to a carrier for transport, must comply with the applicable DOT requirements that are found in 49 CFR.

Licensees commonly use a chain and a padlock to secure a portable gauge in its transportation case to the open bed of a pickup truck while using the vehicle for storage. This is not considered to be adequate security because there is only one physical control. The transportation case is portable, and a theft could occur if the chain is cut and the transportation case with the portable gauge is taken. Similarly, if a licensee simply loops the chain through the handles of the transportation case, a thief could open the transportation case and take the portable gauge without removing the chain or the case. Because the transportation case is also portable, it must be protected by two independent physical controls if the portable gauge is inside. A lock on the transportation case, or a lock

on the portable gauge source rod handle, is not sufficient because both the case and the gauge are portable.

A vehicle may be used for storage; however, IEMA, the NRC and DOT recommend that this practice only be used for short periods of time or when a portable gauge is in transit. A portable gauge should only be kept in a vehicle overnight if it is not practicable to provide temporary storage in a permanent structure. When a portable gauge is being stored in a vehicle, the licensee is specifically required to use a minimum of two independent physical controls to secure the portable gauge.

The following are examples of how two independent physical controls, approved by IEMA, can be used to secure portable gauges in a vehicle:

a. The locked transportation case containing the portable gauge is physically secured to a vehicle with brackets, and two chains (attached to the vehicle) are wrapped around the transportation case such that the case cannot be opened unless the chains are removed. See Figure 13.1.

b. 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 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. After the transportation case is properly secured, additional blocking and bracing will have to be added. See Figure 13.2.

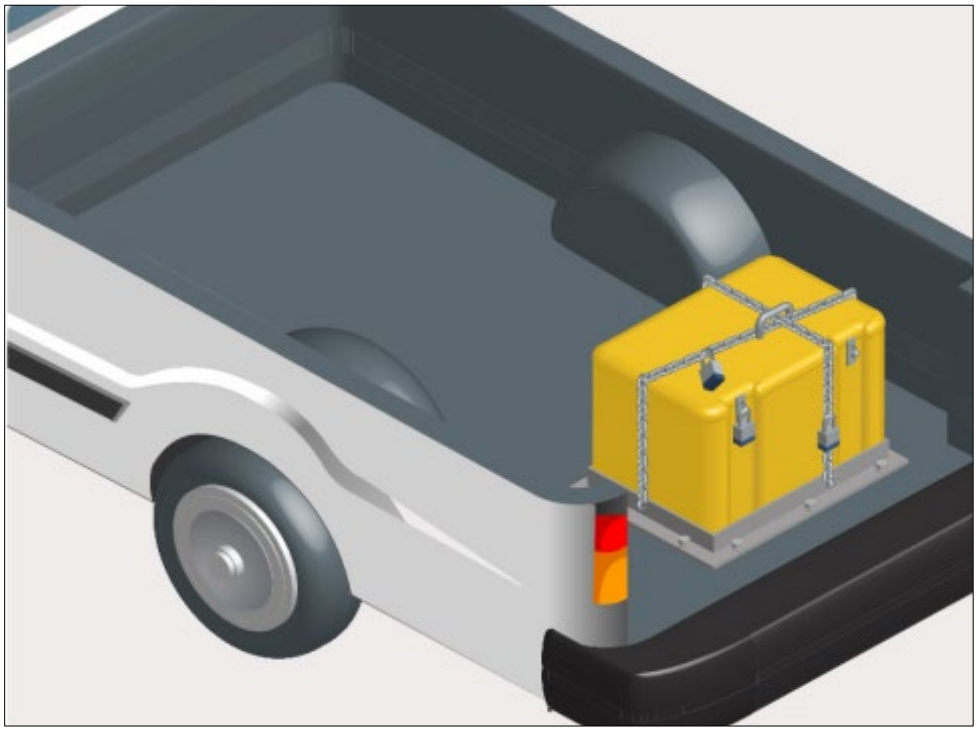


Figure 13.1. *32 Ill. Adm. Code 340.810(g) Example 1*

Figure 13.2. *32 Ill. Adm. Code 340.810(g) Example 2*

Note: The drawings in 13.1 and 13.2 are only two examples of securing portable gauges. There are other ways that licensees may choose to secure their portable gauges.

Securing a Portable Gauge at a Temporary Jobsite or at Locations Other Than a Licensed Facility

When a job requires storage of a portable gauge at a temporary jobsite or at a location other than a licensed 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, the licensee should limit access by storing the gauge in a separate room away from residents and other members of the public. The licensee must also meet the radiation exposure limits specified in 32 Ill. Adm. Code Part 340, "Standards for Protection against Radiation." When a portable gauge is stored at a temporary jobsite or at a location other than an authorized facility, the licensee is required to use a minimum of two independent physical controls to secure the portable gauge.

The following are examples of how two independent physical controls are used to secure portable gauges at these locations:

a. At a temporary jobsite, the portable gauge or transportation case containing the portable gauge is stored inside a locked building or in a locked nonportable structure (e.g., construction trailer, intermodal container) and is physically secured by a chain or steel cable to a nonportable structure in such a manner that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable. A lock on the transportation case or a lock on the portable gauge source rod handle would not be sufficient, because the case and the portable gauge are portable.

b. The portable gauge or transportation case containing the portable gauge is stored inside a locked room within temporary or permanent residential quarters and is physically secured by a chain or steel cable to a permanent or nonportable structure (e.g., large metal drain pipe, support column) such that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable.

c. The portable gauge or transportation case containing the portable gauge is stored in a locked garage and is within a locked vehicle or is physically secured by a chain or steel cable to the vehicle in such a manner that an individual would not be able to open the transportation case or remove the portable gauge without removing the chain or cable.

d. The portable gauge or transportation case containing the portable gauge is stored in a locked garage and is within a locked enclosure or is physically secured by a chain or steel cable to a permanent or nonportable 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.

Examples of two independent physical controls to secure a portable gauge when stored at a licensed facility are:

1. 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 sufficient to act as a tangible barrier;

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

3. The portable gauge or transportation case containing the portable gauge is stored inside a locked, non-portable cabinet inside a room with a locked door if the building is not secured;

4. The portable gauge or transportation case containing the portable gauge is stored in a separate secured area inside a secured mini-warehouse or storage facility; or

5. The portable gauge or transportation case containing the portable gauge is physically secured to the inside structure of a secured mini-warehouse or storage facility.

Appendix L contains a sample set of General Rules for the Safe Use of Radioactive Material for Items a.-j. and l. above. Either indicate that Appendix L will be utilized or submit an alternate procedure, addressing the issues in Item 13 above, for Agency review. If the applicant requests authorization to perform procedures listed in Item k., or perform non-routine maintenance on portable devices, submit additional procedures to address those activities. Examples of acceptable security procedures are provided above and should be incorporated into the licensee's procedures or alternate procedures submitted for Agency evaluation.

Item 14. Emergency Procedures

This section summarizes required emergency procedures. Emergency procedures regarding security and surveillance should be sufficient to limit the exposure to the public ALARA during use or storage and after accidents. Applicants should develop emergency procedures that address a spectrum of incidents (e.g., lost/stolen devices, leaking sources, credible threats, shutter failures, damaged/smashed gauges). After its occurrence becomes known to the licensee, IEMA must be notified when an incident involving licensed material occurs. Refer to the regulations (32 Ill. Adm. Code Part 340, Subpart M for a description of when notifications are required.

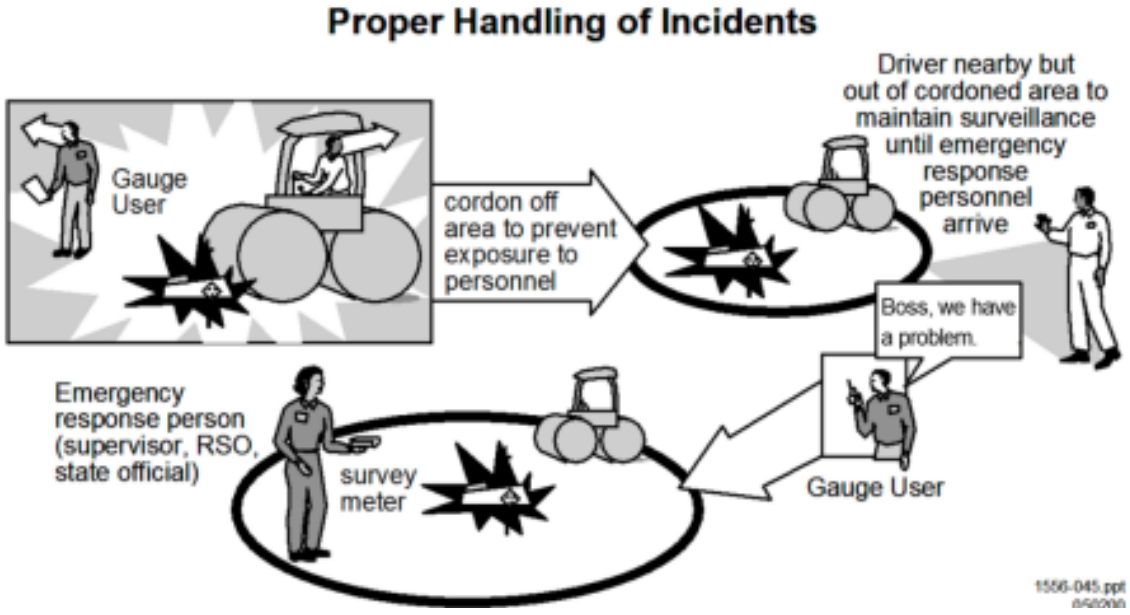


Figure 14.1 Proper Handling of Incidents. *Devices can be damaged by heavy equipment at jobsites. Therefore, Emergency Procedures need to be followed to minimize radiation safety risk..*

Submit a copy of the procedure to be implemented during an emergency involving radioactive materials. A copy of this procedure should be posted in all areas where radioactive material is used/stored and should be available to authorized users at each temporary job site. The procedure should:

a. Describe immediate action to be taken after an incident in order to prevent contamination/radiation exposure of personnel or members of the public. Actions to be taken for handling injured people who may be contaminated should also be addressed.

b. List the names and telephone numbers of the responsible persons (e.g., RSO) to be notified in case of an emergency. The Agency's 24-hour telephone number is to be included in this section (217/782-7860). An emergency contact that is available outside of normal business hours must be provided to the Agency. An alternate contact is also recommended.

c. Instruct personnel on appropriate methods for re-entering effected areas.

d. Describe what action is to be taken in the event of fire, theft, loss, or incident involving radioactive material. This response must include the notification of this Agency in accordance with 32 Ill. Adm. Code 340.1210 and 340.1220.

e. Be posted or readily accessible to all authorized users.

f. If applicable, address stuck source recovery for portable gauging devices whose use requires lowering the sealed source into the ground more than three feet.

Appendix N. contains a sample emergency procedure for Items a.- e. above. Either indicate that the procedure in Appendix N. will be followed or submit an alternate procedure for Agency review. If you request authorization for Item f. above, separate procedures, in addition to the information in Appendix N., must be submitted.

Item 15. Portable Device Transfer and Waste Disposal

Licensed radioactive materials must be disposed of in accordance with Agency requirements by transfer to an authorized recipient.

a. The portable device may be transferred to another licensee who is authorized to possess the same make and model device, for the same isotope and activity, not to exceed the maximum possession limits on the recipient's license. In accordance with 32 Ill. Adm. Code 330.400(c), the licensee transferring radioactive material shall verify the transferee’s license authorizes the receipt of the portable devices. If necessary, licensees may contact the Agency for assistance in this regard.

b. The portable device may also be disposed of by transfer to an authorized recipient who is licensed to receive waste from another licensee or a licensed radioactive waste disposal facility.

c. The portable device may also be returned to the original manufacturer if they are licensed and accept the return.

Before transferring radioactive material, a licensee must verify that the recipient is properly licensed to receive it. In addition, all leak test analysis must be up to date and all packages containing radioactive material must be prepared and shipped in accordance with 32 Ill. Adm. Code 341 and DOT regulations.

Since the licensee is only authorized to transfer or dispose of radioactive material in accordance with 32 Ill. Adm. Code 340.1010, this item requires only affirmation on the application form. Note however, that records pertaining to transfer or disposal are required to be maintained and will be required to be submitted when the licensee requests to remove the portable device from the license, to delete an authorized site location, or to terminate the license.

Item 16. Testing Sealed Sources for Leakage and/or Contamination

32 Ill. Adm. Code 340.410 requires testing to determine whether there is any radioactive leakage from sealed sources. The measurement of the leak test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 Bq (0.005 microcurie) of radioactivity. Leak test samples should be collected at the most accessible area where contamination would accumulate if the sealed source were leaking. Testing of sealed sources for leakage and/or contamination (leak/wipe tests) shall be performed only by persons who are specifically licensed by either the Agency, the U.S. NRC, another Agreement State to perform such services. Leak test records shall be retained for 5 years after they are made or until the source in storage is removed. The requirements for records pertaining to leak tests are detailed in 32 Ill. Adm. Code 340.1135. In establishing a program for performing leak tests in accordance with 32 Ill. Adm. Code 340.410, two alternatives are available from which to choose:

a. The services of a licensed consultant or commercial organization may be used to obtain test samples, analyze the samples and report the results back to the applicant. In addition, a commercially available test kit may be used to obtain a test sample for subsequent analysis by a licensed service company. When using a licensed service, please note the licensee is required to maintain a copy of that company's license, which authorizes them to perform leak tests as a customer service. Collectively, the wipe and the analysis make up the complete “leak test”. The date complete should be used for regulatory purposes.

b. The applicant may request authorization to perform leak tests, including sampling and analysis. Appendix O of this instructional set provides model procedures that represent one acceptable method to perform leak testing for sealed sources. Either commit to the use of Appendix O or submit alternate procedures with all required calculations for Agency evaluation.

Item 17. Personnel Monitoring

Licensees must evaluate the potential occupational exposure of all workers and monitor occupational exposure. The use of individual monitoring devices for external dose is required, pursuant to 32 Ill. Adm. Code 340.520(a), for among others:

a. Adults likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of the limits in Section 340.210(a);

b. Minors who are likely to receive, in 1 year from sources external to the body, a dose in excess of 10 percent of any of the applicable limits in 32 Ill Adm. Code 340.270; and

c. Declared pregnant women likely to receive during the entire pregnancy, from radiation sources external to the body, a deep dose equivalent in excess of 1 mSv (0.1 rem).

Under conditions of routine use (including routine maintenance activities of weekly cleaning and lubrication of the gauge according to the manufacturer's instructions), the typical portable device user does not require use of a personnel monitoring device. In most accidents where a gauge has been run over and damaged, the shielding of the source remains intact. A gauge user also does not require personnel monitoring when proper emergency procedures are used. Portable XRF users also do not normally require use of a personnel monitoring device.

Applicants must do one of the following:

- Submit 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 of 0.05 Sv (5 rems) for whole body and 0.5 Sv (50 rems) for extremities.

  OR

- Submit a description of the occupational exposure monitoring plan. Provide information for dosimetry to be processed and evaluated by a National Voluntary Laboratory Accreditation Program (NVLAP)-approved processor that is exchanged at a frequency recommended by the processor. The application form provides an area for the licensee to indicate the type of dosimetry to be utilized and the associated exchange frequency.

Appendix R of this instructional set provides model procedures for monitoring external occupational exposure. An applicant may utilize this model procedure or provide an alternate procedure which demonstrates compliance with the referenced regulations. Alternate procedures should include the Radiation Safety Officer's role in the personnel dosimetry program, the established investigational levels and the resulting actions the RSO will take if those levels are met or exceeded.

The remainder of this section provides guidance on this topic.

Licensee Evaluation of Occupational Dose

The licensee must evaluate the exposure of all occupational workers to determine if monitoring is required. The licensee should perform an evaluation of the dose the individual is likely to receive prior to allowing the individual to receive the dose. This evaluation need not be made for every individual; evaluations can be made for employees with similar job functions or work areas. Part 1 of Appendix P provides guidance on preparing a written evaluation demonstrating that portable device users are not likely to exceed 10 percent of the applicable limits and thus, are not required to have personnel monitoring devices.

If this prospective evaluation shows that an adult individual's dose is not likely to exceed 10 percent of an applicable regulatory limit, there are no recordkeeping or reporting requirements in regard to the individual's exposure. For individuals who have received doses at other facilities in the current year, the previous dose need not be considered in this prospective evaluation. Only dose that could be received at the facility performing the evaluation need be considered when determining the need for monitoring, and associated recordkeeping and reporting. If it was determined that monitoring was not required, and a subsequent evaluation shows that the 10 percent threshold has or will be exceeded, the dose received when monitoring was not provided should be estimated, recorded, and reported. These estimates can be based on any combination of work location radiation monitoring or survey results, monitoring results of individuals in similar work situations, or other estimates to produce a "best estimate" of the actual dose received.

If the prospective evaluation shows that the individual adult is likely to exceed 10 percent of an applicable limit, then monitoring is required, regardless of the actual dose received. Licensees must provide individual radiation exposure data to each worker as required by 32 Ill. Adm. Code 400.130.

Personnel Monitoring Devices and Exchange Frequency

If external dose monitoring is necessary, the applicant should evaluate the type of personnel dosimetry, such as film badges, optically stimulated luminescence dosimeters (OSLs), and

thermoluminescent dosimeters (TLD), that personnel will use. If occupational workers handle sources/source holders during non-routine maintenance or perform calibrations, the licensee should evaluate the need to provide extremity monitors, which are required if workers are likely to receive a dose in excess of 0.05 Sv [5 rems] shallow-dose equivalent, in addition to whole body badges. Additionally, applicants should ensure that their personnel dosimetry program contains provisions that personnel monitoring devices be worn in such a way that the part of the body likely to receive the greatest dose will be monitored.

Some licensees use self-reading or electronic dosimeters in lieu of processed dosimetry. This is acceptable if the regulatory requirements are met, and the dosimeter can accurately assess the types of radiation for which the licensee is authorized. Refer to ANSI N322-1997, "Inspection, Test, Construction, and Performance Requirements For Direct Reading Electrostatic/Electroscope Type Dosimeters" and Regulatory Guide 8.4, "Personnel Monitoring Device—Direct-Reading Pocket Dosimeters," for more information. If pocket dosimeters are used to monitor personnel exposures, applicants should state the useful range of the dosimeters, along with the procedures and frequency for their calibration [32 Ill. Adm. Code 340.510(e)].

When personnel dosimeters that require processing to determine the radiation dose are used to comply with the individual monitoring requirement for external doses in 32 Ill. Adm. Code 340.520(a), dosimeters must be processed by a National Voluntary Laboratory Accreditation Program (NVLAP)-accredited processor [32 Ill. Adm. Code 340.510(d)]. Most licensees use either OSLs, TLDs, or film badges. NUREG-1556 Volume 11, Rev. 1 states the exchange frequency for dosimeters is typically monthly or quarterly. If film badges are still being utilized, the exchange frequency may need to be monthly because of technical concerns about film fading. After reviewing the radiation protection program's use and exchange frequency, applicants should obtain technical specifications from their NVLAP-approved processor to determine the appropriate type(s) of dosimetry. The NIST maintains a directory of laboratories that are NVLAP-accredited.

If pocket dosimeters are used to monitor personnel exposures, provide the useful range of the dosimeters, along with the procedures and frequency for their calibration [32 Ill. Adm. Code 340.510(e)].

If self-reading or electronic dosimeters are used in lieu of processed dosimetry, provide the following:

a. A statement that the self-reading or electronic dosimeters are deemed appropriate by the manufacturer for the type(s) of radiation and occupational exposures for which they are being utilized.

b. Commit to the development of procedures or operational controls that limit administrative access to exposure data (typically RSO/ARSO and an alternate only).

c. Specify the minimum read frequency (dependent upon the types of use and the licensee's evaluation of potential dose). This is typically monthly or quarterly.

d. Commit to the establishment of administrative procedures to address failures on read frequencies (e.g., emails/alerts at 1 week prior to deadline, daily reminders after 30 days, physical retrieval no later than 45 days or declaration of unit as lost with assignment of dose to individual's record and reissuance of new unit).

Review and record on Agency form IL 473-0299 (IDNS Form 5), or an equivalent form (e.g., dosimeter processor's report), the results of personnel monitoring. This documentation should include routine occupational dose as well as doses received during planned special exposures, accidents and emergency conditions. These forms can be used for reporting dose histories to employees on a monthly basis, annual basis or for those who leave employment with the licensee. If these forms are not used, the licensee must keep clear and legible records containing all of the information required by the forms.

NOTE: In accordance with 32 Ill. Adm. Code 340.1110, no licensee or registrant shall subtract radiation exposures from official personnel monitoring records without the prior written approval of the Agency.

Item 18. Fees

Refer to 32 Ill. Adm. Code 331 and the appropriate fee schedule to review the applicable fees. You will receive a billing statement from the Agency regarding payment of fees. Do not send a fee payment with the application. Note that for new applications however, that although a billing statement will be mailed to new applicants allowing a certain time period to remit the payment, the license will not be issued until the fee for the new application has been paid. Therefore, prompt payment upon billing may avoid unnecessary delay in issuing a license. Questions concerning fees should be directed to the Agency's Division of Fiscal Management at ema.accountsreceivable@Illinois.gov. The regulations also include a requirement for payment of an annual recovery/remediation fee for use in cases where such costs for decontamination/disposal cannot be recovered from the responsible parties or available financial assurance documents.

NOTE: The annual and remote site fees listed in Appendix F to Part 331 are nonrefundable and are assessed on a 12-month period.

Item 19. Financial Assurance

Financial assurance requirements are generally not applicable to portable device users due to the exemptions in 32 Ill. Adm. Code 326.50. The licensee should review Part 326 to ensure they are not required to post financial assurance and indicate such on the application. Should the licensee possess activities requiring financial assurance, the applicant should reference the, "Guidance Document on Financial Assurance" which is available on the Agency's website.

Item 20. Certification

A representative of the corporation or legal entity filing the application must sign and date the application. The application must contain an original signature and date by the applicant, if acting as an individual or by an individual who is authorized by management to sign on behalf of the licensee. A statement signed by facility management granting authority to sign license requests and related documents is required for applications not signed by an officer or the administrator of the facility. Unsigned applications or applications with stamped or computer-generated signatures will be returned for proper signature. For applications not from individuals the Federal Employers Identification Number (FEIN) should be included in the Certification block.

If the individual signing the application is unknown to the Agency (not listed on any license previously), complete the Release and Authorization Full Due Diligence Form to expedite processing of the application. A copy may be obtained from the Agency website https://iema.illinois.gov/nrs/radsafety/guidance.html and is included as Exhibit A.

NOTE: Submit the original, signed copy of the application. Retain a copy for reference and records. More detailed instructions are in Section II. HOW TO FILE

IV. LICENSE AMENDMENTS

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. The change is not in effect until the amendment has been issued. 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 [32 Ill. Adm. Code 330.320]. In case of an emergency requiring an expedited license amendment, contact the materials licensing staff at IEMA. Please do not request expedited amendments without first speaking with a member of licensing staff. Licensees are required to conduct their programs in accordance with the regulations and statements, representations and procedures contained in the license application and supporting documents.

In accordance with 32 Ill. Adm. Code 330.340, "Amendment of Licenses at Request of Licensee," a licensee is required to apply for and receive a license amendment before several activities can occur, including:

- Before receiving, using or transferring radioactive material for a type of use not authorized by the license;
- Adding or changing the RSO
- Before receiving radioactive material in excess of the amount, in a different form, than is authorized on the license;
- Receiving a sealed source from a different manufacturer or of a different model number than authorized by the license unless the sealed source is used in manual brachytherapy, is listed in the SSD registry, for the quantity and for an isotope authorized by the license
- Before adding to or changing any area of use or storage identified on the license, including a change of address.
- Before revising procedures identified ('tied down') in the current license.

Requests for license amendments must identify the license by number and clearly describe the exact nature of the changes, additions, or deletions requested. A licensee requesting a license amendment should do the following:

- Use the most **recent guidance and current regulations** in preparing the amendment request
- Submit the request in letter form or use appropriate Agency forms
- Clearly state the license number and licensee name on the letter
- Identify references to previously submitted information and documents by indicating the applicable date, page, and/or paragraph
- Ensure the request is sent with a valid electronic signature, or physical signature, by an Agency approved contact to the license or the RSO
- Follow Section II. B. "Where to File" for submitting amendment requests via paper or electronically (submission for amendment requests is the same process as applications)
- Licensees must retain a copy of the amendment request submitted to the Agency, no matter the format, for inspection purposes and for the licensee to reference as needed

For all amendments that require a fee the licensee will be billed by the Agency. See Item 18. Fees for additional information regarding issuing amendments and receipt of fees.

V. LICENSE RENEWALS

A. Timely Renewal

It is the licensee's obligation to keep the license current. In order to continue the license after its expiration date, the licensee must submit an application for license renewal at least 30 days before the expiration date [32 Ill. Adm. Code 330.320(a)]. If the renewal application is timely filed prior to the expiration date, your license will remain in effect until the Agency takes final action regarding the application. This filing will ensure that the license does not expire until final action on the application has been taken by the Agency.

Although generally not applicable to portable device licensees, if the licensee has a Reclamation Plan and Cost Estimate for financial assurance filed with the Agency, it must be updated as part of the renewal application. Upon approval of the Cost Estimate, you may need to revise your financial assurance instrument.

It is critical to note that, in accordance with 32 Ill. Adm. Code 330.320(c), if the expiration date passes without license termination requirements having been met by the licensee and/or without a timely renewal application having been filed by the licensee before the expiration date, the authority of the licensee to engage in licensed activities shall expire at the end of the specified expiration date. Immediately upon the passing of the expiration date, a licensee that has neither met license termination requirements nor filed a timely application under 32 Ill. Adm. Code 330.320(a) shall:

- Cease use of radioactive material;
- Store all radioactive material in a secure location and limit activities involving radioactive material to those necessary for shipping, transferring and disposing of the radioactive material;
- File either a new application for a specific license or provide information equivalent to that required on Agency Form KLM.007 (Certificate Termination and Disposition or Radioactive Material);
- Comply with all applicable Agency regulations;
- Comply with the license conditions of the expired license until either a new license is issued or the termination requirements of Section 330.325 are met; and
- Comply with any orders issued by the Agency in accordance with the Act and 32 Ill. Adm. Code 200 that result from violation of 32 Ill. Adm. Code 330.320(a) or any other applicable provisions of Agency regulations or the Act.

B. Complete Renewal Application

Renewals require a complete and up-to-date application, including all required program elements outlined in this instructional set, and current information about the applicant's program. Be sure to use the most recent guidance in preparing a renewal application. Applications should be submitted without reference to documentation and information submitted previously, except for previously approved users. Training documentation for personnel currently listed on the license does not need to be submitted as part of the renewal application as long as the material and uses for each individual are the same as currently authorized on the license. If references to other previously submitted documentation cannot be avoided, they are acceptable provided:

- The reference is made in response to a particular item of required information (e.g., radiation instrument calibration procedures);
- The reference is clear and specific (e.g., title of document, date of submission, page and paragraph); and
- The referenced document contains all information required for a particular item at the time of renewal.
- Any previous exemptions granted to the licensee must be resubmitted in their entirety.

Renewal applications should be submitted in accordance with the procedures outlined in Section II (Filing an Application) of these instructions.

C. Expedited Renewal Application

In an effort to streamline the license renewal process, the Agency has implemented an Expedited Renewal option. Expedited renewals are available to a licensee whose previous renewal was not expedited, has no significant noncompliance or enforcement history, the management and scope of operations have not substantively changed, and the procedures and facilities utilized by the licensee are expected to remain the same. If the licensee is afforded an expedited renewal, the Agency still expects a comprehensive review of your program. However, the applicant need only submit for Agency review those changes required to update the existing license to reflect current licensed operations and facilities, conform with regulatory requirements, informational notices, and inspection and enforcement activities.

After the desired changes are identified, complete the expedited renewal form “EXPEDITED RENEWAL FORM FOR A PORTABLE DEVICE RADIOACTIVE MATERIALS LICENSE”. Attach all pertinent information pertaining to the desired changes and submit

the form with attachments to the Agency. If no changes appear to be necessary or desired, indicate this on the Expedited Renewal Form, complete the remaining items, and submit it to the Agency. Please reference the requirements for timely renewal discussed above.

The Agency does not discourage licensees from submitting a complete renewal application, in lieu of an expedited application. If there have been significant changes to the regulations, guidance, or your program since the last renewal, you should review the impact of these changes on your program and consider which renewal option to pursue. Periodically, the Agency will require the submittal of a complete renewal application to ensure that all program elements are current.

Licensees are subject to all applicable rules, regulations, representations and orders of the Agency and to any conditions specified on the license.

VI. LICENSE TERMINATIONS

A licensee may request termination of a radioactive material license at any time. However, in accordance with 32 Ill. Adm. Code 330.310(i), a licensee must notify the Agency in writing no later than 60 days after principal activities involving the use of radioactive materials at the site or in a separate building or outdoor area have not occurred for a period of 2 years, and the licensee has not decontaminated the site or area. In accordance with 32 Ill. Adm. Code 340.1310, written notification must be provided to the Agency 30 days in advance of vacating or relinquishing possession or control of premises which may have been contaminated with radioactive material. To terminate a license, the licensee must meet the requirements of 32 Ill. Adm. Code 330.325, which include:

- Cease use of radioactive material.
- Notify IEMA, in writing, within 30 days prior to the expiration date, when a decision is made to permanently cease licensed activities.
- Transfer or dispose of all licensed radioactive material in the licensee's possession in accordance with 32 Ill. Adm. Code 340.
- Certify the disposition/transfer of licensed materials by submission of IEMA Form KLM.007, "Certificate – Termination and Disposition of Radioactive Material," (see Exhibit C); and
- Conduct necessary decommissioning and perform radiation monitoring or the equivalent in accordance with 32 Ill. Adm. Code 330.325(b)(1)(F). Submit copies of the latest leak test results for each source possessed under the license. The frequency of required leak tests is specified in 32 Ill. Adm. Code 340.410.

- Submit a record documenting that a licensee noted on KLM.007 received each source transferred.
- If applicable, submit for Agency approval a plan for reclaiming the facility, including decontamination and removal of residual contamination. See additional requirements for detectable levels or residual radioactive contamination in 32 Ill. Adm. Code 330.325(b)(3).
- Pay any outstanding fee or civil penalty owed to IEMA.
- **NOTE:** For portable device licensees whose sources have never leaked, acceptable records important to decommissioning are sketches or written descriptions of the specific locations where each device was used or stored at locations specifically listed in the license, copies of a current leak test for each device, and records of transfer or disposal. However, if portable device licensees have experienced unusual occurrences (e.g., leaking sources and other incidents that involve the spread of contamination) they are required to maintain records about possible contamination that remains after cleanup or that may have spread to inaccessible areas pursuant to 32 Ill. Adm. Code 330.310(k). Records of these areas will be required to facilitate the termination request.

The Agency reserves the right to perform confirmatory monitoring of licensed facilities prior to termination.

VII. TIMELY NOTIFICATION OF TRANSFER OF CONTROL OR BANKRUPTCY

A. Transfer of Control

Licensees must provide all supporting information and obtain IEMA's prior, written consent before transferring control of the license, also referred to as a "change of ownership" and/or "transferring the license." Notification shall be provided to the Agency, including the identity and technical qualifications of the proposed transferee, not later than 90 days prior to the transfer [32 Ill. Adm. Code 330.310(c)(1)]. Transferring control may be the result of mergers, buyouts, or majority stock transfers. Although it is not IEMA's intent to interfere with the business decisions of licensees, under 32 Ill. Adm. Code 330.310(c), licensees must obtain prior IEMA's written consent before transferring control of the license to ensure the following:

- Radioactive materials are possessed, used, or controlled only by persons who have valid U.S. NRC licenses or Agreement State licenses.
- Materials are properly handled and secured.

- Persons using these materials are capable, 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.
- The transferee has the financial resources to decommission the license, if necessary.
- Adequate financial assurance is provided for compliance with the applicable IEMA requirements, if required.
- Public health and safety are not compromised by the use of such materials.

Appendix D of this instructional set contains detailed instructions on information needed for transfers of control. A fillable pdf worksheet is also available on the Agency website to facilitate the submittal of necessary information to IEMA.
https://iema.illinois.gov/nrs/radsafety/guidance.html

B. Notification of Bankruptcy Proceedings

In accordance with 32 Ill. Adm. Code 330.310(j), the Agency must be immediately notified in writing following the filing of a voluntary or involuntary petition for bankruptcy by or against a licensee, an entity controlling the licensee or listing the license or licensee as property of the estate, or an affiliate of the licensee. This notification shall identify the bankruptcy court in which the petition was filed, the date of the filing, the cap.

- The bankruptcy court in which the petition for bankruptcy was filed;
- The date of the filing of the petition;
- The chapter under which the bankruptcy petition has been filed;
- The name, address and phone number of the bankruptcy trustee (if a trustee has been named at the time of the notification);
- Whether the licensed radiation source remains in the possession and control of the licensee and whether any change in possession or control is expected or contemplated;
- The name of the person in possession and control of the licensed radiation source if the licensee no longer maintains possession or control; and
- Whether the Agency has been named in the bankruptcy petition either as a creditor or in some other capacity.

Even though a licensee may have filed for bankruptcy, the licensee remains subject to all applicable IEMA regulatory requirements. IEMA must be notified 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).

APPENDIX A

RETENTION OF DOCUMENTS

Note: Other records are required to be maintained and are listed in the regulations. The listing below is for the most common records required to be maintained.

Record	Recordkeeping Requirement	Retention Period
Copy of License, all active amendments and supporting documents (including the application and all tie-down correspondence)	340.1120(a)	duration of the license
Results of Annual Radiation protection program reviews	340.1120(b)	5 years
Results of surveys and calibrations	340.1130(a)	5 years
Results of surveys to determine individual dose	340.1130(b)	duration of license
Determination of prior occupational dose	340.1140	duration of license
Planned special exposure	340.1150	duration of license
Individual monitoring results	340.1160	duration of license
Dose to a declared pregnant woman	340.1160	duration of license
Dose to individual members of the public	340.1170	duration of license
Waste disposal	340.1180	duration of license
Records of information important to the decommissioning of a facility	330.310(k)	duration of license
Records of receipt of radioactive material	310.40	duration of license
Records of transfer of radioactive material	310.40	duration of license
Records of disposal of radioactive material	310.40	duration of license
Radiation survey instrument calibrations	340.1130(a)	5 years
Leak tests and inventory of sealed sources	340.1135	5 years
Surveys for ambient radiation exposure rate	340.1130	5 years
Records of Training	340.1120	5 years

See Appendix S for a Summary of Applicable US DOT Requirements and associated record retention

APPENDIX B

Portable Device 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 Name: _____ Date of Audit: _____

Auditor Signature:_____ RSO Signature: _____

1. AUDIT HISTORY

a. Last audit of this location conducted on (date)_____.

b. Were previous audits conducted annually? [32 Ill. Adm. Code 340.110(c)]

c. Were records of previous audits maintained? [32 Ill. Adm. Code 340.1120]

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. Is this most current copy of the license available?

b. If the designated contact person, mailing address, telephone, telefacsimile, email address or places of use changed, was the license amended?

c. If ownership changed or bankruptcy was filed, was prior IEMA consent obtained or was IEMA notified?

c. If the RSO was changed, was the license amended? Does the new RSO meet IEMA training requirements?

d. Does the license authorize all of the IEMA-regulated radionuclides contained in the devices possessed?

e. Does the licensee have the manufacturers' manuals for operation and maintenance for each model device possessed?

f. Are the actual uses of devices consistent with the authorized uses listed on the license?

g. Is the RSO fulfilling his/her duties?

3. TRAINING AND INSTRUCTIONS TO WORKERS

a. Were workers instructed per 32 Ill. Adm. Code 400.120? Was refresher training provided, as needed?

b. Did each device operator attend an approved course before using the devices?

c. Are training records maintained for each device operator?

d. Did interviews with operators reveal that they know the emergency procedures?

e. Did this audit include observation of operators using the devices in a field situation? Operating device? Performing routine cleaning and lubrication? Transporting device? Storing device?

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 Subpart H (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 instrument, does the instrument meet IEMA's criteria?

b. If the licensee does not possess a survey instrument, are specific plans made to have one available in the event of an emergency?

c. If applicable, is the survey instrument needed for non-routine maintenance calibrated as required? [32 Ill. Adm. Code 340.510(b)]

d. Are calibration records maintained? [32 Ill. Adm. Code 340.1130]

5. DEVICE INVENTORY AND ACCOUNTABILITY

a. Is a record kept showing the receipt of each device? [32 Ill. Adm. Code 310.40]

b. Are all devices received physically inventoried every 6 months?

c. Are records of inventory results with appropriate information maintained?

d. Are records of use maintained (use logs)?

6. PERSONNEL RADIATION PROTECTION

a. Are ALARA considerations incorporated into the radiation protection program? [32 Ill. Adm. Code 340.110(b)]

b. Is documentation kept showing that unmonitored users receive less than 10 percent of the limit?

c. Did unmonitored users' activities change during the year, which could put them over 10 percent of limit? If so, was a new evaluation performed?

d. If external dosimetry is required (user receiving greater than 10 percent of the limit), is dosimetry provided to users? If yes, address the following:

1. Is the dosimetry supplier NVLAP-approved? [32 Ill. Adm. Code 340.510(d)]
2. Are the dosimeters exchanged at the appropriate frequency?
3. Are dosimetry reports reviewed by the RSO when they are received?
4. Are the records in accordance with IEMA forms 4 or 5 or equivalent? [32 Ill. Adm. Code 340.1160(c)]

- Was IEMA-4 “Cumulative Occupational Exposure History” or equivalent completed?
- Was IEMA-5 “Occupational Exposure Record for a Monitoring Period” or equivalent completed?

e. If a worker declared her pregnancy, did licensee comply with 32 Ill. Adm. Code 340.280? Were records kept of embryo/fetus dose per 32 Ill. Adm. Code 340.1160(d)?

f. Are records of exposures, surveys, monitoring, and evaluations maintained? [32 Ill. Adm. Code 340.1130, 340.1140, 340.1150, 340.1160, and 340.1170]

7. PUBLIC DOSE

a. Are devices stored in a manner to keep doses below 100 mrem in a year? [32 Ill. Adm. Code 340.310(a)(3)]

b. Has a survey or evaluation been performed per 32 Ill. Adm. Code 340.320? 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? [32 Ill. Adm. Code 340.310(a)(1)]

d. Are devices being stored in a manner that would prevent unauthorized use or removal? [32 Ill. Adm. Code 340.810] Is the two-lock rule being implemented and enforced? [32 Ill. Adm. Code 340.810(g)]

e. Are records maintained for public dose? [32 Ill. Adm. Code 340.1170]

8. OPERATING AND EMERGENCY PROCEDURES

NOTE: An ideal way to assess the adequacy and adherence to operating procedures is by observing work in progress.

a. Are operating and emergency procedures being maintained?

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 tests performed every 6 months or at other prescribed intervals?

b. Was the leak test performed as described in correspondence with IEMA 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 IEMA notified?

10. MAINTENANCE OF GAUGES

a. Are manufacturer's procedures followed for routine cleaning and lubrication of the device?

b. Does the source or source rod remain attached to the device during cleaning?

c. Is non-routine maintenance performed where the source or source rod is detached from the device? If yes, was it performed according to license requirements (e.g., extent of work, individuals performing the work, procedures, dosimetry, survey instrument, compliance with 32 Ill. Adm. Code 340 Subpart C limits)?

d. Are labels, signs and postings identifying devices containing radioactive material, radiation areas and warnings clean and legible?

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, 49 CFR 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. Was the package secured against unauthorized access and removal?

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. Were there any credible threats made? Were reports made? [32 Ill. Adm. Code 340.1205]

b. Was any radioactive material lost or stolen? Were reports made? [32 Ill. Adm. Code 340.1210]

c. Did any reportable incidents occur? Were reports made? [32 Ill. Adm. Code 340.1220]

d. Did any overexposures or high radiation levels occur? Were they reported? [32 Ill. Adm. Code 340.1230]

e. Were there any required notifications to individuals? Were they reported? [32 Ill. Adm. Code 340.1250)

f. Were there any leaking or contaminated sources? Were they reported? [32 Ill. Adm. Code 340.1260]

g. Were there any missing waste shipments? Were they reported? [32 Ill. Adm. Code 340.1270]

h. If any events (as described in items a through h above) did occur, what was the root cause? Were the corrective actions appropriate?

i. Is the licensee aware of the 24-hour telephone number for IEMA's Operations Center? Ask for the Nuclear Safety Officer in Charge at (217) 782-7860

14. POSTING AND LABELING

a. Is KLM.001 "Notice to Workers" posted?

b. Are IEMA regulations and license documents posted or is a notice posted stating where these documents are located?

c. Is there any other posting and labeling, such as storage areas and containers? [32 Ill. Adm. Code 340.920]**.**

15. RECORDKEEPING FOR WASTE TRANSFER/DISPOSAL

a**.** Are records for waste transfer/disposal maintained? [32 Ill. Adm. Code 340.1180]

16. BULLETINS AND INFORMATION NOTICES

a. Were any NRC/IEMA Information Notices received?

b. Was appropriate training and action taken in response to the notices?

17. SPECIAL LICENSE CONDITIONS OR ISSUES

a. Did the auditor review special license conditions or other issues (e.g., non-routine maintenance, such as removal of source rod from the device)?

18. EVALUATION OF OTHER FACTORS

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

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

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

19. DEFICIENCIES IDENTIFIED IN AUDIT; CORRECTIVE ACTIONS

a. Summarize problems and/or deficiencies identified during the audit.

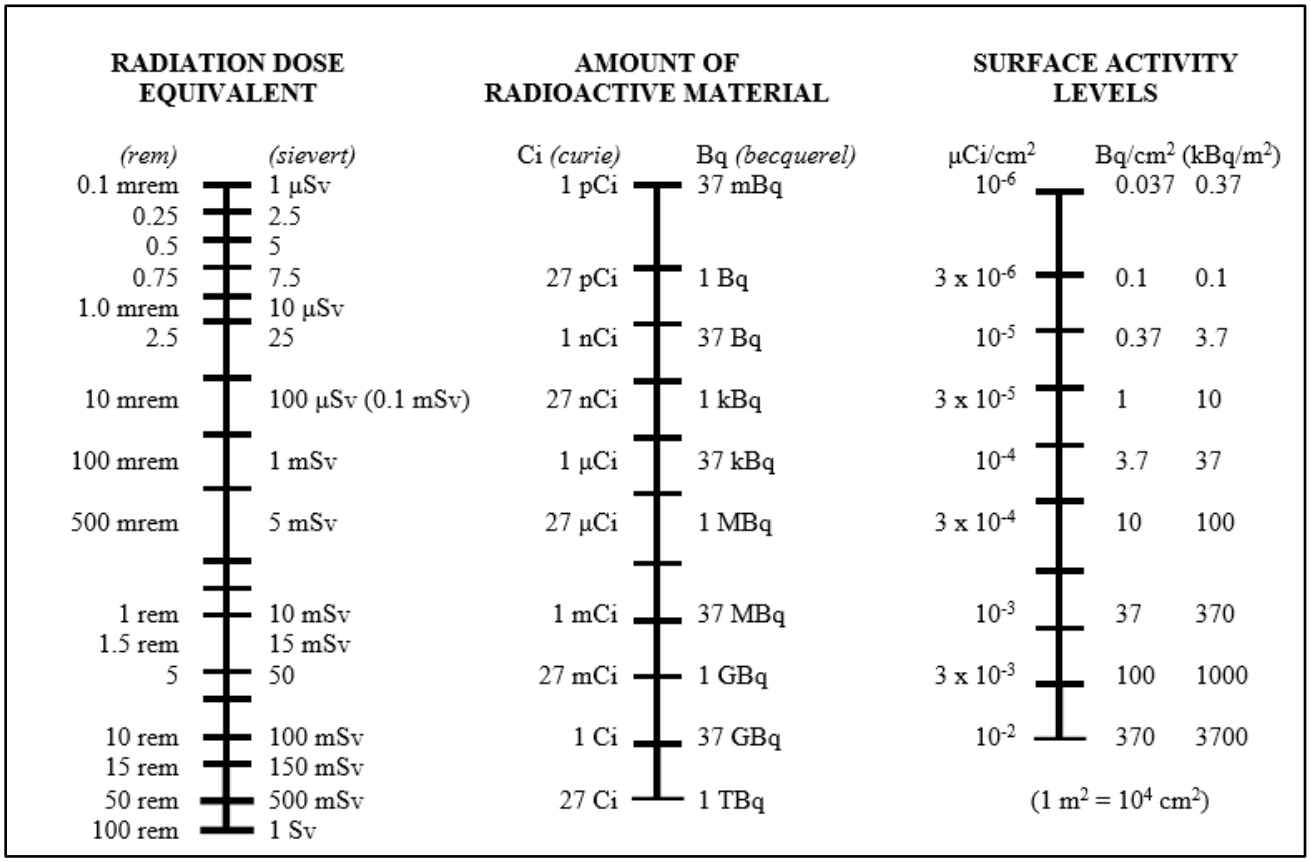
b. If problems and/or deficiencies were identified in this audit, describe the corrective actions planned and taken. Are corrective actions planned and taken at ALL licensed locations (not just location audited)? Include date(s) when corrective actions are implemented.

c. Provide any other recommendations for improvement.

d. Describe communication with management about deficiencies.

APPENDIX C

CONVERSION TO SI UNITS



CONVERSIONS	RADIATION DOSE RATES	DERIVED AIR CONCENTRATION (DAC)	CONCENTRATION IN SOLUTION
100 rem = 1 Sv 100 rad = 1 Gy (gray) 1 ton = 1 Mg 1 ton = 1000 kg 1 kg = 1000 g 1 MBq/ton = 1 Bq/g	µSv/h, mSv/h e.g., 7.5 µSv/h 25 µSv/h	Units: Bq m^{-3} Conversion: µCi cm^{-3} x 3.7 x 10^{10} = Bq m^{-3} $\frac{\text{dpm } m^{-3}}{60}$ = Bq m^{-3}	µCi/l — kBq/dm^3 (kBq/l) 1 — 37 10 — 370 100 — 3700 1 m^3 = 10^3 dm^3 = 10^3 l or 10^3 L 1 mBq/m^3 = 1 kBq/dm^3

PREFIXES FOR UNITS:

a	atto	10^{-18}	
f	femto	10^{-15}	
p	pico	10^{-12}	trillionth
n	nano	10^{-9}	billionth
µ	micro	10^{-6}	millionth
m	milli	10^{-3}	thousandth
k	kilo	10^{3}	thousand
M	mega	10^{6}	million
G	giga	10^{9}	billion
T	tera	10^{12}	trillion
P	peta	10^{15}	
E	exa	10^{18}	

APPENDIX D

INFORMATION NEEDED FOR CHANGE OF CONTROL

Definitions:

Control: *Control of a license is in the hands of the person or persons who are empowered to decide when and how that license will be used. That control is to be found in the person or persons who, because of ownership or authority explicitly delegated by the owners, possess the power to determine corporate policy and thus the direction of the activities under the license.*

Legal Entity: *The 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 legal entity only if the individual is acting in the private capacity and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Documentation of current registration of the applicant/licensee with the Illinois Secretary of State to conduct business within Illinois is also required or hold a similar registration in another state.*

Transferee: *A transferee is an entity that proposes to purchase or otherwise gain control of an IEMA-licensed operation.*

Transferor: *A transferor is an IEMA licensee selling or otherwise giving up control of a licensed operation.*

Information Needed for Transfer of Control

Licensees must provide full information and obtain IEMA's ***prior written consent*** before transferring control of the license in accordance with 32 Ill. Adm. Code 330.310(c). This regulation requires notification to IEMA not later than 90 days prior to the transfer. Provide the following information concerning changes of control by the applicant (transferor and/or transferee, as appropriate). If any items are not applicable, so state. A transfer of control worksheet may be utilized to provide this information to IEMA.

1. Provide a complete description of the transaction (transfer of stocks or assets, or merger). Indicate whether the name has changed and include the new name. Include the name and telephone number of a licensee contact whom IEMA may contact if more information is needed.
2. Describe any changes in personnel or duties that relate to the licensed program. Include training and experience for new personnel (i.e., RSO, radiology manager, plant manager, etc.)
3. Describe any changes in the organization, location, facilities, equipment or procedures that relate to the licensed program.
4. Describe the status of the radiation monitoring program (surveys, wipe tests, quality control) at the present time and the expected status at the time that control is to be transferred.
5. If applicable, commit to the maintenance of Part 337 Security requirements both at the present time and at the time that control is to be transferred.
6. Confirm that all records concerning the safe and effective decommissioning of the facility will be transferred to the transferee or to IEMA, as appropriate. These records include documentation of surveys of ambient radiation levels, and fixed and/or removable contamination, including methods and sensitivity. With regard to contamination of facilities

and equipment, the transferee should confirm, in writing, that it accepts full liability for the site, and should provide evidence of adequate resources to fund decommissioning; or the transferor should provide a commitment to decontaminate the facility before transferring control.

7. Provide documentation that the transferor and transferee agree to transfer control of the licensed material and activity, and the conditions of transfer.
8. Transferee is made aware of all open inspection and enforcement items, as well as their responsibility for completion of any corrective action and/or any resulting enforcement actions.
9. A commitment by the transferee to abide by all constraints, conditions, requirements, representations, and commitments identified in the existing license. If not, the transferee must provide a description of its program, to ensure compliance with the license and regulations.
10. Identify any State or Federal government licenses or registrations for radioactive material already held by the transferee. If applicable, identify the regulating authority and license or registration number. Identify if the license or registration will be related to transferor's operations.

Source: NUREG 1556, Vol 15, Appendix E.

A fillable form is available on the Agency's website to facilitate submittal of this information: https://iema.illinois.gov/nrs/radsafety/guidance.html

Appendix E

Criteria for Acceptable Training Courses for Portable Device Users

Course Content

Acceptable course content for training courses for portable device users includes the following:

a. 1.5 to 2 hours of radiation safety and regulatory requirements, emphasizing practical subjects important to safe use of the device; radiation versus contamination; internal versus external exposure; concepts of time, distance, and shielding to minimize exposure; control and surveillance of devices; location of the sealed source within the portable device; inventory; recordkeeping; incidents; licensing and inspection by IEMA; need for complete and accurate information; employee protection; and deliberate misconduct

b. 1.5 to 2 hours of practical training, to include portable device theory, operating procedures, emergency procedures, security, maintenance, and transportation procedures; and field training emphasizing radiation safety, including dry runs of setting up and making measurements with the device, controlling and maintaining surveillance over the portable device, performing routine cleaning and lubrication, packaging and transporting the gauge, storing the device, and following emergency and security procedures

c. Initial and recurrent (every 3 years) U.S. Department of Transportation hazardous material (HAZMAT) training is required for all gauge users that transport gauges. This training may also be applicable to some portable device users.

Course Examination

Prospective device users participating in training courses should achieve at least a 70-percent score on a 25- to 50-question written test. The test should include the following:

a. an emphasis on radiation safety of portable device storage, security of devices while on jobsites, use, sealed source location, maintenance, and transportation, rather than the theory and art of making portable device measurements

b. review of correct answers to missed questions with the prospective gauge user following the scoring of the test

Instructor Training and Experience

Instructors should have, at a minimum, the following:

a. successful completion of a portable gauge user course

b. successful completion of an 8-hour radiation safety course or radiation safety officer training course

c. documentation of 8 hours of hands-on experience performing measurements with a portable gauge (I.e., not simply having a portable gauge signed out).

Online Courses

Online training for portable device users is acceptable. The online training topics should follow the suggested Course Content in this appendix. Any online training should be supplemented by

the practical hands-on training also described under Course Content. The applicant/licensee should demonstrate how it will meet the training described under Course Content and may consider providing a copy of the curricula covered in the course.

Online training courses should also include an examination described under Course Examination.

Record Retention

Records of worker training must be maintained for 5 years as part of the radiation protection program in accordance with 32 Ill. Adm. Code Part 340.1120. Adequate records of training include the following: date of instruction, name of instructor, scope of instruction provided and signature of each participant that indicates that he/she has received and understood the information presented in the training program that is applicable to his/her duties.

Refresher training that covers all required topics listed in 32 Ill. Adm. Code 400.120(a) shall be provided at intervals not to exceed 12 months.

APPENDIX F

DUTIES AND RESPONSIBILITIES OF THE RADIATION SAFETY OFFICER

Among the specific duties and responsibilities of the RSO are the following:

1. Ensure licensed activities that the RSO considers unsafe are stopped.

2. Possession, use, storage, and maintenance of sources and devices are consistent with the limitations in the license, the Sealed Source and Device Registration sheet(s), and the manufacturer's recommendations and instructions.

3. Assure that only individuals properly trained and authorized by the license use the radioactive material.

4. Radiation Exposures are kept as low as is reasonably achievable (ALARA).

5. Assure that radioactive material possessed by the licensee conforms to the material authorized by the license.

6. Instruct personnel in proper radiation protection practices and maintain training records.

7. 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 Part 340.310.

8. Assure that personnel monitoring devices are used where indicated, exchanged at required intervals and that records are maintained of the results of such monitoring.

9. Up-to-date operating, emergency and security procedures are developed, implemented, maintained, and distributed.

10. For applicants who perform their own maintenance, repair or analysis of test samples for leakage and/or contamination (leak/wipe tests), conduct radiation monitoring where indicated and keep records of such monitoring, including summaries of corrective measures recommended and/or instituted.

11. Ensure non-routine operations are performed by the manufacturer, distributor, or person specifically authorized by IEMA, NRC or an Agreement State.

12. Assure that portable devices are properly secured against unauthorized removal at all times when they are not in use, including storage at temporary job sites.

13. Investigate each known or suspected case of excessive or abnormal exposure to determine the cause and take steps to prevent its recurrence.

14. Assure that the proper authorities (i.e., IEMA, local police, U.S. Department of Transportation, etc.) are notified promptly in case of accident, damage, theft or loss of a portable device.

15. Unusual occurrences involving the device (e.g., accident, damage, etc.) are investigated, cause(s) and appropriate corrective action are identified, and corrective action is taken.

16. Be immediately available to serve as a point of contact with the Agency and give assistance in case of emergency (e.g., portable device damage, fire, theft, etc.).

17. Assure that the Radiation Protection Program is implemented and reviews are performed in accordance with the regulations. When the licensee identifies violation(s) of regulations or license conditions or program weaknesses, corrective action(s) are developed, implemented and documented.

18. Audits are performed at least annually and documented, and corrective actions are taken.

19. Assure that the terms and conditions of the license (e.g., periodic leak/wipe tests, inventories, etc.) are met and that the required records (e.g., personnel exposure, leak/wipe test, accountability, inventory, etc.) are maintained and periodically reviewed for compliance with IEMA regulations and license conditions.

20. Assure that the portable devices are transported in compliance with all applicable IEMA and U.S. Department of Transportation regulations (e.g., labeling, marking, shipping papers, container blocking and bracing, etc.).

21. An up-to-date license is maintained and amendment and renewal requests are submitted in a timely manner.

22. Documents are posted as required by 32 Ill. Adm. Code 400.110: regulations, license and associated documents, operating procedures and notice of violation or order or posting a notice indicating where these documents can be examined. Licensees are also required to post Agency form KLA.001, “Notice to Employees”.

APPENDIX F.1

PROVISION FOR DELEGATING DUTIES TO AUTHORIZED INDIVIDUALS

The Radiation Safety Officer may delegate certain duties to an authorized user or an individual qualified to be a Radiation Safety Officer provided that:

A. The licensee maintains, for a period of 5 years, records of all individuals designated by the Radiation Safety Officer to perform duties or meet regulatory requirements that would otherwise be required as a duty of the Radiation Safety Officer. These records shall include:

1. The name of the individual;

2. A list of all duties the Radiation Safety Officer's designee is authorized to perform;

3. The date upon which the designation became effective;

4. The signature of the Radiation Safety Officer's designee; and

5. The signature of the Radiation Safety Officer.

B. The Radiation Safety Officer shall review records generated by designees and the performance of designees quarterly. In addition, the licensee shall maintain for Agency inspection for a period of 5 years, records of the quarterly reviews of records generated by designees and quarterly reviews of each designee's performance. These records shall include:

1. The date of the review;

2. The records being reviewed and the name of the designee being reviewed;

3. A list of all duties performed by the designee;

4. The results of the Radiation Safety Officer's review and any corrective measures taken, if applicable, based on the review; and

5. The signature of the Radiation Safety Officer.

APPENDIX F.2

MODEL DELEGATION OF AUTHORITY TO RADIATION SAFETY OFFICER

Memo To: Radiation Safety Officer

From: Chief Executive Officer

Subject: Delegation of Authority

You, _____, have been appointed radiation safety officer and are responsible for ensuring the safe use of radiation. You are responsible for managing the Radiation Protection Program; identifying radiation protection problems; initiating, recommending, or providing corrective actions; verifying implementation of corrective actions; stopping unsafe activities; and ensuring compliance with regulations. You are hereby delegated the authority necessary to meet those responsibilities, including prohibiting the use of radioactive material by employees who do not meet the necessary requirements and shutting down operations, when justified, to maintain radiation safety. You are required to notify management if staff does not cooperate and does not address radiation safety issues. In addition, you are free to raise issues with the Illinois Emergency Management Agency at any time. It is estimated that you will spend _____ hours per week conducting radiation protection activities.

I accept the above responsibilities,

_____ _____

Signature of Radiation Safety Officer Date

RSO Printed Name _____

RSO Email _____

RSO Work Address _____

RSO Phone and/or Mobile Number _____

_____ _____

Signature of Management Representative Date

APPENDIX G

SAMPLE MINIMUM DETECTABLE ACTIVITY CALCULATIONS

Several references contain discussions of counting statistics for radiation measurements. The formula the Agency recommends using for determining the minimum detectable activity (MDA) with a 95% confidence level is as follows:

$$\mathrm{MDA} = \frac{2.71 + 4.65\sqrt{\mathrm{Bt}}}{\mathrm{tE}}$$

Where:

MDA = minimum detectable activity in disintegrations per minute (dpm)
B = background count rate in counts per minute (cpm)
t = background counting time in minutes
E = detector efficiency in counts per disintegration

For example, if:

B = 200 cpm
t = 2 minutes
E = 0.1 counts per disintegration (10% efficiency)

$$\mathrm{MDA} = \frac{2.71 + 4.65\sqrt{200\ \mathrm{cpm} \times 2\ \mathrm{minutes}}}{2\ \mathrm{minutes} \times 0.1} = \frac{2.71 + 4.65\sqrt{400}}{0.2}$$

$$= \frac{2.71 + 4.65(20)}{0.2} = \frac{2.71 + 93}{0.2} = \frac{95.71}{0.2}$$

$$= 478.55\ \mathrm{dpm}$$

NOTE: Derivation of equations and discussions of limitations can be found in "Decommissioning Health Physics - A Handbook for MARSSIM Users," Eric W. Abelquist, published by Taylor & Francis Group, 2001

For a copy of the full discussion of the theory and limitations of this test, refer to pages 307-311 in NCRP Report No. 58, A Handbook of Radioactivity Measurement Procedures, issued February 1, 1985 by the National Council on Radiation Protection and Measurements, 7910 Woodmont Avenue, Bethesda, MD 20814.

Detector Efficiency

To determine instrument counting efficiency, a standard source of the same radionuclide as the source being tested or one with similar energy characteristics must be used. The source should be in the same configuration, or geometry, as the sample. Accuracy of the source should be within ± 5% of the stated value and traceable to a primary radiation standard, such as those maintained by

the Nation Institute of Standards and Technology (NIST). The counting rate for the standard is divided by the standard activity to determine the counting efficiency.

Calculate the counting efficiency of the detector using the following equation:

$$\text{Efficiency (E) in} \frac{\text{cpm}}{\text{Ci}} = \frac{(\text{Standard (cpm)} - (\text{Background (cpm)})}{\text{Activity of Standard (Ci)}}$$

Where:

cpm = counts per minute
std = standard
B = background
A = activity in Curie

Example:

The counting rate for the standard is divided by the standard activity to determine the counting efficiency. When dividing, the two values must be in compatible units. For example, a standard activity in µCi must be converted to dpm by multiplying by a factor of 2.2E+6.

APPENDIX H

Calibrating Radiation Detection and Measurement Instruments

NOTE: Licensees must be specifically authorized by the Agency, the U.S. NRC or an Agreement State to calibrate radiation monitoring instruments.

1. Items to be Covered in an Application

An application for a licensee to perform radiation monitoring instrument calibrations should contain the following information:

a) The manufacturer's name and model of the source(s) and the manufacturer's name and model of the calibration instrument to be used.

b) The radionuclide and activity of the radioactive material contained in the source(s) The source should contain a radionuclide that emits radiation of identical or similar type and energy [e.g., cesium-137 (Cs-137), cobalt-60 (Co-60) as the environment in which the calibrated radiation monitoring instrument will be used. Cs-137 sources should be a minimum activity of 85 mCi and Co-60 sources should be a minimum activity of 21 mCi to achieve an appropriate calibration field.

NOTE: Inverse square and radioactive decay laws should be used to account for changes in exposure rate due to distance and decay.

c) The accuracy of the source(s) activity; and documentation that the determination of each source activity is traceable to the National Institute of Standards and Technology - NIST (previously National Bureau of Standards - NBS).

d) A description of the facilities to be used, including room shielding, security, interlocks, signage, remote actuators, viewing systems and the manufacturer's name and model of the operable survey instrument that will be available to the individual performing the calibration.

e) The name and applicable experience of each individual who will perform the calibrations.

f) Calculations related to the calibration procedures.

g) The step-by-step calibration procedures, including associated radiation safety procedures.

h) Copies of records that will be maintained (see Item 4).

i) Verification that the requirements outlined in this appendix will be followed.

2. Recommended Methods for Calibration of Radiation Monitoring Instruments

Electronic calibrations alone are not adequate. Radioactive sealed sources must be used for calibrating dose and dose rate measuring radiation survey instruments. The calibration of radiation monitoring instruments shall be performed in accordance with the following:

a) The radionuclide sources used for calibration shall approximate point sources.

b) The source activities shall be traceable* within +/-5% accuracy to the NIST calibrations.**

NOTE: Sources of cobalt-60 or cesium-137, are appropriate for use in calibrations. The radioactivity of the calibration standard should be sufficient to calibrate the radiation monitoring instruments on all ranges, or at least up to 1 Roentgen per hour on the higher range radiation measurement instruments. If there are higher ranges, they should be checked for operation and an approximate correct response to radiation.

c) The frequency of calibration shall be as specified in 32 Ill. Adm. Code 340.540 (before first use, at intervals not to exceed one year and after servicing/repair that affects the calibration).

d) Each scale of the radiation monitoring instrument shall be calibrated at least at two points such that:

- one point is in each half of the scale; and
- the two points are separated by 50-60% of full scale.

NOTE: Logarithmic and digital readout radiation monitoring instruments with only a single readout scale shall be calibrated, at a minimum, at one point near the midpoint of each decade.

e) The exposure rate measured by the radiation monitoring instrument should not deviate more than +/-10% from the calculated or known value for each point checked. (Read appropriate section of the radiation monitoring instrument manual to determine how to make necessary adjustments to bring the radiation monitoring instrument into calibration.) Readings within +/-20% will be considered acceptable if a calibration chart or graph is prepared and attached to the radiation monitoring instrument. If the radiation monitoring instrument cannot be adjusted so that each reading falls within the +/-20% range, it shall be taken out of service and sent to the manufacturer or to a qualified radiation monitoring instrument laboratory for repair.

f) If an electronic device, such as a pulse generator, is used to calibrate instruments, the instrument with detector must be checked for response to a known source of radiation.

** For purposes of this document, the amount of radioactivity in a source is said to be traceable to a national standard when its radioactivity was determined by comparison with a source of the same radionuclide (or a proper simulated source, isotopically) the activity of which is certified by the NIST.*

*** In lieu of using a traceable radioactive source, a transfer instrument traceable to the NIST, within +/-5%, may be used as an alternative standard. For purposes of this document, a transfer instrument shall meet the definition as contained in the American National Standard Institute publication, ANSI N323A-1997, "American National Standard Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments."*

3. Use of a Reference Check Source for Operational Checks

a) A reference check source of a long half-life (e.g., greater than five years) shall be used to obtain a radiation monitoring instrument response by the licensee. The reading shall be taken with the check source placed in a specific geometry relative to the detector and:

b) Shall be taken before use on each day the instrument is used;

c) Shall be taken after calibration by the licensee or after return to the licensee of a radiation monitoring instrument sent for calibration by a specifically licensed firm authorized to perform radiation monitoring instrument calibrations as a customer service;

d) Shall be taken after maintenance and/or each battery change; and

e) Shall be taken at least quarterly.

If any operational check reading using the reference check source, with the same geometry, is not within +/- 20% of the reading measured immediately after calibration (or upon receipt from a calibration firm), the radiation monitoring instrument shall be removed from service and recalibrated.

4. Records

Records for items 2, 3(b), 3(c) and 3(d) of this procedure shall be maintained. Records for item 2 shall include, at a minimum:

a) Radionuclide used;

b) Activity and assay date of source;

c) Present activity;

d) Calculated and measured radiation values, including the percent of difference;

e) Respective distance from source for each calculated and measured radiation value;

f) Necessary scale correction factors (required if calculated and measured radiation values do not agree within +10%);

g) Make, model and serial number of radiation monitoring instrument being calibrated;

h) Name of individual performing the calibration; and

i) Date radiation monitoring instrument calibration was performed.

Records for items 3(b), 3(c) and 3(d), of this procedure shall include, at a minimum:

a) Radionuclide used;

b) Activity and assay date of the radionuclide used;

c) Reading of check source at time of calibration;

d) Geometry of check source relative to detector (position);

e) Date of calibration;

f) Make, model and serial number of the radiation monitoring instrument;

g) Date reference check was performed; and

h) Name of individual who performed the reference check.

5. Use of Inverse Square Law and Radioactive Decay Law

A calibrated source will have a calibration certificate giving its output at a given distance measured on a specific date by the manufacturer or National Institute of Standards and Technology (NIST).

a) The Inverse Square Law may be used with any point source to calculate the exposure rate at other distances.

b) The Radioactive Decay Law may be used to calculate the output at other times after the specified date.

INVERSE SQUARE LAW:

Exposure rate at P_2:

$$R_2 = \frac{(P_1)^2 \; x \; (R_1)}{(P_2)^2}$$

Where:

R_1 and R_2 are the exposure rates at P_1 and P_2 in the same units (*e.g., mR/hr or R/hr*).

P_1 and P_2 are the distances from the point source in the same units (*e.g., centimeters, feet, etc*.)

RADIOACTIVE DECAY LAW:

$$R_t = R_o \, e^{-(0.693 \, t \, / \, T_{½})}$$

where: R_o and R_t are in the same units (*e.g., mR/hr or R/hr*)

R_o is exposure rate on specified calibration date (*i.e., time zero*)

R_t is exposure rate "t" units of time later

$T_{1/2}$ and t are in the same units (*e.g., years, months, days, etc*.)

$T_{1/2}$ is the half-life of the radionuclide

t is the time elapsed between the source calibration (assay) date and the radiation monitoring instrument calibration date (i.e., present time)

Example: Source output is given by calibration certificate as 100 mR/hr at 1 foot on December 10, 2020. Radionuclide half-life is 5.27 years.

Question: What is the output at 3 feet on December 10, 2022 (2.0 years later)?

Output at 1 foot, 2.0 years after calibration date:

$$R_{(1\ ft)} = 100\ mR/hr\ [\exp^{-((0.693 \times 2.0)/5.27)}]$$

$$= 100\ mR/hr\ (0.77)$$

$$= 77\ mR/hr \text{ at } 1 \text{ foot on December 10, 2022}$$

Output at 3 feet, 2.0 years after calibration date:

$$R_{(3\ ft)} = \frac{(1\ foot)^2}{(3\ feet)^2}\ (77mR/hr)$$

$$= 1/9\ (77\ mR/hr)$$

$$= 8.6\ mR/hr \text{ at } 3 \text{ feet on December 10, 2022}$$

APPENDIX I

GUIDANCE FOR DEMONSTRATING THAT INDIVIDUAL MEMBERS OF THE PUBLIC WILL NOT RECEIVE DOSES EXCEEDING THE ALLOWABLE LIMITS

Licensees must ensure that:

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

- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.

Licensees must show compliance with the regulations. Calculations or a combination of calculations and measurements (e.g., using an environmental TLD) are often used to prove compliance.

Members of the public include persons who live, work, or may be near locations where portable devices are used or stored. Employees whose assigned duties do not include the use of licensed materials but who work in the vicinity where devices are used or stored are considered members of the public.

Typical unrestricted areas may include offices, shops, laboratories, areas outside buildings, property, nonradioactive equipment storage areas, and occupied areas of personal residences. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials. However, the licensee may control access to these areas for other reasons such as security.

CALCULATIONAL METHOD*

The calculational method takes a realistic approach, assuming use/storage situations most likely to occur in the workplace. Conservative assumptions should be used when performing the calculations. The calculations make the following simplifications: (1) each device is a point source; (2) typical radiation levels are taken from either the Sealed Source & Device (SSD) Registration Sheet or the manufacturer's literature; and (3) no credit is taken for any shielding found between the devices and the unrestricted areas.

*For ease of use by most portable device licensees, the examples in this appendix use conventional units. The conversions to SI units are as follows: 1 ft = 0.305 m; 1 mrem = 0.01 mSv.

The calculations use the hourly exposure rates measured from the device or as stated by the manufacturer in the Sealed Source and Device Registry and considers the distance and the amount of time that both the device and the affected member of the public are present. Using this approach, licensees make only those calculations that are needed to demonstrate compliance. Note that worst case scenarios should be used in the calculations (e.g., If the devices are in the office as opposed to out in the field during certain parts of the year then those time frames should be used in the calculations.) Licensees can perform additional calculations as storage/use

scenarios change throughout the year. The results of these calculations provide a method for estimating conservative doses that could be received. Note that the following is merely an example and that the licensee needs to use exposure rates, time frames and distances that are relative to their own operations.

Example 1

To better understand the calculational method, we will look at Moisture-Density Measurements, Inc., a portable gauge licensee. Yesterday, the company's president noted that the new gauge storage area is very close to his secretary's desk and he asked Joe, the Radiation Safety Officer (RSO), to determine if the company is complying with IEMA regulations.

The secretary's desk is near the wall separating the reception area from the designated, locked, gauge storage area, where the company stores its three gauges. Joe measures the distances from each gauge to the wall and looks up in the manufacturer's literature the radiation levels that individuals are expected to encounter for each gauge. Figure I.1 is Joe's sketch of the areas in question, and Table I.2 summarizes the information Joe has on each gauge.

A Bird's Eye View of Office and Gauge Storage Area

Figure I.1 *Diagram of Office and Gauge Storage Area.*

Table I.2 Information Known about Each Gauge

DESCRIPTION OF KNOWN INFORMATION	GAUGE 1	GAUGE 2	GAUGE 3
How gauge is stored	Gauge in transport container	Gauge in transport container	Gauge out of transport container and being recharged
Dose rate in mrem/hr encountered at specified distance from the gauge (from manufacturer's	2 mrem/hr at 1 ft	8 mrem/hr at 1 ft	2 mrem/hr at 3 ft
Distance in ft to secretary's chair	8 ft	12 ft	15 ft

INFORMATION ON WHEN GAUGES ARE PRESENT IN THE STORAGE AREA:

GAUGE 1: an old gauge located in the storage area continuously (24 hours per day).

GAUGE 2: a new gauge located in the storage area continuously (24 hours per day) for 32 weeks of the year; for the remaining 20 weeks of the year it is at temporary job sites.

GAUGE 3: a new gauge located in the storage area overnight; it is used every day at temporary job sites all year and returned to the storage location at the end of each day. The gauge is usually present during the secretary's first and last hours of work each day.

INFORMATION FROM THE EXAMPLE ON WHEN THE SECRETARY IS SITTING AT THE DESK:

- 5 hours per day
- 3 days per week
- 50 weeks per year

Table I.3. Calculational Method, Part 1 – Hourly and Annual Dose Received from Gauge 1

		GAUGE 1	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from gauge (e.g.,	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2.	$(1)^2$	1
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft^2.	$(8)^2$	64
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result).	2 x 1 =2	
5	Divide the result of Step 4 by the result of Step 3 to calculate the dose received by an individual at the secretary's desk = HOURLY DOSE RECEIVED FROM GAUGE 1, in mrem	2/64 = 0.031	
6	Multiply the result of Step 5 by 5 hours/ day x 3 days/ week x 50 weeks/year = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 1, in mrem in a year.	0.031 x 5 x 3 x 50 = 93 mrem/year	

Table I.4. Calculational Method, Part 1 – Hourly and Annual Dose Received from Gauge 2

		GAUGE 2	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from gauge (e.g.,	8	8
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2.	$(1)^2$	1
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft^2.	$(12)^2$	144
4	Multiply the results of Step 1 by the results of Step 2 (this is	8 x 1 = 8	
5	Divide the result of Step 4 by the result of Step 3 to calculate received in an hour by an individual at the secretary's desk = HOURLY DOSE RECEIVED FROM GAUGE 2, in mrem in an hour.	8/144 = .056 dose	
6	Multiply the result of Step 5 by 5 hours per day x 3 days per week x 32 weeks/year = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 2	0.056 x 5 x 3 x 32 = 26.9 mrem	

Table I.5. Calculational Method, Part 1 – Hourly and Annual Dose Received from Gauge 3

		GAUGE 3	
Step No.	**Description**	**Input Data**	**Results**
1	Dose received in an hour at known distance from gauge (e.g., from manufacturer's data), in mrem/hr.	2	2
2	Square of the distance (ft) at which the Step 1 rate was measured, in ft^2.	$(3)^2$	9
3	Square of the distance (ft) from the gauge to the secretary's desk in an unrestricted area, in ft^2.	$(15)^2$	225
4	Multiply the results of Step 1 by the results of Step 2 (this is an intermediate result).	2 x 9 =18	
5	Divide the result of Step 4 by the result of Step 3 to calculate dose received by an individual at the secretary's desk = HOURLY DOSE RECEIVED FROM GAUGE 3, in mrem in an hour.	18/225 = 0.08	
6	Multiply the hourly dose received by the number of hours per year the secretary is exposed to the gauge (e.g., 2 hours/day and 3 days/week x 50 weeks/year= MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGE 3	0.08 x 2 x 3 x 50 = 24 mrem/year	

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

Table I.6. Calculational Method, Part 1 – Total Hourly and Annual Dose Received from Gauges 1, 2, and 3

Step No.	Description	Gauge 1	Gauge 2	Gauge 3	Sum
7	TOTAL HOURLY DOSE RECEIVED from Step 5 of Tables I.3, I.4, and I.5, in mrem in an hour.	0.031	0.056	0.08	0.167
8	TOTAL ANNUAL DOSE RECEIVED from Step 6 of Tables I.3, I.4, and I.5, in mrem in a year.	93	26.9	24	143.9

NOTE: The Sum in Step 7 demonstrates compliance with the 2 mrem in any one hour limit. Reevaluate if assumptions change. Since the Sum in Step 8 exceeds 100 mrem/yr, personnel monitoring is required.

Since the result in Step 8 exceeds 100 mrem/yr, then the licensee could have done one or more of the following:

- Consider whether the assumptions used to determine occupancy and the time each gauge is in storage are accurate, revise the assumptions as needed, and recalculate using the new assumptions;
- Calculate the effect of any shielding located between the gauge storage area and the secretarial workstation (see Combination method below);
- Take corrective action to increase the distance from the individual to the gauge storage area (e.g., move gauges within storage area, move the storage area, move the secretarial workstation) and perform new calculations to demonstrate compliance.

Note that in the example, the unrestricted area outside only one wall of the gauge storage area was calculated. Licensees also need to make similar evaluations for each unrestricted area, (i.e., above, beside and below the storage area) and to keep in mind the ALARA principle, taking reasonable steps to keep radiation dose received below regulatory requirements. In addition, licensees need to be alert to changes in situations (e.g., moving any of the gauges closer to the secretarial workstation, adding gauges to the storage area, or changing the estimate of the portion of time spent at the desk or longer storage periods) and to perform additional evaluations, as needed.

RECORDKEEPING: 32 Ill. Adm. Code 340.1170 requires licensees to maintain records demonstrating compliance with the dose limits for individual members of the public.

COMBINATION MEASUREMENT – CALCULATIONAL METHOD

This method, which allows the licensee to take credit for shielding between the gauge and the area in question, begins by measuring radiation levels in the areas, as opposed to using manufacturer-supplied rates at a specified distance from each gauge. These measurements must be made with calibrated survey meters sufficiently sensitive to measure background levels of radiation. A maximum dose of 1 mSv (100 mrem) received by an individual over a period of 2080 hours (40 hours per week for 52 weeks per year is equal to less than 0.5 microsievert (0.05 mrem) per hour.

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

Licensees may also choose to use environmental TLDs in unrestricted areas next to the gauge storage area for monitoring. This direct measurement method would provide a definitive measurement of actual radiation levels in unrestricted areas without any restrictive assumptions. Records of these measurements can then be evaluated to ensure that rates in unrestricted areas do not exceed the 1 mSv/yr (100 mrem/yr) limit.

Example 2

As in Example 1, Joe is the RSO for Moisture-Density Measurements, Inc., a portable gauge licensee. The company has three gauges stored in a designated, locked storage area that adjoins an unrestricted area where a secretarial workstation is located. See Figure I.1 and Table I.2 for information. Joe wants to see if the company complies with the public dose limits at the secretarial station.

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

Table I.10. Combination Measurement – Calculational Method

PART 1

Step No.	Description	Input Data and Results
1	Dose received by TLD, in mrem.	100
2	Total hours TLD exposed.	24 hr/d x 30 d/mo = 720
3	Divide the results of Step 1 by the results of Step 2 to determine HOURLY DOSE RECEIVED, in mrem in an hour.	0.14
4	Multiply the results of Step 3 by 365 days per year x 24 hours per day = 8760 hours in one year = MAXIMUM ANNUAL DOSE RECEIVED FROM GAUGES, in mrem in a year.	365 x 24 x 0.14 = 8760 x 0.14 = 1226

NOTE: For the conditions described above, Step 3 indicates that the dose received in any one hour is less than the 2 mrem in any one-hour limit. However, if there are any changes, then the licensee would need to reevaluate the potential doses that could be received in any 1 hour. Step 4 indicates that the annual dose received would be much greater than the 100 mrem in a year allowed by the regulations.

PART 2

At this point Joe can adjust for a realistic estimate of the time the secretary spends in the area as he did in Part 2 of Example 1.

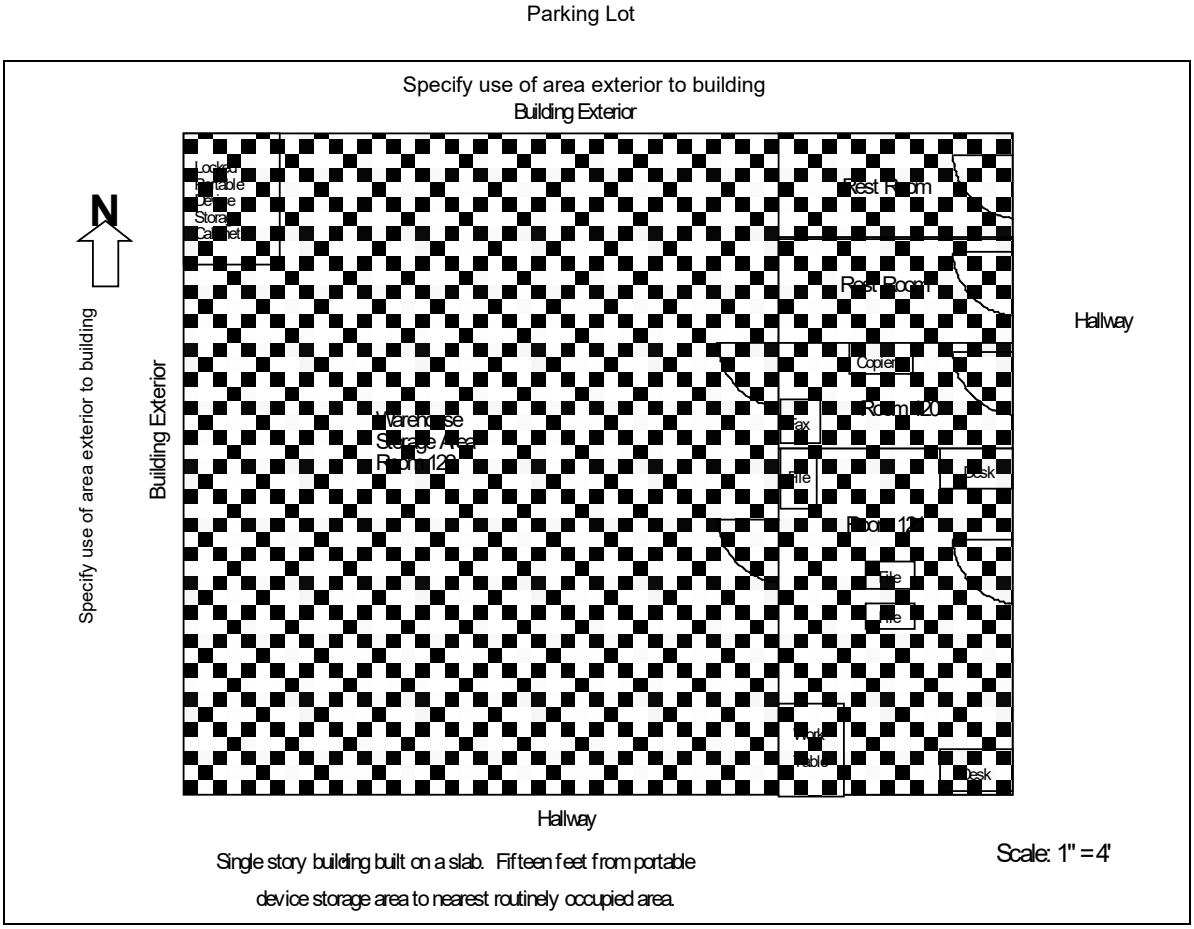
PART 3

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

APPENDIX J

SAMPLE FACILITY DIAGRAM

NOTE: Depict the nearest routinely occupied workstation on the diagram. This is usually in the lab area.



Warehouse storage area

APPENDIX K

SAMPLE PROCEDURE FOR ORDERING, RECEIVING AND SAFELY OPENING PACKAGES CONTAINING RADIOACTIVE MATERIAL

Ordering and Receiving Radioactive Material Packages

- The Radiation Safety Officer (RSO) or qualified designee must approve or place all orders for radioactive material.
- The RSO must ensure that the requested material, quantities, manufacturer, and model designations are authorized by the license and that possession limits are not exceeded.
- Establish and maintain a system for ordering and receiving radioactive material; include the following information:
  - records that identify the AU or department, radionuclide, physical and/or chemical form, activity, and supplier
  - confirmation, through the above records, that material received was ordered through proper channels
- Packages of radioactive material containing in excess of a Type A quantity as defined in 49 CFR 173.435 or subject to 32 Ill. Adm. Code Part 337 require arrangements to receive the package. See 32 Ill. Adm. Code 340.960 and 32 Ill. Adm. Code Part 337, if applicable.
- During normal working hours, the RSO or their designee must be notified immediately upon delivery of radioactive packages. The packages must be taken to the radioactive material storage area for inspection. Instruct carriers to deliver radioactive packages directly to a specified area and provide contact information to the carrier for any questions (e.g., delivery area not accessible, staff not present to receive package).
- During off-duty hours, security or other designated trained personnel must accept delivery of radioactive packages in accordance with the procedure outlined in the sample memorandum below. Develop a similar memorandum for delivery of packages to other departments.

SAMPLE MEMORANDUM

FOR: Security Personnel

FROM: Facility Administrator

SUBJECT: RECEIPT OF PACKAGES CONTAINING RADIOACTIVE MATERIAL

If the package appears to be damaged, immediately contact the facility's RSO. Ask the carrier to remain at the facility until it can be determined that neither the carrier nor the vehicle is contaminated.

Any packages containing radioactive material that arrive outside normal working hours shall be signed for by the Security guard or another designated trained individual on duty and taken immediately to the designated storage area/room. Unlock the door, place the package in the designated secured storage area and relock the door.

RADIATION SAFETY OFFICER (RSO): _____
OFFICE PHONE: _____
CELL PHONE: _____
ILLINOIS EMERGENCY MANAGEMENT AGENCY 24-HOUR PHONE: (217) 782-7860

Safely Opening Radioactive Material Packages

Licensees should refer to the regulatory requirements for radioactive material packages in 32 Ill. Adm. Code 340.960. Special requirements must be followed for packages containing quantities of radioactive material in excess of the Type A quantity limits as defined in 49 CFR 173.435. Such packages must be received expeditiously when the carrier offers them for delivery or when the carrier notifies the licensee that the package has arrived at the carrier's terminal. For these and other packages for which monitoring is required, check for external radiation levels and surface contamination within 3 hours of receipt, if received during working hours, or no later than 3 hours from the beginning of the next working day, if received after working hours, in accordance with the requirements of 32 Ill. Adm. Code 340.960. Notify the final delivery carrier and IEMA's operations center (217) 782-7860, by telephone, when:

1. A package or its radioactive contents are lost or missing,
2. Removable radioactive surface contamination exceeds the limits of 49 CFR 173.443;
3. External radiation levels exceed the limits of 49 CFR 173.441.

For packages received under the specific license, authorized individuals shall implement procedures for opening each package as follows:

1. Visually inspect the package for any sign of damage (e.g., crushed). If damage is noted, stop and notify the Radiation Safety Officer (RSO). Accordingly, the licensee should implement their emergency procedures and obtain technical assistance from the Agency and arrange for a timely evaluation of the source integrity following receipt of a damaged package.
2. If there is evidence of degradation of package integrity, such as a package that is crushed or damaged, the monitoring for radiation levels and leakage shall be performed as soon as practicable after receipt of the package, but not later than three (3) hours after the package is received at the licensee's facility if it is received during the licensee's normal working hours; or if received outside normal working hours, no later than three (3) hours after the beginning of the next business day.
3. Open the outer package, if applicable, (following supplier's directions if provided) and remove packing slip to verify contents (compare requisition, packing slip and device label). Check integrity of the device (inspecting for damage). Check also that the shipment does not exceed license possession limits or differ in the form, type, manufacturer, model, etc. as that authorized by the radioactive material license. If anything is other than expected, stop and notify the RSO.
4. Place the portable device in its transportation container or package in the designated secured storage area.
5. Maintain records of receipt.

Appendix L

GENERAL RULES FOR THE SAFE USE OF RADIOACTIVE MATERIAL AND SECURITY REQUIREMENTS

1. Each individual using the portable device will complete the training requirements prior to operation of the device.

2. Before removing the portable device from its place of storage, and for 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, then lock the transport case.

3. For portable gauges, use a minimum of two independent physical controls that form tangible barriers to secure portable gauges from unauthorized removal whenever the portable gauges are not under the licensee's direct control and constant surveillance (i.e., in storage). When the portable gauge is not in use at a temporary job site, place the portable gauge in a secured storage location with two independent physical controls. Examples of two independent physical controls are: 1) securing the portable gauge in a locked storage facility located in a separate secured area in a warehouse; 2) securing the portable gauge inside a locked van and secured to the vehicle with a steel cable; 3) or storing the portable gauge inside a locked, non-removable box and further securing the box with a steel cable or chain. If chains or cables are used as a method of providing security, the locks, cables and chains must be physically robust enough to provide both a deterrence and a reasonable delay mechanism. Log the gauge into the daily use log when it is returned to storage.

4. The portable device must be stored and used in a manner to minimize the amount of radiation exposure to the operator and each individual in its vicinity.

5. The sample utilization log located in Appendix M of Instructional Set 65.0, Revision 3, March 2023 will be completed each time the portable device is moved and/or used and will be completed to document the physical inventory or a utilization log containing equivalent information will be used.

6. Only an approved transport container will be used to transport the portable device and it will be properly labeled and marked and containers will be braced, blocked and locked. Shipping papers will be completed and kept with the driver when transporting the portable device.

7. When transporting the device, fully secure the portable device within the vehicle and away from the passenger compartment or if transported in an open-bed vehicle, the portable device must be properly secured/locked to the vehicle. Use a minimum of two independent physical controls that form tangible barriers with locks to secure portable gauges from unauthorized removal. Block and brace the device to prevent movement during transport and follow all applicable Department of Transportation (DOT) requirements when transporting the device.

8. Use the device according to the manufacturer’s instructions and recommendations.

9. Do not touch the unshielded source or source rod near the source with your fingers, hands, or any part of your body and do not place hands, fingers, feet, or other body parts in close proximity to an unshielded source.

10. 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.

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

12. A portable device must be under the control and constant surveillance of an authorize user unless the device is secured from unauthorized access (e.g., locked within a room or transport vehicle (i.e., at a temporary job site) to which only authorized users have access). Note that a portable device locked within a hotel room where hotel personnel have access is not considered secured. During use of the device take action necessary to protect the device and yourself from danger of moving heavy equipment.

13. Always keep unauthorized persons away from the gauge.

14. Personnel monitoring devices, if required by the regulations or the radioactive material license, shall be worn during use of the portable device and shall not be worn during other non-occupational radiation exposure (e.g., medical or dental x-rays, etc.). They must be worn at chest or waist level where the highest exposure is expected. Each personnel monitoring device shall be assigned to only one individual and shall not be shared. They shall be stored in a low background area away from the radioactive material storage area. They shall not be stored in areas subject to extreme environmental conditions (e.g., a car during weather extremes).

15. The source holder shall be locked in the "off" or closed position when the device is not in use.

16. Sealed sources shall not be opened or removed from their source holders by the licensee.

17. The licensee shall conduct routine cleaning of the device only in accordance with the manufacturer's instructions. Nonroutine maintenance/repair involving dismantling, removal of sources or source holders, etc., must be performed only by the manufacturer or other persons specifically authorized to perform such services by the Agency, the U.S. Nuclear Regulatory Commission, or another Agreement State.

18. Current copies of the following documents shall be maintained at temporary job sites for Agency inspection:

    a) The license, including all active amendments;

    b) Manufacturer's instruction manual for the sealed sources and devices at the temporary job site;

c) The licensee's emergency procedures; and

d) The results of the latest test for leakage and/or contamination performed on the sealed source.

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

20. 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). **NOTE**: *This is not common.*

Appendix M

Template Utilization / Inventory Log

SOURCE / DEVICE IDENTIFICATION					
MANUFACTURER: _____			MODEL: _____		
SERIAL NUMBER: _____			RADIONUCLIDE(S): _____		
SOURCE ACTIVITY: _____			ACTIVITY ASSAY DATE: _____		
DATE AND TIME REMOVED FROM STORAGE	DEVICE SIGNED OUT BY (NAME):	JOB SITE LOCATION OF USE	DATE AND TIME RETURNED TO STORAGE	DEVICE RETURNED BY (NAME)	DATE OF PHYSICAL INVENTORY AND IDENTITY OF INDIVIDUAL PERFORMING INVENTORY

APPENDIX N

EMERGENCY PROCEDURES

1. If the source fails to return to the shielded position (e.g., the source becomes stuck below the surface as a result of being damaged), or if any other emergency or unusual situation arises such that it causes damage or compromises the device (e.g., the gauge is struck by a moving vehicle, is dropped, or is in a vehicle involved in an accident), do the following:

   a. Evaluate the situation to determine if any individuals have been exposed to radiation. If individuals are suspected to be contaminated, care for life threatening injuries first, then notify emergency personnel and the hospital staff about possible radioactive material contamination.

   b. Immediately secure the area and keep people at least 15 feet away from the portable device until the situation is assessed and the 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.

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

   d. Portable device users and other potentially contaminated individuals should not leave the scene until emergency assistance arrives. They should stand outside of the 15-foot radius unless medical reasons take priority.

   e. As soon as possible, notify the following persons, in the order listed below, of the situation. Follow the directions provided.

Emergency Contact Name	Work Phone Number	Alternate Phone Number	After-Hours Phone Number

Radiation Safety Officer and licensee Management

   a. As soon as possible, notify the Illinois Emergency Management Agency at (217) 782-7860. The IEMA Operations Center is staffed 24/7; request to speak with the Nuclear Safety Officer in Charge.

   b. The licensee should obtain technical assistance from the Agency and arrange for a timely evaluation of the source integrity following an incident. Agency inspectors can assist with the initial evaluation and surveys if needed.

c. 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 jobsite 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.

d. Arrange for visual inspection of the portable device to determine whether any damage to the source housing or shield has occurred. Do not move the portable device until the extent of contamination has been determined.

e. 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.

2. In the event of lost, stolen or missing portable devices, notify the Radiation Safety Officer and the Illinois Emergency Management Agency (IEMA) at (217) 782-7860 in accordance with 32 Ill. Adm. Code 340.1210. IEMA notification is required when portable devices containing licensed material are lost or stolen, when devices are damaged or involved in incidents that result in doses in excess of 32 Ill. Adm. Code 340.310 limits, and when it becomes apparent that attempts to recover a source stuck below the surface will be unsuccessful. Appendix Q of this Instructional Set summarizes incidents which require notification to the Agency and the timeline in which notification must be made.

3. Make necessary notifications to local authorities as well.

APPENDIX O

TESTING SEALED SOURCES FOR LEAKAGE AND/OR CONTAMINATION

Applicants who wish to perform their own tests for leakage and/or contamination (leak/wipe tests), including the procurement and the analysis of the test samples, must submit the following descriptive information in support of the application.

Training

Before allowing an individual to perform leak testing, the licensee will ensure sufficient classroom and on-the-job training to show competency in performing leak tests independently. Records for training on the applicable leak-test procedures should be maintained.

Submit a description and the format of training. Classroom training may be in the form of lecture, online, video, hands-on or self-study, and will cover the following subject areas:

1. Principles and practices of radiation protection;

2. Radioactivity measurements, monitoring techniques, and the use of instruments;

3. Mathematics and calculations used for measuring radioactivity;

4. Biological effects of radiation.

Submit a description of on-the-job training. Appropriate on-the-job-training consists of:

1. Observing authorized personnel collecting and analyzing leak test samples and

2. Collecting and analyzing leak-test samples under the supervision and in the physical presence of an individual authorized to perform leak test and sample analysis

Frequency of Leak Testing

Required leak test frequency is specified in 32 Ill. Adm. Code 340.410, which may refer to the source's sealed source and device registry (SSDR) sheet. Many devices have been approved for a one-year leak test frequency. The manufacturer can advise on the leak test frequency approved in the SSDR. If a sealed source is not registered, leak tests should be conducted at 6-month intervals, unless a different interval is established during the licensing process. Leak testing of sealed sources may be required by license condition.

Facilities and Equipment

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

2. Identify the calibration standards to be used in the analysis of each radioactive material to be tested. The identification shall include the manufacturer, model, radionuclide and activity of each standard. Such standards shall be traceable to a national standard.
3. Describe the material or leak/wipe test kit to be used in collecting the leak/wipe test samples.
4. Describe the method for disposing of contaminated leak/wipe test samples.
5. Commit to the use of a calibrated and operable radiation survey instrument to check leak test samples for gross contamination before they are analyzed.
6. Ensure analysis of leak test samples will be performed using an instrument that is appropriate for the type of radiation to be measured [e.g., NaI (Tl) well-counter system for gamma-emitters (e.g., Cs-137, Co-60), liquid scintillation for beta-emitters (e.g., Sr-90), and gas-flow proportional counter for alpha-emitters (e.g., Am-241).].
7. Describe all instrumentation, which will be used for the analysis of the test samples. The descriptive information should include:

    a. The manufacturer, model and serial number of each instrument;

    b. The types and energies of detectable radiation, as applicable to each instrument;

    c. The calibration procedures and the frequency of calibration for each instrument
8. Determine and submit the instrument's counting efficiency using a 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).

    Efficiency Calculation Example:

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

    Where: cpm = counts per minute
    std = standard
    bkg = background
    Bq = becquerel
9. Determine and submit the sensitivity of the counting system. Submit the minimum detectable activity (MDA) of each instrument, for each type of radioactive material to be tested, including the supportive calculations. At a minimum, the instrument used must be capable of detecting 185 Bq (0.005 µCi) of the radioactive material being tested. For radium-226, the instrument must be sensitive enough to detect 185 Bq (0.005 µCi) external radon-daughter contamination or the escape of radon at the rate of 37 Bq (0.001 µCi) per 24 hours. Example MDA calculations are available in Appendix G of this Instructional Set.
10. Submit sample calculations showing the conversion of the raw counting data to units of becquerels or microcuries.

11. Verify records of tests for leakage and/or contamination will be maintained for the duration and contain all necessary information listed in 32 Ill. Adm. Code 340.1135. Describe the records to be maintained for each leak/wipe test. These shall include:

Procedures

1. Wear gloves.
2. For each source to be tested, list identifying information such as device/source serial number, manufacturer, model, radionuclide, and activity.
3. Use a survey meter to monitor exposure.
4. Use a calibrated and operable survey instrument to check leak test samples for gross contamination before they are analyzed.
5. Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
6. Number each wipe to correlate with identifying information for each source.
7. Wipe the most accessible area where contamination would accumulate if the sealed source were leaking (see manufacturer's instructions).
8. Select instrumentation that is sensitive enough to detect 185 Bq [0.005 microcuries] of the radionuclide contained in the portable device.
9. To ensure achieving the required sensitivity of measurements, analyze leak tests in a low-background area.
10. Using the selected instrument, count and record background count rate.
11. Check the instrument's counting efficiency using a standard source of the same radionuclide as the source being tested or one with similar energy characteristics. The calibration source must be in the same configuration as the sample. Accuracy of standards should be within plus or minus 5 percent of the stated value and traceable to primary radiation standards such as those maintained by the National Institute of Standards and Technology
12. Calculate and record the counting efficiency of the detector.
13. Count each wipe sample; determine net count rate.
14. For each sample, calculate and record estimated activity in Bq (or microcuries). The activity of the sample in becquerels may be calculated using the following formula:

$$\text{Activity on sample} = \frac{[(\text{cpm from wipe sample}) - (\text{cpm from bkg})]}{\text{Efficiency in cpm/Bq}}$$

15. Sign and date the list of sources, data, and calculations. Retain records for 5 years in accordance with 32 Ill. Adm. Code 340.1135.
16. If the wipe test activity is 185 Bq (0.005 microcurie) or greater, notify the radiation safety officer so that the source can be withdrawn from use and disposed of properly. Also notify IEMA.

APPENDIX P

Guidance for Demonstrating that Unmonitored Individuals are Not Likely to Exceed 10 Percent of the Allowable Limits

Dosimetry is required for individuals likely to receive, in one year from sources external to the body, a dose in excess of 10 percent of the applicable regulatory limits in 32 Ill. Adm. Code 340.210. Thus, a licensee needs to evaluate the doses its workers receive in performing these tasks to assess whether dosimetry is required.

The most common way that individuals *might* exceed 10 percent of the applicable limits is by performing frequent routine cleaning, lubrication and use of devices. L**icensees are not authorized to remove the source from the device for nonroutine maintenance without being specifically licensed to do so. For those licensees who are authorized to perform non-routine maintenance (e.g., remove the source from the device for cleaning, lubrication or maintenance) extremity monitoring will likely be required.** For licensees who will use the device and for those not performing nonroutine maintenance, the licensee needs to evaluate the whole body and extremity doses its workers receive in performing these tasks. Note that the following example is for a portable gauge, but XRF licensees can use these same calculations substituting the appropriate information for radionuclide, activity and exposure rates pertinent to the XRF being used.

Example:

A gauge manufacturer has estimated the exposure rates received at various distances from the gauge. Each gauge in this example is authorized to contain up to 0.33 gigabecquerels (9 millicuries) of Cs-137 and either 1.63 gigabecquerels (44 millicuries) of Am-241 or 2.44 megabecquerels (66 microcuries) of Cf-252. The manufacturer stated its exposure rates were based on actual measurements with an appropriate radiation monitoring instrument. Using the exposure rates listed by the manufacturer and the amount of time and distance the individual user is from the device, the individual doses can be calculated.

A. Whole body exposures can be calculated by estimating the time needed to use the device, based on the user lowering the source into the measurement area of interest, moving out of the area at least 15 feet away from the device during the actual measurement, and then returning to the device to retract the source into the safe position. The user should only be exposed to the source for a few minutes during each lowering and retracting the source and moving to and from the device during the actual measurement.

    1. Determine the expected dose rates received by the whole body of the individual associated with using the device and determined using measured or manufacturer-determined data (e.g., manufacturer's data states the maximum exposure rate at one meter from the device is 0.65 mrem/hour);

    2. Estimate the time the individual was exposed to the source during each measurement (e.g., 3 minutes to lower the source to conduct the measurement, walk to and from the device and to retract the source after completion of the measurement);

    3. Determine how many measurements are performed each year (e.g., 10 measurements/day, 2 days/week for 26 weeks/year).

4. Using the exposure rate information for both the gamma and neutron sources supplied by the manufacturer, an example of the estimated whole body exposure to an individual routinely using the device follows:

(0.65 mrem/hr ÷ 60 minutes/hour x (3 minutes/measurement x 10 measurements/day x 2 days/week x 26 weeks/year)) = 16.9 mRem/year TEDE (whole body) exposure.

The applicable TEDE (whole-body) limit is 50 mSv (5 rems) per year and 10 percent of that value is 5 mSv (500 millirems) per year. In the above example, personnel monitoring would not be required. Note that if the individual also cleans and lubricates the device as described below in Item B., additional whole body dose estimates must include these activities as well. Also note that increased use of the device would also require reevaluation of the doses expected to the individual.

B. Extremity exposures can be calculated by estimating the time needed to clean or lubricate the device (without extending or removing the source) and should be based on the amount of time the individual is exposed to the source, the distance the extremities are from the source and the number of times per year the individual is exposed. The user should only be exposed to the source for a few minutes during each cleaning and lubrication of the device. The neutron exposures from the surface of the device supplied by the manufacturer plus the gamma exposures from the surface of the device should be used for calculating individual exposures.

1. Determine the expected dose rates received by the extremities of the individual associated with cleaning and lubricating the device (i.e., without extending or removing the source from the device) determined by using measured or manufacturer-determined data (e.g., manufacturer's data states the exposure rate on the surface of the bottom of the device for the neutron and gamma sources is 19.9 mrem/hour).
2. Estimate the time the individual was exposed to the sources during each cleaning and lubrication. (e.g., Manufacturer's estimate it takes 10 minutes to complete this procedure with the hands exposed to the source for 3 minutes to clean and lubricate the device;
3. Determine how many times the individual cleans and lubricates the device each year. (e.g., The licensee performs 10 measurements/day, 2 days/week for 26 weeks/year. So assume the device is cleaned once/day, 2 days/week for 26 weeks/year.)
4. Using the exposure rate information for both the gamma and neutron sources supplied by the manufacturer, an example of the estimated extremity and whole body exposure to an individual routinely cleaning and lubricating the device follows:

(19.9 mrem/hr ÷ 60 minutes/hour x (3 minutes/cleaning/lubricating procedure x 1 procedure/day x 2 days/week x 26 weeks/year)) = 51.74 mRem/year extremity dose.

The whole body dose should also be estimated using the manufacturer's stated maximum dose rate at one foot from the device of 3.2 mrem/hour and estimated for the entire 10 minute procedure:

(3.2 mrem/hr ÷ 60 minutes/hour x (10 minutes/cleaning/lubricating procedure x 1 procedure/day x 2 days/week x 26 weeks/year)) = 27.73 mRem/year TEDE whole body dose.

The applicable limit for the extremities is 500 mSv (50 rems) per year and 10 percent of that value is 50 mSv (5 rems or 5000 millirems) per year. Cleaning/lubrication of the device will create an extremity dose and licensees must calculate extremity doses in their calculations as well using the same equation above and compare it with the 5 rem limit requiring extremity monitoring.

In the above example, personnel monitoring would not be required. Note that the whole body dose received during cleaning and lubricating the device must be added to the whole body dose estimated in Item A. above to determine if personnel monitoring is required. In the above examples, the whole body dose estimated in Item A. is 16.9 mrem plus 27.73 mrem estimated in Item B. = 44.63 mrem/year, which is lower than the limit of 500 mrem requiring personnel monitoring. Note that increased use, cleaning and lubricating the device would also require reevaluation of the doses expected to the individual.

Note that the above examples only cover the cleaning/lubrication procedures and use of the device and one must also consider the dose received during storage of the device if the individual receives doses associated with device storage.

Guidance to Licensees:

Licensees who wish to demonstrate that they are *not* required to provide dosimetry to their workers must prepare a written evaluation similar to that shown in the examples above, which includes estimating the dose received from actual use/cleaning and lubricating and storage of the device.

The expected dose rates, times, and distances used in the above example may *not* be appropriate to individual licensee situations. In their evaluations, licensees must use information appropriate to the various types of devices on which they will actually use. This information is available from device manufacturers or the SSD Registration Sheet maintained by NRC and Agreement States.

Licensees should review evaluations periodically and revise them as needed. They should check assumptions used in their evaluations to ensure that the assumptions are up-to-date and accurate. For example, if workers became lax in following good radiation safety practices in the example used above, the extremities could be closer to the unshielded source, and the workers would receive a higher dose. Alternatively, workers could perform the task more slowly than the estimated 10 minutes total and 3 minutes with the hands near the unshielded source. Also, using new gauges containing sources of different activities, different radionuclides, or different cleaning/lubrication procedures requires a new evaluation.

Appendix Q

REPORTING REQUIREMENTS

NOTE: The following list of notification and reporting requirements is provided to inform licensees about typical notification and reporting requirements that apply to their licensed activities. Licensees should note that the list is incomplete in that not all potentially applicable requirements have been included. Also, notification and reporting requirements change; therefore, licensees should consult the regulations for definitive information about current requirements.

Typical IEMA Notifications and/or Reports			
Event	**Telephone Notification**	**Written Report**	**Regulatory Requirement**
Reports to individual workers	None	annually	32 IAC 400.130(b)
Reports to former individual workers	None	upon request	32 IAC 400.130(c)
Notification of special circumstances to individuals	None	30 days	32 IAC 400.130(d)
Reports to worker terminating employment	None	upon request	32 IAC 400.130(e)
Package received with removable radioactive surface contamination exceeding the limits of 32 IAC 341.10 (49 CFR 173.443); or external radiation levels exceeding the limits of 32 IAC 341.10 (49 CFR 173.443).	immediate [(IEMA) and final delivery carrier must be notified]	none	32 IAC 340.960(d)
Theft or loss of material	immediate	30 days	32 IAC 340.1210(a) and (b)
Whole body dose greater than 0.25 Sieverts (Sv) [25 rem]	immediate	30 days	32 IAC 340.1220(a)(1)(A), 32 IAC 340.1230(a)
Extremity dose greater than 2.5 Gray [250 rads]	immediate	30 days	32 IAC 340.1220(a)(1)(C), 32 IAC 340.1230(a)
Whole body dose greater than 0.05 Sv [5 rem] in 24 hours	24 hours	30 days	32 IAC 340.1220(b)(1)(A), 32 IAC 340.1230(a)
Extremity dose greater than 0.5 Sv [50 rem] in 24 hours	24 hours	30 days	32 IAC 340.1220(b)(1)(C), 32 IAC 340.1230(a)
Doses in excess of specified criteria	None	30 days	32 IAC 340.1230(a)(2)
Levels of radiation or concentrations of radioactive material in excess of specified criteria	None	30 days	32 IAC 340.1230(a)(3) 32 IAC 340.1230(a)
Planned special exposures	None	30 days	32 IAC 340.1240
Report to individuals of exceeding dose limits	None	30 days	32 IAC 340.1250
Report of individual monitoring	None	annually	32 IAC 400.130
Event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits	Immediate (not morethan 4 hours after discovery)	30 days	32 IAC 340.1220(a) 32 IAC 340.1230

Typical IEMA Notifications and/or Reports (Continued)			
Event	**Telephone Notification**	**Written Report**	**Regulatory Requirement**
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	32 IAC 340.1220(c)(2) 32 IAC 340.1230
Unplanned fire or explosion that affects the integrity of any licensed material or device, container, or equipment with licensed material	24 hours	30 days	32 IAC 340.1220(c)(4) 32 IAC 340.1230
Generally licensed devices	None	30 days	32 IAC 330.220(a)(3) 32 IAC 330.220(a)(4) 32 IAC 330.220(a)(9)
Leaking source	none	5 days	32 IAC 340.1260 32 IAC 330.220(a)(3)(E)

Note: Telephone notifications shall be made to the IEMA Operations Center at 217-782-7860, except as noted. The Center is staffed 24 hours a day. Request to speak with the Nuclear Safety Officer in Charge.

Appendix R

MODEL PROCEDURES FOR OCCUPATIONAL DOSE MONITORING PROGRAM

This model provides acceptable procedures for an external occupational dose monitoring program. Applicants may either adopt these model procedures for an occupational dose monitoring program or develop alternative procedures to meet the requirements of 32 Ill. Adm. Code 340.110 and Subparts C ("Occupational Dose Limits") and F ("Surveys and Monitoring") of 32 Ill. Adm. Code Part 340. The model includes guidance as well as a discussion of regulatory requirements that are to be reflected in the elements of an occupational dose monitoring program.

"Dosimetry" is a broad term commonly applied to the use of monitoring devices, bioassay, and other methods to measure or otherwise quantify radiation doses to individuals. The licensee must control occupational doses and provide individuals with monitoring devices in accordance with the requirements of 32 Ill. Adm. Code 340.520(a). The occupational dose limits for adults are provided in 32 Ill. Adm. Code 340.210, while 32 Ill. Adm. Code 340.520, "Conditions requiring individual monitoring of external and internal occupational dose," provides, in part, that adults likely to receive in a year a dose in excess of 10 percent of those dose limits must be provided with dosimetry. Definitions of relevant terms, such as total effective dose equivalent (TEDE), deep-dose equivalent (DDE), and committed effective dose equivalent (CEDE) can be found in 32 Ill. Adm. Code 310.20, "Definitions." In addition, if monitoring is required pursuant to 32 Ill. Adm. Code 340.520, each licensee shall maintain records of doses received (see 32 Ill. Adm. Code 340.1160, "Records of individual monitoring results"). Also, if monitoring is required pursuant to 32 Ill. Adm. Code 340.520, the licensee must provide individuals with an annual report of their doses, if their occupational dose exceeds 1 mSv [100 mrem] TEDE or 1 mSv [100 mrem] to any individual organ or tissue or the individual requests their annual dose report (see 32 Ill. Adm. Code 400.130(b), "Notifications and reports to individuals").

The licensee must consider the dose that an individual may receive in the current year from all sources of employment where the individual's assigned duties involve exposure to sources of radiation. See Reg Guide 8.7, Rev. 4, "Instructions for Recording and Reporting Occupational Radiation Dose Data," May 2018.

If an individual may receive more than 10 percent of the annual dose limit, IEMA requires the licensee to monitor the dose, to maintain records of the dose, and, on at least an annual basis, to inform the worker of his or her dose.

The As Low As Reasonably Achievable "ALARA" Program

Regulations in 32 Ill. Adm. Code 340.110 state that "each licensee shall develop, document, and implement a radiation protection program that ensures compliance with the provisions [32 Ill. Adm. Code Part 340]" and "the licensee shall use, to the extent practical, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and doses public doses that are as low as is reasonably achievable (ALARA)." Additionally, 32 Ill. Adm. Code 340.110 requires that licensees review, at intervals not to exceed 12 months, the radiation protection program content and implementation.

External Exposure

It is necessary to assess doses to radiation workers to demonstrate compliance with regulatory limits for radiation dose and to help demonstrate that doses are maintained at ALARA levels.

Providing for the safe use of radioactive materials and radiation is a management responsibility. It is important that management recognize the importance of radiation monitoring as part of the overall requirements for radiation protection.

There are three dose limits included in 32 Ill. Adm. Code 340.210 that apply to external exposure: deep dose to the whole body [5 rem or 0.05 Sievert (Sv)], shallow dose to the skin or extremities [50 rem or 0.5 Sv], and dose to the lens of the eye [15 rem or 0.15 Sv]. According to the definitions in 32 Ill. Adm. Code 310.20, the DDE to the whole body is considered to be at a tissue depth of 1 centimeter (cm) [1,000 milligram (mg)/square centimeters (cm^2)], shallow-dose equivalent (SDE) to the skin or extremities at 0.007 cm [7 mg/cm^2], and lens of the eye dose equivalent (defined in 32 Ill. Adm. Code 340.30) at 0.3 cm [300 mg/cm^2]. In evaluating the lens of the eye dose equivalent, it is acceptable to take credit for the shielding provided by protective lenses or other protection factors.

Under 32 Ill. Adm. Code 340.520(a), the use of individual monitoring devices is required for the following:

- Adults likely to receive, in a year, from sources external to the body, a dose in excess of 10 percent of the occupational dose limits in 32 Ill. Adm. Code 340.210(a). Monitoring devices are accordingly required for adults likely to receive an annual dose in excess of:
    - 0.5 rem [0.005 Sv] DDE
    - 1.5 rem [0.015 Sv] lens (of the eye) dose equivalent
    - 5 rem [0.05 Sv] SDE to the skin
    - 5 rem [0.05 Sv] SDE to any extremity
- Minors who are likely to receive an annual dose in excess of:
    - rem [1.0 millisievert (mSv)] DDE
    - 0.15 rem [1.5 mSv] lens (of the eye) dose equivalent
    - 0.5 rem [5 mSv] SDE to the skin, or
    - 0.5 rem [5 mSv] SDE to any extremity
- Declared pregnant women likely to receive an annual dose in excess of 0.1 rem [1.0 mSv] DDE during the entire pregnancy.
- Individuals entering a high- or a very-high-radiation area *(Generally not applicable to portable device licensees)*.

To demonstrate that monitoring of occupational exposure is not necessary for a group of radiation workers, it must be demonstrated that doses will not exceed 10 percent of the applicable limits. In these cases, IEMA does not require licensees to monitor radiation doses for this class of worker.

The following methods may be used to demonstrate that doses are expected to be within 10 percent of regulatory limits:

- Prior Experience: Reviews of radiation dose histories for workers in a specific work area (typically spanning three to five years) show that they are not likely to receive a dose in excess of 10 percent of the limits.
- Area Surveys: Demonstrate through the conduct of appropriate radiation level surveys [e.g., using a radiation survey meter or area thermoluminescent dosimeters (TLDs)] in the work area, combined with estimates of occupancy rates and calculations, that doses to workers are not likely to exceed 10 percent of the limits (exposures associated with reasonable "accident" scenarios should also be evaluated).
- The licensee performs a reasonable calculation, based upon source strength, distance, shielding, and time spent in the work area, that shows that workers are not likely to receive a dose in excess of 10 percent of the limits. See Appendix P of this Instructional Set for example calculations.

External dose is determined by using individual monitoring devices, such as film badges, optically stimulated luminescence dosimeters (OSLs), or TLDs. These devices must be evaluated by a processor that is National Voluntary Laboratory Accreditation Program-approved, as required by 32 Ill. Adm. Code 340.510.

The device for monitoring the whole-body dose, eye dose, skin dose, or extremity dose shall be placed near the location expected to receive the highest dose during the year [32 Ill. Adm. Code 340.210(c)]. When the whole body is exposed fairly uniformly, the individual monitoring device is typically worn on the front of the upper torso.

If the radiation dose is highly nonuniform, causing a specific part of the whole body (head, trunk, arms above the elbow, or legs above the knees) to receive a substantially higher dose than the rest of the whole body, the individual monitoring device shall be placed near that part of the whole body expected to receive the highest dose. For example, if the dose rate to the head is expected to be higher than the dose rate to the trunk of the body, a monitoring device shall be located on or close to the head. For additional guidance, see Reg Guide 8.40, "Methods for Measuring Effective Dose Equivalent from External Exposure," July 2010.

If, after the exposure is received, the licensee somehow learns that the maximum dose to a part of the whole body, eye, skin, or extremity was substantially higher than the dose measured by the individual monitoring device, an evaluation shall be conducted to estimate the actual maximum dose.

Records of individual monitoring results must be maintained as described in 32 Ill. Adm. Code 340.1160. For additional guidance, see Reg Guide 8.7, Rev. 4, "Instructions for Recording and Reporting Occupational Radiation Dose Data," May 2018.

Exchange Frequency

Radiation protection programs of limited scope and authorized uses may elect to assign a single dosimetry type and exchange frequency.

Determining the appropriate frequency of dosimeter exchange depends upon both the exposure potential and the manufacturer's recommendations for the dosimetry in use. Consider the following elements:

- the forms and types of radiation to be monitored

- potential exposure of the individual
- sensitivity of the dosimetry in use
- acceptable uncertainty in the estimate of external exposures

Exchange and timely analysis of dosimetry should be conducted often enough to identify and quantify potential exposures, during any year, that are likely to exceed 10 percent of the occupational limits specified in 32 Ill. Adm. Code 340.210. The 10 percent criterion is consistent with 32 Ill. Adm. Code 340.520(a), which requires licensees to monitor occupational doses for exposed individuals who are likely to exceed 10 percent of the applicable limit. Additionally, licensees should also consider the magnitude of potential exposures with relation to investigational limits set by the licensee or NVLAP processor.

After reviewing the radiation protection program's use and exchange frequency, applicants should obtain technical specifications from their NVLAP-approved processor to determine the appropriate type(s) of dosimetry.

Licenses which perform instrument calibration or nonroutine maintenance should account for the potential of increased extremity exposure. The licensee should detail in the dosimetry procedures the criteria which will be used to select appropriate dosimetry and assign exchange frequency.

Finally, because evaluation of dose is an important part of the radiation protection program, it is important that users return dosimeters on time. Licensees should be thorough in their effort to recover any missing dosimeters. Delays in processing a dosimeter can result in the loss of the stored information.

Investigational Levels – External Dose Monitoring

IEMA has emphasized that the Investigational Levels in this program are not new dose limits but, as noted in International Commission on Radiological Protection (ICRP) Report 26, "Recommendations of the International Commission on Radiological Protection," Investigational Levels serve as check points above which the results are considered sufficiently important to justify investigation.

When the cumulative annual exposure to a radiation worker exceeds Investigational Level I in the table below (i.e., 10 percent of the annual limit for occupational exposure), the radiation safety officer (RSO) or the RSO's designee should investigate the exposure and review the actions that might be taken to reduce the probability of recurrence. When the cumulative annual exposure exceeds the Investigational Level II in the table below (i.e., 30 percent of the annual limit for occupational exposure), the RSO or the RSO's designee should investigate the exposure and review actions to be taken to reduce the probability of recurrence, and management should review the report of the actions to be taken to reduce the probability of occurrence.

Investigational Levels		
Part of Body	**Investigational Level I (mrem/yr)**	**Investigational Level II (mrem/yr)**
whole body, head, trunk including male gonads, arms above the elbow, or legs above the knee	500 [5 mSv]	1,500 [15 mSv]
hands, elbows, arms below the elbow, feet, knees, legs below the knee, or skin	5,000 [50 mSv]	15,000 [150 mSv]
lens of the eye	1,500 [15 mSv]	4,500 [45 mSv]

Review and record on Agency form IL 473-0299 (IDNS Form 5), or an equivalent form (e.g., dosimeter processor's report), the results of personnel monitoring. Take the actions listed below when the investigation levels listed in the table above are reached:

Personnel dose less than Investigational Level I

Except when deemed appropriate by the RSO or the RSO's designee, no further action will be taken, if an individual's dose is less than the table values for Investigational Level I.

Personnel dose equal to or greater than Investigational Level I but less than Investigational Level II

When the dose of an individual equals or exceeds Investigational Level I, the RSO or the RSO's designee should conduct a timely investigation and review the actions that might be taken to reduce the probability of recurrence, following the period when the dose was recorded. If the dose does not equal or exceed Investigational Level II, no action related specifically to the exposure is required, unless deemed appropriate by the RSO or the RSO's designee. Consider investigating the factors that led to the radiation exposure and the radiation doses and work habits of other individuals engaged in similar tasks to determine if improvements or additional safety measures are needed to reduce exposures. Evaluate, in the context of ALARA program quality, and record the results of investigations and evaluations.

Personnel dose equal to or greater than Investigational Level II

The RSO should investigate, in a timely manner, the causes of all personnel doses equaling or exceeding Investigational Level II. The RSO should consider actions to reduce the probability of occurrence, and a report of the actions should be reviewed by the licensee's management at its first meeting following completion of the investigation.

Reestablishment of Investigational Level II to a level above that listed in the table

In cases where a worker's dose or the dose for a group of workers needs to exceed an Investigational Level, a new, higher Investigational Level may be established for that individual or group on the basis that it is consistent with good ALARA practices. Justification for new Investigational Levels should be documented.

Declared Pregnancy and Dose to Embryo/Fetus

Regulations in 32 Ill. Adm. Code 340.280, "Dose equivalent to an embryo/fetus," state that the licensee shall ensure that the dose equivalent to an embryo or fetus during the entire pregnancy, due to occupational exposure of a declared pregnant woman, does not exceed 0.5 rem [5 mSv]. The licensee shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman. If the pregnancy is declared in writing and includes the worker's estimated date of conception, the dose equivalent to an embryo or fetus shall be taken as the sum of

- the DDE to the declared pregnant woman, and
- the dose equivalent to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman

Licensees should reference Reg Guide 8.13, Rev. 3, "Instructions Concerning Prenatal Radiation Exposure," June 1999, for information to help pregnant women and other personnel make decisions regarding radiation exposure during pregnancy and Reg Guide 8.36, "Radiation Dose to the Embryo/Fetus," July 1992, for calculating the radiation dose to the embryo/fetus.

Internal Exposure

With respect to internal exposure, licensees are required to monitor occupational intake of radioactive material and assess the resulting dose if it appears likely that personnel will receive greater than 10 percent of the annual limit on intake (ALI) from intakes in a year (32 Ill. Adm. Code 340.520). Values for radionuclide intakes by means of inhalation and ingestion (i.e., derived air concentration (DAC) and ALI) are provided in Table 1 of Appendix B of 10 CFR Part 20.

It is unlikely any portable device licensee will need to account for annual internal exposures from sealed sources. Even in accident scenarios, while the devices become damaged; the sealed sources will typically remain intact. Contact IEMA for questions or additional resources on developing programs for internal occupational exposures.

Changes to an Individuals Record of Dose

If an individual's dosimeter is lost, the licensee needs to perform and document an evaluation of the dose the individual received and add it to the employee's dose record, to demonstrate compliance with occupational dose limits in 32 Ill. Adm. Code 340.210. 32 Ill. Adm. Code 340.1110(c) requires that licensees first obtain Agency authorization before modifying an employee's dosimetry record. Sometimes the most reliable method for estimating an individual's dose is to use his or her recent dose history. In other cases, particularly if the individual does nonroutine types of work, it may be better to use doses of coworkers as the basis for the dose estimate. It also may be possible to estimate doses by modeling and calculation (i.e., reconstruction) of scenarios leading to dose.

Requests for modification of dosimetry records should be submitted to the Agency either in writing or electronically to ema.speclic@illinois.gov. Social security numbers or other personally identifiable information should not be submitted electronically. To the extent possible, exclude social security numbers and utilize only account numbers or other unique identifiers. The licensee's request should provide sufficient details on the investigation performed and adequately support the basis of the request.

The licensee should provide data from the employee's previous personnel monitoring results to estimate the radiation exposure for the subject monitoring period. While there is no standard on how far back the dosimetry records need to go, historically the Agency has used three years. The licensee shall certify that there has not been a change of duties or a significant increase in workload during this monitoring period or provide appropriate calculations for adjustment.

If the licensee is claiming the dosimeter was misplaced during the wear-period and it was subsequently analyzed and found to have a high exposure, it would be appropriate to have a certification from the dosimetry processor (if possible) to state that the exposure conditions were static, dynamic, or in contamination conditions.

NOTE: For some dosimeter models, this may only be available if the OSL returned an exposure in excess of 500 mR.

Recordkeeping

Records of dosimetry data and methods for calculating dose must be maintained as required by 32 Ill. Adm. Code 340.1160. For additional information on recordkeeping and reporting occupational exposure data, including intakes, refer to Reg Guide 8.7, Rev. 4, "Instructions for Recording and Reporting Occupational Radiation Dose Data," May 2018.

APPENDIX S

SUMMARY OF DOT REQUIREMENTS FOR TRANSPORTATION OF TYPE A,TYPE B, OR LIMITED QUANTITIES OF LICENSED MATERIAL

NOTE: The charts included at the end of this Appendix are for reference only and are not a substitute for U.S. Department of Transportation (DOT) and IEMA transportation regulations.

Licensed material must be transported in accordance with DOT regulations. Applicants and licensees should review the most recent regulations in Title 49 of the *Code of Federal Regulations* (49 CFR). Licensees should note that the list is incomplete, in that not all potentially applicable requirements have been included. Also, transportation requirements change; therefore, licensees should consult the regulations for definitive information about current requirements. The following are the major areas in DOT regulations most relevant for medical use licensees transporting licensed material:

- Table of Hazardous Materials and Special Provisions—Subpart B
  - 49 CFR 172.101—Purpose and Use of Hazardous Materials Table [proper shipping name, hazard class, identification number]
  - Table 2, Appendix A to 49 CFR 172.101—List of Hazardous Substances and Reportable Quantities [for radionuclides]
- Shipping Papers—Subpart C
  - 49 CFR 172.201—Preparation and retention of shipping papers
  - 49 CFR 172.202—Description of hazardous material on shipping papers
  - 49 CFR 172.203—Additional description requirements
  - 49 CFR 172.204—Shipper's certification [if applicable]
- Markings—Subpart D
  - 49 CFR 172.301—General marking requirements for non-bulk packaging
  - 49 CFR 172.304—Marking requirements
  - 49 CFR 172.310—Class 7 (radioactive) materials
  - 49 CFR 172.324—Hazardous substances in non-bulk packaging [designation of "reportable quantities" with the letters "RQ"]
- Labeling—Subpart E
  - 49 CFR 172.400—General labeling requirements

- 49 CFR 172.400(a)—Exceptions from labeling
- 49 CFR 172.403—Class 7 (radioactive) material
- 49 CFR 172.406—Placement of labels
- 49 CFR 172.436, 172.438, 172.440, 172.450—Labels [White-1, Yellow-2, Yellow-3, Empty]

- Placarding—Subpart F
  - 49 CFR 172.504—General placarding requirements
  - 49 CFR 172.516—Visibility and display of placards
  - 49 CFR 172.556—RADIOACTIVE placard
- Emergency Response Information—Subpart G
  - 49 CFR 172.600—Applicability and general requirements
  - 49 CFR 172.602—Emergency response information
  - 49 CFR 172.604—Emergency response telephone number
- Training—Subpart H
  - 49 CFR 172.702—Applicability and responsibility for training and testing
  - 49 CFR 172.704—Training requirements [types of training, frequency, recordkeeping]
- Safety and Security Plans – Subpart I
  - 49 CFR 172.800—Purpose and applicability
  - 49 CFR 172.802—Components of a security plan
- Shippers—General Requirements for Shipments and Packaging—49 CFR Part 173
  - Class 7 (Radioactive Materials) – Subpart I.
    - 49 CFR 173.25—Authorized packaging and overpacks
    - 49 CFR 173.403—Definitions
    - 49 CFR 173.410—General design requirements
    - 49 CFR 173.412—Additional design requirements for Type A packages

- 49 CFR 173.413—Requirements for Type B packages
- 49 CFR 173.415—Authorized Type A packages
- 49 CFR 173.416—Authorized Type B packages [includes packaging certification requirements]
- 49 CFR 173.421—Excepted packages for limited quantities of Class 7 (radioactive) materials
- 49 CFR 173.422—Additional requirements for excepted packages containing Class 7 (radioactive) materials
- 49 CFR 173.425—Table of activity limits—excepted quantities and articles [limited quantity]
- 49 CFR 173.431—Activity limits for Type A and Type B packages
- 49 CFR 173.435—Table of A_1 and A_2 values for radionuclides [fordetermination of package type]
- 49 CFR 173.441—Radiation level limitations and exclusive use provisions
- 49 CFR 173.443—Contamination control
- 49 CFR 173.471—Requirements for U.S. Nuclear Regulatory Commission approved packages
- 49 CFR 173.476—Approval of special form Class 7 (radioactive) materials [includes requirement for documentation of special form status]

- Carriage by Public Highway—49 CFR Part 177
  - General Information and Regulations-Subpart A
    - 49 CFR 177.817—Shipping papers [location of shipping papers during transport]
- Loading and Unloading—Subpart B
  - 49 CFR 177.842—Class 7 (radioactive) material [includes requirement for blocking and bracing during transport]

Applicants should visit the DOT Web site for additional information on transportation requirements: https://www.dot.gov/.

1. Minimum Required Packaging for Class 7 (Radioactive) Material:[1] (49 CFR 173 and 32 IAC Part 341)[2]

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.

Minimum Packaging Required for Radioactive Materials other than Low Specific Activity (LSA) Material and Surface Contaminated Objects (SCO) based on Activity of Package Contents

Radioactive Material Quantity[3]		Limited Quantities and Articles	Type A[4] [9]	Type B
Activity Restrictions		≤ the limits specified in Table 4 of § 173.425	≤ A_1 for special form ≤ A_2 for normal form	> A_1 for special form > A_2 for normal form
Contents of Package	Non-fissile and Fissile Excepted	Excepted Package	Type A Package	Type B(U) or Type B(M) package
	Fissile	N/A	Type AF[10] package	Type B(U)F or Type B(M)F package

Minimum Packaging Required for LSA Material and SCO[5,6]

Type(s) of LSA and/or SCO	LSA-I	LSA-II	LSA-III	SCO-I	SCO-II
Category of Package for Domestic or International Transport[7,8]	Unpackaged[8] **IP-1:** solids or liquids/exclusive use **IP-2:** liquids/non-exclusive use **Specification tank cars or cargo tank motor vehicles:** liquids/exclusive use	- - **IP-2:** exclusive use[9] **IP-3:** liquids or gases/non-exclusive use[9]	- - **IP-2:** exclusive use **IP-3:** non-exclusive use	Unpackaged[8] IP-1 - -	- - IP-2 -
Alternative Provisions for Domestic only Transport[8]	Packaging shall meet the requirements of §§ 173.24, 24a, and 173.410. Transportation shall be an exclusive use shipment. Activity per shipment must be less than an A_2 quantity (see § 173.427(b)(4)).				

[1] Additional provisions may apply for radioactive materials that are pyrophoric, oxidizing, fissile excepted, or uranium hexafluoride.

[2] Each IEMA licensee shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180,and 390 through 397 (see § 71.5).

[3] Materials that contain radionuclides, where both the activity concentration and the total activity in the consignment exceed either thevalues specified in the table in § 173.436 or the values derived according to the instructions in § 173.433, must be regulated in transport as Class 7 (radioactive) material.

[4] Except for LSA material and SCO, a Type A package may not contain a quantity of Class 7 (radioactive) material greater than A_1 orA_2 (see § 173.431(a)). See A_1 and A_2 definitions in § 173.403.

[5] The external dose rate from LSA material or SCO in a single package may not exceed 10 mSv/h (1 rem/h) at 3 meters from theunshielded material or objects (see §§ 173.427(a)(1) and (d)).

[6] LSA material and SCOs that are or contain fissile material in quantities that are not fissile excepted must be packaged in appropriateType AF or Type BF packages, and not classified as LSA material or SCO. For alternate domestic transport provisions, see § 173.427(b)(4). For comprehensive guidance on packaging and transportation of LSA material and SCO, see NUREG-1608.

[7] For the quantity of LSA material and SCO transported in a single conveyance, see the limits specified in § 173.427(a)(2).

[8] LSA material or SCO shall be appropriately packaged in accordance with § 173.427(b) or (d). Certain LSA-I material and SCO-I maybe transported unpackaged under the conditions in § 173.427(c).

[9] See §§ 173.411(c) and 173.415(a) for requirements related to package record retention (2 years) and associated documentation of physical tests.

[10] See §§ 71.22(a), 71.23(a) and 173.417(a) for regulations regarding the use of non-AF packages for fissile materials.

2. Radiation Level, TI and CSI Limits for Transportation by Mode:[1] (49 CFR 173 - 177, and 32 Ill. Adm. Code Part 341)[10]

Type of Transport	Non-exclusive use	Exclusive use		
Mode of Transport	**Road, Rail, Vessel and Air[9]**	**Road and Rail**	**Vessel**	**Air (cargo only)**
Radiation Level Limits[2]				
Package Surface	**2 mSv/h (200 mrem/h)**	**2 mSv/h (200 mrem/h):** other than closed vehicles **10 mSv/h (1000 mrem/h):** closed vehicles	**2 mSv/h[11] (200 mrem/h)**	**2 mSv/h (200 mrem/h)[3]**
Conveyance[4]	**N/A**	**2 mSv/h (200 mrem/h):** outer surfaces (sides, top and underside) of vehicle[5]	**N/A**	**N/A**
		0.1 mSv/h (10 mrem/h): at any point two (2) m (6.6 ft) from sides of the vehicle[5]	**N/A**	**N/A**
Occupied position	**N/A**	**0.02 mSv/h (2 mrem/h):** in any normally occupied area[6]	**Requirements of § 176.708 apply**	**N/A**
Transport Index (TI) Limits[2]				
Package[7]	**3:** passenger aircraft **10:** road, rail, vessels and cargo aircraft	**No limit**		**10**
Conveyance[4]	**50:** road, rail and passenger aircraft **50 to No limit:** vessels[8] **200:** cargo aircraft	**No limit**		**200**
Overpack	**N/A:** for road, rail **50 to 200:** vessel[8] **3:** passenger aircraft; **10:** cargo aircraft	**N/A**	**No limit[8]**	**N/A**
Criticality Safety Index (CSI) Limit for fissile material[2]				
Package[7]	**50**	**100**	**100**	**100**
Conveyance[4]	**50:** road, rail and air **50:** for holds, compartments or defined deck areas of vessels[8] **200 to No limit:** for a total vessel[8]	**100**	**200 to No limit:** for a total vessel[8]	**100**
Overpack	**50:** road, rail, vessels[8] and air	**N/A**		

[1] Radiation level, TI, and CSI are defined in § 173.403.

[2] In addition to any applicable radiation level, TI and CSI limits, separation distance requirements apply to packages, conveyances, freight containers and overpacks; to occupied positions; and to materials stored in transit. Separation distancesare based on the sum of the TIs and, for fissile materials, the sum of the CSIs. [see applicable 49 CFR references for: Rail - § 174.700; Air – §§ 175.700 through 175.703; Vessel - §§ 176.700 through 176.708; and Highway - § 177.842].

[3] Higher package surface radiation levels may be allowed through an approved special arrangement.

[4] Conveyance is, for transport by public highway or rail, any transport vehicle or large freight container; and for transport by air,any aircraft. See definitions in § 173.403.

[5] The outer surfaces (sides, top and underside) of vehicles are specified for road and rail vehicles in § 173.441.

[6] For rail, normally occupied areas include the transport vehicle and adjacent rail cars. The 0.02 mSv/h (2 mrem/h) limit does not apply to carriers operating under a State or federally regulated radiation protection program where personnel wear radiation dosimetry devices.

[7] Additional TI and CSI limits apply for individual packages when non-fissile radioactive material packages are mixed with fissilematerial packages (see § 173.459).

[8] For details on TI and CSI limits for transport by vessel, see § 176.708.

[9] Only excepted packages and packages intended for use in research, medical diagnosis, and treatment are permitted onpassenger aircraft (see §§ 173.448(f) and 175.700).

[10] The limits in this table do not apply to excepted packages. See the following references for the radiation level limits for: limitedquantities, § 173.421; instruments and articles, § 173.424; articles containing natural uranium or thorium, § 173.426; or empty packaging, § 173.428.

[11] 2 mSv/h (200 mrem/h) other than intermodal transport of closed transport vehicles or exclusive use vessel.

3. Contamination Limits and Quality Control for Class 7 (Radioactive) Materials: (49 CFR 173.443 and 173.475, and 10 CFR 71)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.

Maximum Permissible Limits for Non-fixed Radioactive Contamination on Packages When Offered for Transport

The level of non-fixed (removable) radioactive contamination on the external surface of each package, conveyance, freight container, and overpack offered for transport must be kept as low as reasonably achievable, and shall not exceed the values shown in the following table:

Contaminant	Maximum permissible limits (§ 173.443(a), Table 9)		
	Bq/cm^2	µCi/cm^2	dpm/cm^2
Beta and gamma emitters and low toxicity alpha emitters	4	10^{-4}	240
All other alpha emitting radionuclides	0.4	10^{-5}	24

The non-fixed contamination shall be determined by:

(a) wiping, with an absorbent material using moderate pressure, sufficient areas on the package to obtain a representative sampling of the non-fixed contamination;
(b) ensuring each wipe area is 300 cm^2 in size;
(c) measuring the activity on each single wiping material and dividing that value by the surface area wiped and the efficiency of the wipe procedure, where an actual wipe efficiency may be used, or it may be assumed to be 0.10.

Alternatively, the contamination level may be determined using alternative methods of equal or greater efficiency.
A conveyance used for non-exclusive use shipments is not required to be surveyed unless there is reason to suspect that it exhibits contamination (see § 173.443(a)(2)).

Provisions for Control of Contamination on Radioactive Material Packages Offered for Transport and at the Time of Receipt

- When offered for transport, the non-fixed contamination on each package of radioactive material must be kept as low as reasonably achievable and may not exceed the limits set forth in § 173.443(a), Table 9 (as shown above).
- During transport, non-fixed contamination levels on packages transported as exclusive use by rail or highway may not exceed 10 times the limits in § 173.443(a), Table 9 (as shown above).

Provisions for Non-fixed (Removable) Contamination on Excepted and Empty Radioactive Material Packages

- The non-fixed radioactive surface contamination on the external surface of excepted and empty packages shall not exceed the limits specified in § 173.443(a), Table 9 (as shown above).
- The internal contamination of an empty package must not exceed 100 times the limits in § 173.443(a), Table 9 (as shown above).

Provisions for Non-fixed (Removable) Contamination on Packages and in Rail and Road Vehicles used for Exclusive Use Shipments of Radioactive Material

- The levels of non-fixed radioactive contamination on the packages (a) at the beginning of transport, may not exceed the levels prescribed in the above table, and (b) at any time during transport, may not exceed ten times the levels prescribed in § 173.443(a), Table 9 (as shown above) [see § 173.443(b)].
- Each conveyance, overpack, freight container, or tank used for transporting Class 7 (radioactive) material as an exclusive use shipment that utilizes the provisions of § 173.443(b) must be surveyed with appropriate radiation detection instruments after each exclusive use transport. If contamination values exceed acceptable levels, the transport vehicle may not be returned to exclusive use transport service, and then only for subsequent exclusive use shipment, unless the radiation dose rate at each accessible surface is demonstrated to be 0.005 mSv/h (0.5 mrem/h) or less, and that there is no significant non-fixed radioactive surface contamination as specified in § 173.443(a), Table 9 (as shown above) [see § 173.443(c)].

Provisions for Non-fixed (Removable) Contamination in Closed Rail and Road Vehicles that are used Solely for the Transportation of Radioactive Material (§ 173.443(d))

- The contamination levels must not exceed 10 times the levels prescribed in § 173.443(a), Table 9 (as shown above).
- Each vehicle is marked with the words "*For Radioactive Materials Use Only*" in letters at least 76 mm (3 in) high in a conspicuous place on both sides of the exterior of the vehicle.
- The vehicle must meet the placard requirements of Subpart F of Part 172.
- A survey of the interior surfaces of the empty closed vehicle must show that the radiation dose rate at any point does not exceed 0.1 mSv/h (10 mrem/h) at the surface or 0.02 mSv/h (2 mrem/h) at 1 m (3.3 feet) from the surfaces.
- Each vehicle shall be kept closed except for loading or unloading.

Provisions for Quality Control Prior to Each Shipment of Radioactive Material (§ 173.475)

- Before each shipment of any radioactive materials package, the offeror must ensure, by examination or appropriate tests, that:
  (a) the packaging is proper for the contents to be shipped;
  (b) the packaging is in unimpaired physical condition, except for superficial marks;
  (c) each closure device of the packaging, including any required gasket, is properly installed, secured, and free of defects;
  (d) for fissile material, each moderator and neutron absorber, if required, is present and in proper condition;
  (e) each special instruction for filling, closing, and preparation of the packaging for shipment has been followed;
  (f) each closure, valve, or other opening of the containment system is properly closed and sealed;
  (g) each packaging containing liquid in excess of an A_2 quantity and intended for air shipment has been tested to show that it will not leak under an ambient atmospheric pressure of not more than 25 kPa, absolute (3.6 psia), where the test must be conducted on the entire containment system, or on any receptacle or vessel within the containment system, to determine compliance with this requirement;
  (h) the internal pressure of the containment system will not exceed the design pressure during transportation; and
  (i) the external radiation and contamination levels are within the allowable limits specified in §§ 173.441 and 173.443.

4. Hazard Communications for Class 7 (Radioactive) Materials: Shipping Papers (49 CFR 172, Subpart C)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information. [1]

Shipping Paper Entries

Always Required

Basic description (in sequence):

- **UN Identification number**
- **Proper Shipping Name**
- **Hazard Class (7)**
- **Maximum activity contained in each package in SI units** (e.g., Bq, TBq), or in both SI and customary units (e.g., Ci, mCi) with customary units in parentheses following the SI units
- **Number and type of packages**

Additional description:

- **Name of each radionuclide**[2]
- **Description of physical and chemical form** (unless special form)
- **"Special form" when not in the proper shipping name**
- **Category of label** used
- **Transport index (TI)** of each package bearing a Yellow-II or Yellow-III label

Additional entry requirements:

- 24 hour **emergency telephone number**
- **Shipper's Certification** shall be provided by each person offering radioactive material for transportation[3]
- Proper page numbering (e.g., Page 1 of 4)

Sometimes Required

Materials-based Requirements:

- The criticality safety index (CSI) or "Fissile Excepted" for fissile material
- "Highway route controlled quantity" or "HRCQ" for highway route controlled quantities
- The letters "RQ" entered either before or after the basic description for each hazardous substance [see § 171.8]
- Enter applicable subsidiary hazard class(es) in parentheses immediately following the primary hazard class when a subsidiary hazard label is required
- A hazardous waste manifest and the word "Waste" preceding the proper shipping name is required for radioactive material that is hazardous waste

Package-based Requirements:

- The applicable DOE or NRC package approval identification marking for each Type B(U), Type B(M), or fissile material package
- The International Atomic Energy Agency (IAEA) Certificate of Competent Authority identification marking for export shipment or shipment in a foreign made package

Shipment- and Administrative-based Requirements:

- Specify "exclusive use shipment" as required
- Specify instructions for maintaining exclusive use controls for shipments of LSA material or SCO under exclusive use
- Specify the notation "DOT–SP" followed by the special permit number for a special permit shipment

Optional Entries

- The weight in grams or kilograms may be inserted instead of activity units for fissile radionuclides, except for Pu-239 and Pu-241
- The weight in grams of Pu-239 and Pu-241 may be inserted in addition to the activity units
- Other information is permitted provided it does not confuse or detract from the proper shipping name or other required information

Special Considerations/Exceptions for Shipping Papers

- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, or be entered in a color that readily contrasts with any description on the shipping papers or highlighted on the shipping papers in a contrasting color, or be designated by an "X" (or "RQ" if appropriate).
- Emergency response information consistent with §§ 172.600 – 172.606 shall be readily available on the transport vehicle.
- Shipments of excepted radioactive material in excepted packages, under UN2908, UN2909, UN2910, and UN2911, are excepted from shipping paper requirements if (a) the material is not a hazardous substance or hazardous waste and (b) the package does not contain fissile material or contain fissile material that is excepted by § 173.453.
- For road transport, the shipping papers shall be (a) readily available to authorities in the event of accident or inspection, (b) stored within the driver's immediate reach while he is restrained by the lap belt, (c) readily visible to a person entering the driver's compartment or in a holder which is mounted to the inside of the door on the driver's side of the vehicle, and (d) either in a holder mounted to the inside of the door on the driver's side of the vehicle or on the driver's seat [see § 177.817(e)].

[1] International Atomic Energy Agency (IAEA); International Air Transportation Association (IATA); International Civil Aviation Organization (ICAO); International Maritime Organization (IMO).

[2] For mixtures of radionuclides, the radionuclides to be shown must be determined in accordance with § 173.433(g), which is commonlyknown as the 95% rule; abbreviations (symbols) are authorized.

[3] The Shipper's certification shall satisfy the requirements of § 172.204.

5. Hazard Communication for Class 7 (Radioactive) Materials: Marking of Packages:(49 CFR 172, Subpart D; and 49 CFR 173.471, 178.3 and 178.350)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Markings on Packages

Markings Always Required Unless Excepted[1]

For Non-bulk Packages:

- Proper shipping name
- Identification number (preceded by "UN" or "NA," as appropriate)
- Name and address of consignor or consignee, unless the package is:
  - highway only and no motor carrier transfers; or
  - part of a rail 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

For Bulk Packages:

- Identification number on orange panel or white square-on-point display [see §§ 172.332 or 172.336]:
  - on each side and each end, if the packaging has a capacity of 3,785 L (1,000 gallons) or more[2], or
  - on two opposing sides, if the packaging has a capacity of less than 3,785 L (1,000 gallons)[2]

Additional Markings Sometimes Required

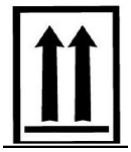
Package-based marking requirements:

- Gross mass, including the unit of measurement (which may be abbreviated) for each package with gross mass greater than 50 kg (110 lb)
- Package type as appropriate, i.e., "TYPE IP–1," "TYPE IP–2," "TYPE IP–3," "TYPE A," "TYPE B(U)" or "TYPE B(M)"[1]
- Marked with international vehicle registration code of country of origin for IP–1, IP–2, IP–3 or Type A package design (e.g., "USA")
- Radiation (trefoil) symbol[3] on outside of outermost receptacle of each Type B(U) or Type B(M) packaging design

- Each NRC-approved package (e.g., Type AF, Type B(U), Type B(M), Type B(U)F, and Type B(M)F) must be marked with the identification marking indicated in the package approval
- For Specification 7A packaging, mark on the outside with "USA DOT 7A Type A", and the name and address or symbol of the manufacturer satisfying §§ 178.3 and 178.350

Materials-based requirements:

- For a non-bulk IP–1 package containing a liquid, use underlined double arrow symbol indicating upright orientation[4], where the symbol is placed on two opposite sides of the packaging [see § 172.312]



- For a non-bulk package containing a hazardous substance, mark the outside of each package with the letters "RQ" in association with the proper shipping name

Administrative-based requirements:

- For each Type B(U), Type B(M) or fissile material package destined for export shipment, mark "USA" in conjunction with specification marking, or certificate identification; and package identification indicated in the U.S. Competent Authority Certificate
- Mark "DOT–SP" followed by the special permit number assigned for each package authorized by special permit
- Competent authority identification marking and revalidation for foreign made Type B(U), Type B(M), Type H(U), Type H(M), or fissile material package for which a Competent Authority Certificate is required

Optional Markings

- Both the name and address of consignor and consignee is recommended.
- Other markings on packages such as advertising are permitted, but must be located away from required markings and labeling.

For marking exceptions for LSA material and SCO, [see § 173.427(a)(6)(vi)] (e.g., RADIOACTIVE-LSA, RADIOACTIVE-SCO, or RQ, as appropriate).

For an overpack, the marking "OVERPACK" in lettering 12 mm (0.5 inches) high. This marking is not required if the package type contained in the overpack is visible from the outside [see § 173.25].

Special Considerations for Marking Requirements

- All markings are to be (a) on the outside of each package, (b) durable and legible, (c) in English, (d) printed on or affixed to the surface of a package or on a label, tag, or sign, (e) displayed on a background of sharply contrasting color, and (f) unobscured by labels or attachments.
- When an overpack is used, see §§ 173.25 and 173.448(g) for marking requirements.

[1] Some marking exceptions exist for excepted packages, as specified in §§ 173.421, 173.422, 173.424, 173.426 and 173.428.

[2] If the identification number marking on a bulk package is not visible, the transport vehicle or freight container must be marked on each side and each end [see § 172.331].

[3] The radiation symbol shall be resistant to the effects of fire and water, plainly marked by embossing, stamping or other means resistant to the effects of fire and water and conform to the size requirements of Appendix B to Part 172.

[4] The arrows must be either black or red on white or other suitable contrasting background and commensurate with the size of the package; depicting a rectangular border around the arrows is optional.

6. Hazard Communications for Class 7 (Radioactive) Materials:
Labeling of Packages (49 CFR 172.400-450)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

Requirements for Labels[1]

- Label each package, except for (a) excepted packages of radioactive material; and (b) Low Specific Activity (LSA) material and Surface Contaminated Objects (SCO), packaged or unpackaged, when transported under exclusive use controls domestically and when the material or object contains less than an A_2 quantity.
- Labels are required to be (a) printed or affixed to a surface other than the bottom of the package, (b) placed near the proper shipping name marking, (c) printed or affixed to a background of contrasting color or have a dotted or solid line outer border, (d) clearly visible, (e) not obscured by markings or other attachments, (f) representative of the hazardous material content, and (g) in conformance with the label specifications of § 172.407.
- The appropriate radioactive label must be affixed to opposite sides or two ends (other than the bottom) of all non-bulk packages of radioactive material.

Category of Radioactive Labels [3]

White-I

Yellow-II

Yellow-III

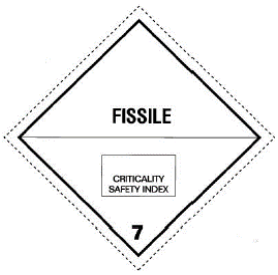
Maximum Radiation Surface Level (RSL)

mSv/h	**RSL** ≤ 0.005	0.005 < **RSL** ≤ 0.5	0.5 < **RSL** ≤ 2[5]
mrem/h	**RSL** ≤ 0.5	0.5 < **RSL** ≤ 50	50 < **RSL** ≤ 200[5]

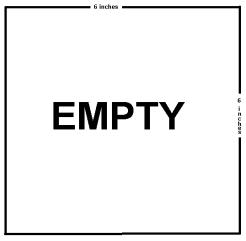
Transport Index (TI):[4]

TI = 0	0 < **TI** ≤ 1	1 < **TI** ≤ 10[5]

Other Radioactive Labels[2]



Fissile



Empty

Fissile labels required for each package containing fissile material, other than fissile-excepted material; and labels must be affixed adjacent to radioactive category labels.

Empty labels required for empty Class 7 (radioactive) packages satisfying § 173.428; and any previously-used labels must not be visible.

Contents on Labels

- Each radioactive category label must contain: (a) Except for LSA-I material, the names of the radionuclides in the package where, for mixtures of radionuclides, the names listed must be in accordance with the 95% rule specified in § 173.433(g); and, for LSA-I material, the term "LSA-I"; (b) maximum activity in appropriate SI units (e.g., Bq, TBq), or appropriate customary units (e.g., Ci, mCi) in parentheses following SI units; and (c) for Yellow-II or Yellow-III labels the Transport Index (TI). Abbreviations and symbols may be used. Except for Pu-239 and Pu-241, the weight in g or kg of fissile radionuclides may be inserted instead of activity units; for Pu-239 and Pu-241, the weight in g of fissile radionuclides may be inserted in addition to the activity units [see § 173.403 for fissile material definition].
- Each fissile label must contain the relevant Criticality Safety Index (CSI) [see § 172.403(e)].

[1] Additional labels may be required if the contents of a package contains material that also meets the definition of one or more other hazard class. See §§ 172.402 and 406(c) for details on additional labeling requirements. [See §§ 172.400a, 173.421 through 173.427for details when labels are not required, and see § 172.407 for details on label durability, design, size, color, form identification, exceptions, and the trefoil symbol size].

[2] A "Cargo Aircraft Only" label is required for each package containing a hazardous material which is authorized for cargo aircraft only[see § 172.402(c)].

[3] The category of the label must be the higher of the two values specified for RSL and TI [see § 172.403(b)].

[4] The TI is determined from the radiation level 1 meter from the package surface [see TI definition in § 173.403]. If the measured TI is notgreater than 0.05, the value may be considered to be zero. When an overpack is used, it must be labeled in accordance with § 72.403(h).

[5] Packages with a TI > 10 or an RSL > 2 mSv/h (200 mrem/h) must be transported under exclusive use provisions [see § 173.441(b)].Any package containing a Highway Route Controlled Quantity (HRCQ) must be labelled as RADIOACTIVE YELLOW-III.

7. Hazard Communications for Class 7 (Radioactive) Materials: Placarding (49 CFR 172, Subpart F)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.
NOTE: IAEA, IATA/ICAO, and IMO may require additional hazard communication information.

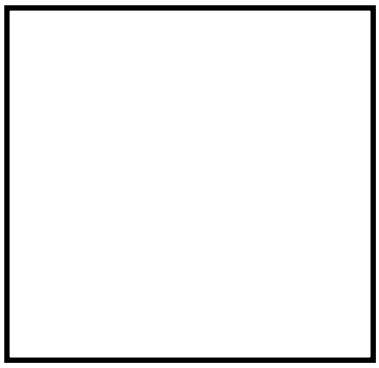
Conditions when Display of Placards is Required [§§ 172.504, 172.507(a), 172.508, and 172.512]

- Each bulk package, freight container, unit load device[1], transport vehicle, or rail car containing any quantity of hazardous material must be placarded on each side and each end with the placards specified in § 172.504(e).
- Radioactive placards are required for: shipments that contain a package labeled as Radioactive Yellow-III; unpackaged LSA-I or SCO-I when transported under exclusive use provisions; shipments required by §§ 173.427, 173.441, and 173.457 to be operated under exclusive use; and closed vehicles marked "For Radioactive Materials Use Only" transported under § 173.443(d).
- The Radioactive placard is placed on a square background on any motor vehicle used to transport a package containing a Highway Route Controlled Quantity (HRCQ) Class 7 (radioactive) material[2].

Visibility and Display of Radioactive Placards [§ 172.516]

- Placards are required to:
  - be clearly visible, on a motor vehicle and rail car, from the direction they face, except from the direction of another transport vehicle or rail car to which the motor vehicle or rail car is coupled[3]
  - be securely attached or affixed thereto or placed in a holder thereon
  - be located clear of appurtenances and devices such as ladders, pipes, doors, and tarpaulins
  - be located, so far as practical, so dirt or water is not directed to it from the transport vehicle wheels
  - be located at least 3 inches (76.0 mm) away from any marking (e.g. advertising) that could reduce its effectiveness
  - have "RADIOACTIVE" printed on it displayed horizontally, reading from left to right
  - be maintained by the carrier so format, legibility, color, and visibility of the placard will not be substantially reduced due to damage, deterioration, or obscurement by dirt or other matter
  - be affixed to a background of contrasting color, or have a dotted or solid line outer border which contrasts with the background color.

Radioactive Placards

PLACARD (FOR OTHER THAN HRCQ)	PLACARD FOR HRCQ
	
White triangular background color in the lower portion with yellow triangle in the upper portion; trefoil symbol, text, class number and inner and outer borders in black. [see § 172.556 and Appendix B of Part 172]	Square background must consist of a white square surrounded by one-inch black border. The placard inside the square is identical to that for other than HRCQ. [see § 172.527]

General Specifications for Placards and Subsidiary Hazard Placarding

- Placards must conform to the specifications in § 172.519.
- A CORROSIVE placard is also required for each transport vehicle that contains 454 kg (1001 pounds) or more gross weight of non-fissile, fissile-excepted, or fissile uranium hexafluoride [see § 172.505(b)].
- Placards are also required for subsidiary hazards of POISON INHALATION HAZARD, POISON GAS, or DANGEROUS WHEN WET [see § 172.505].

[1] See § 172.512 for exceptions and variations to the placarding requirements for freight containers and aircraft unit load devices.
[2] See § 173.403 for the definition of Highway Route Controlled Quantity (HRCQ). A package containing an HRCQ must be labeled with RADIOACTIVE Yellow-III labels [see §§ 172.403(c) and 172.507(a)].
[3] Required placarding of the front of a motor vehicle may be on the front of a truck-tractor instead of or in addition to the placarding on thefront of the cargo body to which a truck-tractor is attached § 172.516(b).

8. Requirements/Guidance for Registration, Emergency Response and Action for Class 7 (Radioactive) Materials: (49CFR 107, Subpart G; 49 CFR 171.15; 49 CFR 172, Subparts F and G)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.

Provisions for Persons Who Offer or Transport Class 7 (Radioactive) Materials (49 CFR 107, Subpart G)

- Any person, other than those excepted by § 107.606, who offers for transportation, or transports, in foreign, interstate or intrastate commerce any of the following Class 7 (radioactive) materials must satisfy registration and fee requirements of Part 107, Subpart G:
  - a highway route-controlled quantity of radioactive material;
  - a shipment in a bulk packaging with a capacity ≥ 13,248 L (3,500 gallons) for liquids or gases, or > 13.24 cubic meters (468 cubic feet) for solids; or
  - any quantity of radioactive material that requires placarding, under provisions of Part 172, Subpart F.
- Any person required to register must submit a complete and accurate registration statement on DOT Form F 5800.2 by June 30th for each registration year, or in time to have on file a current Certificate of Registration in accordance with § 107.620.
- Each registrant or designee must maintain for a period of 3 years from the date of issuance a copy of the registration statement and Certificate of Registration issued by PHMSA and must furnish its Certificate of Registration (or a copy thereof) and related records to an authorized representative or special agent of DOT upon request.
- Each motor carrier subject to registration requirements of this subpart must carry a copy of its current Certificate of Registration or another document bearing the registration number on board each truck and truck tractor, and the Certificate of Registration or document must be made available, upon request, to enforcement personnel.
- The amount of fees to be paid and procedures to be followed are found at §§ 107.612 and 107.616.

Provisions for Providing and Maintaining Emergency Response Information (49 CFR 172, Subpart G)

- When shipping papers for the transportation of radioactive materials are required [see Part 172, Subpart C], emergency response information shall
  - be provided and maintained during transportation and at facilities where materials are loaded for transportation, stored incidental to transportation, or otherwise handled during any phase of transportation;
  - be provided by persons who offer for transportation, accept for transportation, transfer or otherwise handle hazardous materials during transportation;
  - be immediately available for use at all times the hazardous material is present; and
  - include and make available the emergency response telephone number [see § 172.604] to any person, representing a Federal, State or local government agency, who responds to an incident involving the material or is conducting an investigation which involves the material.
- Emergency response information is information that can be used in mitigating an incident involving radioactive materials. It must contain at least the information specified in §§ 172.602 and 172.604; and includes an emergency response telephone number that is monitored at all times the material is in transportation by (a) knowledgeable person, or (b) a person who has immediate access to a knowledgeable person, or (c) an organization capable of accepting responsibility for providing the necessary detailed information concerning the material.
- Each carrier who transports or accepts for transportation radioactive material for which a shipping paper is required shall instruct, according to the requirements of § 172.606, the operator of a conveyance to contact the carrier in the event of an incident involving the material.

Actions to be Taken in the Event of Spillage, Breakage, or Suspected Contamination by Radioactive Material

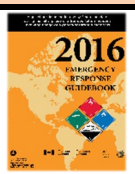
- If there is evidence of a leaking package or conveyance, access to the package or conveyance must be restricted, the area impacted and the extent of the contamination must be determined, and appropriate measures must be taken to minimize impact to persons and the environment [see § 173.443(e)].
- Except for a road vehicle used solely for transporting Class 7 (radioactive) material [see § 173.443(d)], each aircraft used routinely, and each motor vehicle used for transporting radioactive materials under exclusive use, must be (a) periodically checked for radioactive contamination, (b) taken out of service if contamination levels are above acceptable limits, and (c) remain out of service until the radiation dose rates at accessible surfaces are less than 0.005 mSv/h (0.5 mrem/h) and non-fixed radioactive surface contamination levels are below the limits in §§ 173.443(a), Table 9; and 173.443(c) for exclusive use vehicle provisions [see Chart 3].
- Following any breakage, spillage, release or suspected radioactive contamination incident, any rail or air carrier shall notify, as soon as possible, the offeror (i.e. the consignor); special provisions apply for buildings, areas, and equipment that might become contaminated during rail transport. Alternative provisions may apply for motor vehicles transporting radioactive materials under exclusive use [see §§ 174.750(a), 175.705(e), and 177.843(b)].

Provisions for Immediate Notification for Reportable Incidents Involving Radioactive Materials (§§ 171.15 and 171.16)

- Each person in physical possession of radioactive material must provide notice in the event of a reportable incident (see § 171.15(b)) as soon as practical, but no later than 12 hours after the occurrence of the reportable incident, to the National Response Center (NRC) by telephone at 800–424–8802 (toll free) or 202–267–2675 (toll call) or online at https://www.nrc.uscg.mil. Thereafter, notify the IEMA Operations Center by telephone at 217-782-7860.
- Each notice must include the information specified in § 171.15(a)(1) – (a)(7).
- A detailed incident report must also submitted as required by § 171.16.

Guidance on Responding to Emergencies (Emergency Response Guidebook)

- The DOT issues guidance to aid first responders in quickly identifying the hazards of the dangerous goods involved in an accident or incident, and for protecting themselves and the general public during the initial response to the accident or incident. For each proper shipping name or UN ID Number, the user is led to a specific guide that provides insight into potential hazards and steps to be taken for public safety and emergency response.
- The current edition of the Emergency Response Guidebook is available at https://phmsa.dot.gov/hazmat/outreach-training/erg.



9. Requirements for Training and Safety and Security Plans for Class 7 (Radioactive) Materials: (49 CFR 172, Subparts H and I, 49 CFR 173, and 32 Ill. Adm. Code Part 337)

These are basic reference charts; refer to current U.S. DOT and IEMA regulations for complete requirements.

Training (49 CFR 172, Subpart H)

- For any person who is employed by an employer or is self-employed, and who directly affects hazardous materials transportation safety, a systematic program shall be established to ensure that the person:
  - has familiarity with the general provisions of Part 172, Subpart H;
  - is able to recognize and identify radioactive materials;
  - has knowledge of specific requirements of Part 172 that are applicable to functions performed by the employee;
  - has knowledge of emergency response information, self-protection measures and accident prevention methods and procedures; and
  - does not perform any function related to the requirements of Part 172 unless instructed in the requirements that apply to that function.
- The person shall be trained pursuant to the requirements of § 172.704(a) and (b), may be trained by the employer or by other public or private sources, and shall be tested by appropriate means. The training must include the following:
  (a) general awareness training providing familiarity with applicable regulatory requirements;
  (b) function-specific training applicable to functions the employee performs;
  (c) safety training concerning emergency response information, measures to protect the employee from hazards, and methods and procedures for avoiding accidents;
  (d) security awareness training providing awareness of security risks and methods designed to enhance transportation security; and
  (e) in-depth security training if a security plan is required for the shipment(s) involved.
- Initial and recurrent training shall comply with the requirements of § 172.704(c).
- Records of training shall be created and retained in compliance with the requirements of § 172.704(d).

Security (49 CFR 172, Subpart I, 49 CFR 173, and 32 Ill. Adm. Code Part 337)

- A security plan for hazardous materials that conforms to the requirements of Part 172, Subpart I must be developed and adhered to by each person who offers for transportation in commerce or transports in commerce in a motor vehicle, rail car, or freight container any of the following radioactive materials:
  (a) IAEA Code of Conduct Category 1 and 2 materials (see §§ 172.800(b)(15) and 32 Ill. Adm. Code Part 337);
  (b) a highway route controlled quantity (HRCQ) of radioactive material as defined in § 173.403 [see § 172.800(b)(15)];
  (c) known radionuclides in forms listed as radioactive material quantities of concern (RAM–QC) by IEMA [see §§ 172.800(b)(15)and 32 Ill. Adm. Code Part 337]; or
  (d) a quantity of uranium hexafluoride requiring placarding under § 172.505(b) [see § 172.800(b)(14)].
- The security plan must include an assessment of possible transportation security risks and appropriate measures to address the assessed risks.
- Specific measures put into place by the plan may vary commensurate with the level of threat at a particular time.
- At a minimum, a security plan must address personnel security, unauthorized access, and enroute security.
- The security plan must be
  (a) in writing;
  (b) retained for as long as it remains in effect;
  (c) available as copies or portions thereof to the employees who are responsible for implementing it, consistent with personnel security clearance or background investigation restrictions and a demonstrated need to know;
  (d) revised and updated as necessary to reflect changing circumstances; and
  (e) maintained (all copies) as of the date of the most recent revision, when it is updated or revised.
- Security plans that conform to regulations, standards, protocols, or guidelines issued by other Federal agencies, international organizations, or industry organizations may be used to satisfy the requirements in Part 172, provided such security plans address the requirements specified in Part 172, Subpart I.
- Additional security planning requirements may apply for rail transport of a highway route-controlled quantity of radioactive material[see §§ 172.820 and 173.403].

Exhibit A

RELEASE AND AUTHORIZATION
FULL DUE DILIGENCE INVESTIGATION

I authorize and grant my consent to any authorized representative of IEMA to conduct a background investigation to obtain any information related to my activities from individuals, schools, residential management agents, previous employers, criminal justice agencies, or other sources of information. This information may include, but is not limited to, my academic, residential, achievement, or performance information and information about my attendance, disciplinary, employment, and criminal history records. I understand that the purpose of the background investigation is so IEMA has a basis of confidence to approve me as an agent authorized to speak and act on behalf, or to be an authorized user on a radioactive material license.

I understand that, for previous employers and other sources of information, separate specific releases may be needed and that I may be contacted for such releases at a later date. I authorize custodians of records and other sources of information pertaining to me to release such information upon request of the investigator or other duly authorized representative of IEMA regardless of any previous agreement to the contrary.

I understand that photocopies of this authorization and consent document with my signature are valid and that this authorization will remain in effect as long as I am authorized to speak and/or act on behalf of the radioactive material licensee.

Applications for a radioactive materials license and other documents submitted to the Agency pursuant to 32 Ill. Adm. Code 330 are subject to disclosure under the Illinois Freedom of Information Act. However, the Agency takes the protection of personal information seriously and will only release such information in accordance with Illinois law or only as needed for official State of Illinois business. Any information obtained by the Agency during the background investigation will either be redacted or destroyed to prevent unauthorized use.

_____ _____
Applicant Full Legal Name (Printed) Other Names Used (Printed)

_____
Street and Physical Address

_____
City, State and Zip Code

_____ _____
Contact Email Contact Phone

_____ _____
Social Security Number Date of Birth

I certify that all information provided on this questionnaire is correct. I understand that any misstatement, misrepresentation, or omission may be cause for disapproval by the Illinois Emergency Management Agency – Division of Nuclear Safety.

_____ _____
Applicant Signature Date

EXHIBIT B

INSTRUMENTATION FORM

NOTE: A licensee reserves the right to upgrade survey instruments as necessary, as long as they are adequate to measure the type and level of radiation for which they are used.

1. Portable Radiation Monitoring Instruments
   (Typically, 1 μSv/hr to 500 μSv/hr [0.1 mrem/hr to 50 mrem/hr])

   Manufacturer: _____

   Model: _____

   # Available: _____

   Range: _____

   Units: _____

   Detector Type (G-M, Ion Chamber, etc.): _____

   Window Thickness (mg/cm^2), if applicable: _____

2. Instrument Used for Analysis of Leakage and/or Contamination Samples
   (Submit calculations as described in Appendix G.)

   Generic Description: _____

   Manufacturer: _____

   Model: _____

   Minimum Detectable Activity*: _____

3. Other Instruments
   (Continue on separate sheet if necessary.)

   Generic Description: _____

   Manufacturer: _____

   Model: _____

   Range: _____

   Nationally Recognized Std. or Manuf. Instructions for Calibration (attached) ____

EXHIBIT C

State of Illinois
Illinois Emergency Management Agency

Division of Nuclear Safety
1035 Outer Park Drive
Springfield, IL 62704

IEMA is requesting disclosure of information that is necessary to accomplish the statutory purpose as outlined under 420 ILCS 40/1-40/44. Disclosure of this information is required. Failure to provide any information will result in delay of termination of license.

CERTIFICATE
TERMINATION AND DISPOSITION OF RADIOACTIVE MATERIAL

LICENSEE:	LICENSE NUMBER:
ADDRESS:	
	TELEPHONE NUMBER:

The following information is provided in accordance with 32 Ill. Adm. Code 330.325, "Termination Requirements for Specific Licenses and Locations of Use."
This regulation appears on the back of this form. Check all that apply below.

☐ 1. All use of radioactive material authorized under the above referenced license has been terminated.

☐ 2. Radioactive contamination has been removed to the level outlined in 32 Ill. Adm. Code 340.Appendix A, to the extent practicable.

☐ 3. All radioactive material previously procured and/or possessed under the authorization granted by the above referenced license has been disposed of as follows:

- ☐ Transferred to (Name and Address): _____
  who is authorized to possess such material under License Number _____
  issued by (Licensing Agency): _____
- ☐ Decayed, surveyed and disposed of as non-radioactive waste.
- ☐ Licensed under License Number: _____
  issued by (Licensing Agency): _____
- ☐ No radioactive material has ever been procured and/or possessed by the licensee under the authorization granted by the above referenced license.
- ☐ Other (Attach additional pages).

☐ 4. Attached are radiation surveys or the equivalent as specified in 32 Ill. Adm. Code 330.325(b)(1)(F).

☐ 5. Records required to be maintained for the license requested to be terminated are available at the following location:

Name: _____
Address: _____

Telephone No.: _____ Contact Person: _____

☐ 6. Additional remarks. (Attach additional pages.)

THE UNDERSIGNED, ON BEHALF OF THE LICENSEE, HEREBY CERTIFIES THAT LICENSABLE QUANTITIES OF RADIOACTIVE MATERIAL UNDER THE JURISDICTION OF THE ILLINOIS EMERGENCY MANAGEMENT AGENCY ARE NOT POSSESSED BY THE LICENSEE. IT IS THEREFORE REQUESTED THAT THE ABOVE REFERENCED LICENSE BE TERMINATED.

SIGNATURE: _____ DATE: _____

NAME: _____ TITLE: _____
(print or type)

Section 330.325 Termination Requirements for Specific Licenses and Locations of Use

a) To lawfully obtain termination of a specific license or a location of use, each licensee shall meet the requirements of this Section no later than the end of the expiration date on the specific license or on any applicable amendment to the specific license unless the licensee has filed an application for renewal in accordance with Section 330.320(a) of this Part prior to the expiration date.

AGENCY NOTE: If the licensee has filed a renewal application in accordance with Section 330.320(a) of this Part and the Agency subsequently denies the application, the Agency shall, in an order issued to the licensee in accordance with the Act, the Illinois Administrative Procedure Act [5 ILCS 100] and 32 Ill. Adm. Code 200, specify the time by which the licensee must meet the requirements of this Section.

b) Requirements for Obtaining Termination of a Specific License, Removal of a Site or Location of Use from a Specific License

1) The licensee shall:

A) Cease use of radioactive material;

B) Remove radioactive contamination to levels considered acceptable for unrestricted use. A site will be considered acceptable for unrestricted use when:

i) Radioactive contamination is removed to levels outlined in 32 Ill. Adm. Code 340.Appendix A; or

ii) The residual radioactivity, excluding radon, thoron and their progeny, that is distinguishable from background radiation does not result in a total effective dose equivalent (TDE) to an average member of the critical group that exceeds 25 mrem (0.25 mSv) per year, including that from groundwater sources of drinking water, and the residual radioactivity has been reduced to levels that are as low as reasonably achievable (ALARA). Determination of the levels that are ALARA must take into account consideration of any detriments, such as deaths from transportation accidents, expected to potentially result from decontamination and waste disposal;

C) Properly transfer and/or dispose of radioactive material;

D) Submit a completed Agency Form KLM.007 (Certificate Termination and Disposition of Radioactive Material) or provide equivalent information;

E) For licensees authorized to possess sealed sources, submit evidence of transfer and/or disposal of all sealed sources authorized on the license and a copy of the most recent leak test; and

F) For licensees authorized to possess radioactive material in forms other than sealed sources, submit a radiation survey report to confirm the absence of radioactive materials or to establish the levels of residual radioactive contamination, unless the licensee demonstrates the absence of residual radioactive contamination in some other manner. The radiation survey report shall specify the date of the survey and the instrumentation used and shall certify that each instrument was properly calibrated and tested. The licensee shall, as applicable, report levels or quantities of:

i) Beta and gamma radiation at 1 centimeter from surfaces in units, multiples, or subunits of Sieverts or rem per hour;

ii) Gamma radiation at 1 meter from surfaces in units, multiples, or subunits of Sieverts or rem per hour;

iii) Removable radioactivity on surfaces in units, multiples, or subunits of Becquerels or Curies per 100 square centimeters of surface area, or in disintegrations (transformations) per minute per 100 square centimeters of surface area;

iv) Fixed radioactivity on surfaces in units, multiples, or subunits of Becquerels or Curies per 100 square centimeters of surface areas or in disintegrations (transformations) per minute per 100 square centimeters of surface area;

v) Radioactivity in contaminated liquids, such as water, oils or solvents, in units, multiples, or subunits of Becquerels or Curies per milliliter of volume; and

vi) Radioactivity in contaminated solids, such as soils or concrete, in units, multiples, or subunits of Becquerels or Curies per gram of solid.

2) If no residual radioactive contamination attributable to activities conducted under the license is detected, the licensee shall submit a certification that no detectable radioactive contamination was found.

3) If detectable levels or residual radioactive contamination attributable to activities conducted under the license are found, the licensee shall:

A) In addition to the information submitted under subsections (b)(1)(D) and (b)(1)(F) of this Section, submit for Agency approval a plan for reclaiming the facility, including decontamination and removal of residual radioactive contamination;

B) Limit actions involving radioactive material to those approved under the decontamination plan in subsection (b)(3)(A) of this Section;

C) Continue to control entry to restricted areas until they are suitable for release for unrestricted use; and

D) Implement and complete the plan approved under subsection (b)(3)(A) of this Section.

c) When a licensee ends activities authorized under a specific license and has met the termination requirements of subsection (b) of this Section, the licensee shall immediately notify the Agency in writing and request that the license be terminated. This notification and request for termination shall include the documents required by subsection (b) of this Section and shall otherwise substantiate that the licensee has met all of the requirements in subsection (b) of this Section.

d) After receiving a request for license termination pursuant to subsection (c) of this Section, the Agency shall confirm, through such inspections and record reviews as may be necessary, that the licensee has met the requirements of subsection (b) of this Section. Upon confirmation, the Agency shall issue an amendment to terminate the licensee. Until issued the termination amendment, the licensee shall maintain a valid specific license in accordance with Section 330.320 of this Part.

e) A licensee who fails to comply with the pertinent requirements of this Section shall be subject to such civil penalties and sanctions as may be appropriate in accordance with the Act and 32 Ill. Adm. Code 310. The passing of the expiration date shall not relieve the licensee of the duties and responsibilities of applying for and maintaining a valid specific license in accordance with Section 330.320 of this Part, decommissioning, reclaiming, and meeting the license termination requirements of this Section. Immediately upon the passing of the expiration date, a licensee that fails to comply with subsection (a) of this Section shall comply with the requirements of Section 330.320(c) of this Part.

(Source: Added at 30 Ill. Reg. 8928, effective April 28, 2006)