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STATE OF OHIO  
DEPARTMENT OF HEALTH

**GUIDANCE ABOUT X-RAY FLUORESCENCE DEVICE LICENSES**

**NMS-LIC-01A**

**Rev. 1**

**Effective Date: May 9, 2008**

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This consolidated guidance is based on the Nuclear Regulatory Commission's NUREG 1556 Volume 1, and along with the State of Ohio Radioactive Materials Licensing Program provides the applicants and reviewers with information concerning how to file a license request, a listing of the applicable rules and industry standards, policies affecting evaluation and registration, certain administrative procedures to be followed, information on how to perform the review and write a license and the responsibilities of the licensee.

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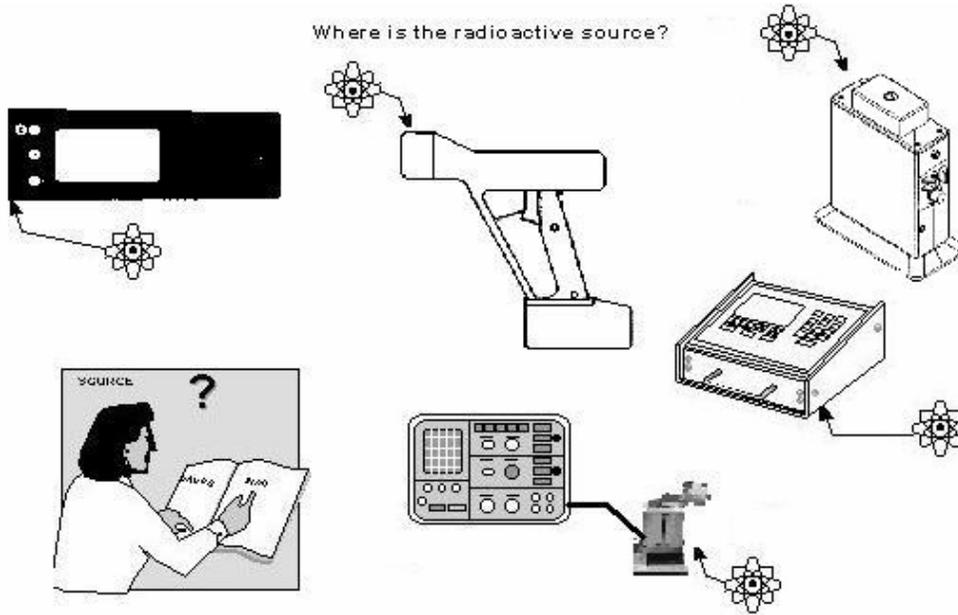
## ABBREVIATIONS

ALARA	As Low As Reasonably Achievable
Bq	Becquerel
BRP	Bureau of Radiation Protection
CRCPD	Conference of Radiation Control Program Directors, Inc.
DOE	United States Department of Energy
DOT	United States Department of Transportation
mrem	Millirem
mSv	Millisievert
NARM	Naturally Occurring or Accelerator-produced Radioactive Material
NIST	National Institute of Standards and Technology
NRC	United States Nuclear Regulatory Commission
NVLAP	National Voluntary Laboratory Accreditation Program
OAC	Ohio Administrative Code
OCR	Optical Character Reader
ODH	Ohio Department of Health
OSD	Optically Stimulated Dosimeter
RQ	Reportable Quantities
RSO	Radiation Safety Officer
SS&D BBS	Sealed Source and Devices Bulletin Board System
SSD	Sealed Source and Device
Sv	Sievert
TEDE	Total Effective Dose Equivalent
TI	Transportation Index
TLD	Thermoluminescent Dosimeters

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# 1. PURPOSE OF REPORT

This report provides guidance to an applicant in preparing an X-ray Fluorescence license application, as well as Ohio Department of Health (ODH) criteria for evaluating an X-ray Fluorescence license application. It is not intended to address any other types of portable or fixed gauging devices. Such devices are addressed in NMS-LIC-01 or the research and development of gauging devices or the commercial aspects of manufacturing, distribution and service of such devices. Within this document, the phrases, "X-ray fluorescence device" or "XRF," may be used interchangeably.



**Figure 1.1 Where is the Radioactive Source?** *The wide variety of X-ray fluorescence device designs includes placing the sealed source within different parts of the device, resulting in different radiation safety problems.*

Due to the relatively lower hazard presented by the typically small quantities in XRF devices, this report was developed to provide a more streamlined approach to the licensing application process and radiation safety programs than that provided in NMS-LIC-01. This report addresses the variety of radiation safety issues associated with XRF devices of many designs. As shown in Figure 1.1, XRF devices are of many different designs based, in part, on their intended use (e.g., to measure metallic alloy content, lead in painted surfaces). Because of differences in design, manufacturers provide appropriate instructions and recommendations for proper operation and maintenance. In addition, with varying designs, the sealed sources may be oriented in different locations within the devices, resulting in different radiation safety problems.

This report identifies the information needed to complete the ODH "Application for Radioactive Material License," for the use of sealed sources in X-ray fluorescence devices and provides some alternate recommendations for documentation of the requested information for certain specified uses.

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

- Rules - references the rules applicable to the item.
- Criteria - outlines the criteria used to judge the adequacy of the applicant's response.
- Discussion - provides additional information on the topic sufficient to meet the needs of most readers.
- Response from Applicant - provides suggested response(s), offers the option of an alternative reply or indicates no response is needed on that topic during the licensing process.

Notes and References are self-explanatory and may not be found for each item on the application form.

Appendix A contains a sample application. As the application form is subject to change, applicants should obtain a blank application form from the Bureau of Radiation Protection (BRP). Appendix B is a checklist that applicants may use to present the program information requested in items 5 through 11 of the application. BRP staff may use this checklist to review applications or the checklist in NMS-LIC-01. Appendixes C through G contain additional information on various radiation safety topics. Appendix H contains a sample XRF license.

## 2. AGREEMENT STATES

Certain states have entered into agreements with the Nuclear Regulatory Commission (NRC) that give them the authority to license and inspect byproduct, source or special nuclear materials used or possessed within their borders. A current list of Agreement States (including names, addresses and telephone numbers of responsible officials) may be obtained upon request from the NRC's regional or field offices. Any applicant other than a federal agency who wishes to possess or use licensed material in one of these Agreement States needs to contact the responsible officials in that state for guidance on preparing an application; file these applications with state officials, not with the NRC.

In general, materials licensees who wish to conduct operations at temporary job sites in an Agreement State should contact that state's radiation control program office for information about state regulations. To ensure compliance with Agreement State reciprocity requirements, a licensee should request authorization well in advance of scheduled use.

Table 2.1 provides a quick way to check on which agency, if any, has regulatory authority.

**Table 2.1, Who Regulates the Activity?**

APPLICANT AND PROPOSED LOCATION OF WORK	REGULATORY AGENCY
Federal agency regardless of location (except that Department of Energy [DOE] and, under most circumstances, its prime contractors are exempt from licensing [rule 3701:1-40-06 of the Ohio Administrative Code (OAC)])	NRC
Non-federal entity in non-Agreement State, US territory or possession	NRC
Non-federal entity in Agreement State at non-federally controlled site	Agreement State
Non-federal entity in Agreement State at federally controlled site NOT subject to exclusive federal jurisdiction	Agreement State
Non-federal entity in Agreement State at federally controlled site subject to exclusive federal jurisdiction	NRC

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### 3. MANAGEMENT RESPONSIBILITY

The BRP recognizes effective radiation safety program management is vital to achieving safe and compliant operations. The BRP also believes consistent compliance with its regulations provides reasonable assurance licensed activities will be conducted safely. Ineffective management is frequently the underlying cause of safety and compliance problems. The term "management" refers to a senior-level manager who has responsibility for overseeing licensed activities.

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

- Radiation safety, security and control of radioactive materials and compliance with regulations.
- Completeness and accuracy of the radiation safety records and all information provided to BRP (Rule 3701:1-40-05 OAC).
- Knowledge about the contents of the license and application.
- Committing adequate resources (including space, equipment, personnel, time and, if needed, contractors) to the radiation protection program to ensure public and worker safety is protected from radiation hazards and compliance with regulations is maintained.
- Selecting and assigning a qualified individual to serve as the radiation safety officer (RSO) for their licensed activities.

For information on inspection, investigation, enforcement and other compliance issues, contact the Bureau of Radiation Protection at (614) 644-2727, or visit the ODH Web site at <http://www.odh.ohio.gov>.

As guidance documents are finalized, they will be added to the Web site.

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## 4. HOW TO FILE

Applicants for a materials license should do the following:

- Be sure to use the most recent guidance in preparing an application.
- Complete the application form (Appendix A) Items 1 to 4 and Items 12 to 15 on the form itself.
- Complete the application form Items 5 through 11 on supplementary pages or use Appendix B.
- For each separate sheet, other than Appendix A, that is submitted with the application, identify and key it to the item number on the application or the topic to which it refers.
- Submit all documents, typed, on 8-1/2 – x - 11 inch paper.
- Avoid submitting proprietary information unless it is absolutely necessary. If necessary, mark all such pages prominently with the words, "Trade Secret," along with a cover sheet for those pages also so marked. Do not include personal information such as individuals' Social Security numbers, birth dates, radiation dose<sup>1</sup> information, etc., unless specifically requested.
- Submit an original, signed application and one copy.
- Retain one copy of the license application for future reference.

All license applications will be available for review by the general public by contacting the BRP.

Deviations from the suggested wording of responses as shown in this guide or submission of alternative procedures may require a custom review. To ensure a smooth process, applicants are requested to follow these suggestions for attachments:

- Submit typewritten text on smooth, crisp paper that will feed easily into a copier. Any handwritten text must be in block print.
- Choose typeface designs that are sans serif such as Arial, Helvetica, Futura, Univers; the text of this document is in a sans serif font called Verdana.
- Choose 10-point or larger font size.
- Avoid stylized characters such as script, italic, etc.
- Be sure the print is clear and sharp.

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<sup>1</sup> In this document, dose or radiation dose is used as defined in rule 3701:1-38-01 OAC, i.e., a generic term that means absorbed dose, dose equivalent, effective dose equivalent, committed dose equivalent, committed effective dose equivalent or total effective dose equivalent. These latter terms are also defined therein.

- Be sure there is high contrast between the ink and paper (black ink on white paper is best).

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## **5. WHERE TO FILE**

Applicants wishing to possess or use licensed material subject to ODH jurisdiction must file an application with the ODH at:

Ohio Department of Health  
Bureau of Radiation Protection  
246 North High Street  
Columbus, Ohio 43215

In general, applicants wishing to possess or use licensed material in Ohio must file an application with the ODH, not the NRC. However, if work will be conducted at federally controlled sites in Ohio, applicants must first determine the jurisdictional status of the land in order to determine whether the NRC or the Agreement State has regulatory authority. See the section on "Agreement States" for additional information.

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## **6. LICENSE FEES**

The ODH will invoice licensees the appropriate fees for new licenses and license amendments. Once technical review has begun, fees will generally not be refunded; application fees will be charged regardless of disposition of an application or the withdrawal of an application.

Most licensees are also subject to annual fees; refer to rule 3701:1-38-02 OAC for these fees, and for additional information on exemptions from annual fees and reduced annual fees for licensees that qualify as "small entities."

Direct all questions about fees or completion of Item 14 of the application form (Appendix A) to the Ohio Department of Health, Bureau of Radiation Protection, 246 North High Street, Columbus, Ohio 43215. You may also call (614) 644-2727.

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## 7. CONTENTS OF AN APPLICATION

The following comments apply to the indicated items on the application form (Appendix A).

**Note:** Given the relative simplicity of operation of typical hand-held XRF devices, the BRP may accept as a complete submission the completed form available from the ODH Web site, available at <http://www.odh.ohio.gov/pdf/forms/hea5133.pdf>, and a completed checklist from Appendix B, XRF Program Summary.

### 7.1 ITEM 1: Type of Application

This is an application for: (Check appropriate item)

\_\_\_\_\_ Initial (new) License

\_\_\_\_\_ Amendment to License No.: \_\_\_\_\_

\_\_\_\_\_ Renewal of License No.: \_\_\_\_\_

### 7.2 ITEM 2: Name and Mailing Address of Applicant

List the legal name of the applicant's corporation or other legal entity with direct control over use of the radioactive material; a division or department within a legal entity may not be a licensee. An individual may be designated as the applicant only if the individual is acting in a private capacity or a sole proprietorship and the use of the radioactive material is not connected with employment in a corporation or other legal entity. Provide the mailing address where correspondence should be sent.

**Note:** The ODH must be notified in the event of change of ownership or control and bankruptcy proceedings; see below for more details.

#### Timely Notification of Change of Ownership or Control:

**Rules:** Paragraph (A) of Rule 3701:1-40-16 OAC.

**Criteria:** Licensees must provide full information and obtain written concurrence from the ODH when transferring ownership or control of the license. A corporate ownership change is a major amendment.

**Discussion:** Changes in ownership may be the results of mergers, buyouts or majority stock transfers. Although it is not the ODH's intent to interfere with the business decisions of licensees, it is necessary for licensees to notify the ODH promptly. This is to ensure the following:

- Radioactive materials are possessed, used or controlled only by persons who have a valid Ohio license unless it is on federal jurisdiction specifically designated to the NRC or DOE.
- Materials are properly handled and secured.
- Persons using these materials are competent and committed to implementing appropriate radiological controls.
- A clear chain of custody is established to identify who is responsible for final disposal of the radioactive material.
- Public health and safety are not compromised by the use of such materials.

**Response from Applicant:**

None from an applicant for a new license; Appendix C identifies the information to be provided about changes of ownership or control.

**Notification of Bankruptcy Proceedings**

**Rules:** Paragraph (F) of Rule 3701:1-40-16 OAC.

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

**Response from applicant:**

None at time of application for a new license.

**7.3 ITEM 3: ADDRESS(ES) WHERE LICENSED MATERIAL WILL BE USED OR POSSESSED**

Most applicants need to provide two types of information in response to Item 3:

Description of storage, use and dispatch locations.

Specification of whether they intend to use the radioactive material at temporary job sites.

Specify the street address, city and state or other descriptive address (such as on Highway 10, five miles east of the intersection of Highway 10 and State Route 234, Anytown, State) for each permanent facility used as a location of storage or use and each facility from which the applicant will dispatch XRF device users to job sites for more than one customer. If XRF devices will NOT be stored at a dispatch site, so indicate. The descriptive address should be sufficient to allow an inspector to find the storage location. A post office box address is not acceptable.

Being granted a radioactive materials license does not relieve a licensee from complying with other applicable federal, state or local regulations (e.g., local zoning requirements for storage locations).

To conduct operations at temporary job sites (i.e., locations where work is conducted for limited periods of time and from which XRF device users are NOT dispatched to job sites for other customers), specify "temporary job sites throughout Ohio."

**Note:** As discussed later under "Financial Assurance and Record Keeping for Decommissioning," licensees need to maintain permanent records on where licensed material was used or stored while the license was in force. This is important for making future determinations about the release of these locations for unrestricted use (e.g., before the license is terminated). Acceptable records are sketches or written descriptions of storage or use locations specifically listed on the license. Licensees do not need to maintain this information for temporary job sites where sealed sources have never leaked.

#### **7.4 ITEM 4: PERSON TO BE CONTACTED ABOUT THIS APPLICATION**

Identify the individual who can answer questions about the application and include their telephone number. This is typically the proposed radiation safety officer, unless the applicant has named a different person as the contact. The BRP will contact this individual if there are questions about the application.

Notify the BRP if the contact person or their telephone number changes so BRP can contact the applicant or licensee in the future with questions, concerns or information. This notice is for information only and does not require a license amendment or a fee.

Items 5 through 11 may be submitted on separate sheets of paper if necessary. Applicants may use Appendix B for this purpose and should note that deviations from the suggested responses and submission of alternative procedures may require custom review.

#### **7.5 ITEM 5: RADIOACTIVE MATERIAL - SEALED SOURCES AND DEVICES**

**Rules:** Paragraph (E) of rule 3701:1-40-14 OAC.  
Paragraph (A)(2) of rule 3701:1-40-15 OAC.  
Rule 3701:1-46-49 OAC.

**Criteria:** Licensees will be authorized only for sealed sources and devices registered by the NRC or an Agreement State designated for product review.

**Discussion:** The NRC or an Agreement State performs a safety evaluation of sealed sources before authorizing a manufacturer to distribute the sources to specific licensees. The safety evaluation is documented in a Sealed Source and Device (SSD) Registration Certificate, also called an SSD Registration Sheet. When issuing an X-ray Fluorescence license, the BRP usually provides a generic authorization to allow the licensee to

possess and use any sealed source/device combination that has been registered by the NRC or an Agreement State. This method of authorization allows licensees flexibility in obtaining new source/device combinations without having to amend their licenses.

Consult with the proposed supplier to ensure sources and devices conform to the sealed source and device designations registered with the NRC or an Agreement State. Licensees may not make any changes to the sealed source, device or source/device combination that would alter the description or specifications from those indicated in the respective registration certificates.

**Response from applicant:**

- Identify each radionuclide (e.g., Cadmium-109, Iron-55, Cobalt-57) that will be used in each source in the device(s).
- Confirm each sealed source, device and source/device combination is registered as an approved sealed source or device by the NRC or an Agreement State.
- Confirm the activity per source will not exceed the maximum activity listed on the approved certificate of registration issued by NRC or by an Agreement State.

**Note:** Information on SSD registration certificates is available electronically on the Internet at: <http://www.hsrp.ornl.gov/nrc/ssdrform.htm>.

## **7.6 ITEM 5: RADIOACTIVE MATERIAL - FINANCIAL ASSURANCE AND RECORD KEEPING FOR DECOMMISSIONING**

**Rules:** Paragraph (A) of rule 3701:1-40-16 OAC.  
Rule 3701:1-40-17 OAC.

**Criteria:** X-ray fluorescence licensees possessing sealed sources containing long-lived radioactive material (half-life greater than 120 days) in excess of the limits specified in rule 3701:1-40-17 OAC must provide evidence of financial assurance for decommissioning.

Licensees are required to maintain, in an identified location, decommissioning records related to structures and equipment where radioactive materials are used or stored and history of leaking sources.

Licensees must transfer these records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with paragraph (A) of rule 3701:1-40-16 OAC or to the BRP before the license is terminated.

**Discussion:** The requirements for financial assurance are specific to the types and quantities of radioactive material authorized on a license. Most applicants and licensees do not need to comply with the financial assurance requirements because the thresholds for sealed sources are,

for example, about 3,700 terabecquerels (100,000 curies) Cesium-137 and 3.7 terabecquerels (100 curies) of Americium-241. Thus, a licensee would need to possess hundreds of XRF devices typically containing 296 megabecquerels (8 millicuries) of Cesium-137 or 740 megabecquerels (20 millicuries) of Cadmium-109 before the financial assurance requirements would apply. Because the standard license does not always specify the maximum amount the licensee may possess (allowing the licensee flexibility in obtaining sources as needed without amending its license), it contains a condition requiring the licensee to limit its possession of radioactive materials to quantities not requiring financial assurance for decommissioning. Applicants and licensees desiring to possess radioactive materials exceeding the threshold amounts must submit evidence of financial assurance.

The same regulation also requires licensees to maintain records important to decommissioning in an identified location. All licensees need to maintain records of structures and equipment where radioactive materials are used or stored at locations specifically listed on the license. As-built drawings with modifications of structures and equipment shown as appropriate fulfill this requirement. If drawings are not available, licensees may substitute appropriate records concerning the areas and locations. In addition, if licensees have experienced unusual occurrences (e.g., leaking sources, other incidents that involve spread of contamination), they also need to maintain records about contamination that remains after cleanup or that may have spread to inaccessible areas.

For XRF device licensees whose sources have never leaked, acceptable records important to decommissioning are sketches or written descriptions of XRF device storage or use locations specifically listed on the license. Similar information need not be maintained for temporary job sites.

**Response from applicants:**

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

Licensees must transfer records important to decommissioning either to the new licensee before licensed activities are transferred or assigned in accordance with paragraph (A) of rule 3701:1-40-16 OAC or to the BRP before the license is terminated.

**7.7 ITEM 6: PURPOSE(S) FOR WHICH LICENSED MATERIAL WILL BE USED**

**Rules:** Paragraph (A)(1) of rule 3701:1-40-15 OAC.

**Criteria:** Devices will be used only for the purposes for which they were designed and according to the manufacturer's recommendations for use as specified in an approved SSD Registration Sheet.

**Response from applicant:**

If the gauging device(s) will be used for the purposes listed on the SSD Registration Sheet, state the following:

"XRF devices will be used for the purposes described in their respective SSD Registration Sheets."

If the gauging device(s) will be used for purposes other than those listed on the SSD Registration Sheet, specify these other purposes.

**Note:** The typical X-ray Fluorescence license authorizes use of devices "to measure physical properties of materials."

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

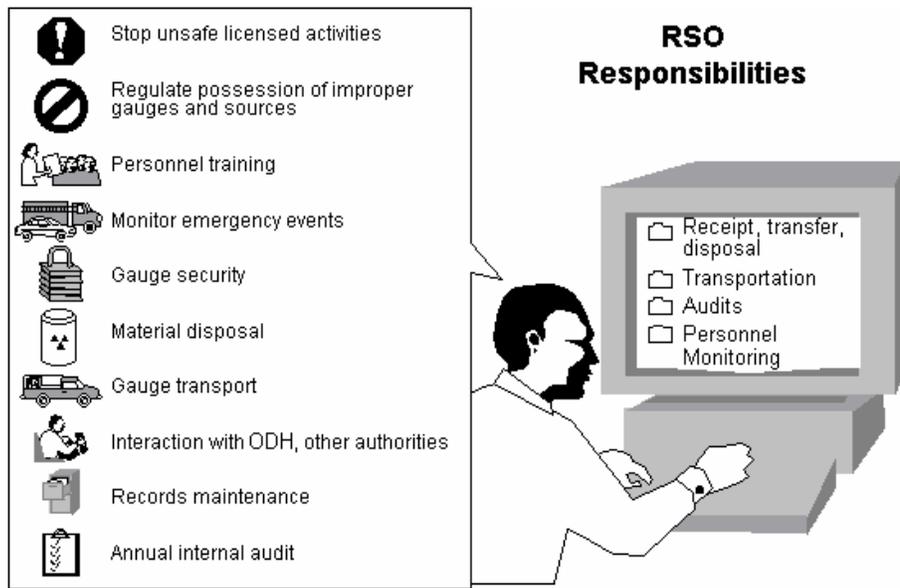
**7.8 ITEM 7: INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING EXPERIENCE - RADIATION SAFETY OFFICER (RSO)**

**Rules:** Paragraph (A)(1) of rule 3701:1-40-15 OAC.

**Criteria:** RSOs must have adequate training and experience. In the past, the BRP has found successful completion of one of the following as evidence of adequate training and experience:

- Participation in an X-ray fluorescence device manufacturer's course for users or for RSOs.
- Equivalent course that meets the criteria selected by the manufacturer.
- Prior NRC or Agreement State licensure.

**Discussion:** The person responsible for the radiation protection program is called the RSO. The RSO needs independent authority to stop operations that he or she considers unsafe. He or she must have sufficient time and commitment from management to fulfill certain duties and responsibilities to ensure radioactive materials are used in a safe manner. Typical RSO duties are illustrated in Figure 7.1 and described in Appendix E. The BRP requires the name of the RSO on the license to ensure licensee management has always identified a responsible, qualified person and that the named individual knows of his or her designation as RSO.



**Figure 7.1 RSO Responsibilities.** *Typical duties and responsibilities of RSOs.*

**Response from Applicant:**

Provide either of the following:

- Name of the proposed RSO.

AND EITHER:

- Statement that: "Before obtaining licensed materials, the proposed RSO will have successfully completed one of the training courses described in Criteria in the section titled "Individual(s) Responsible for Radiation Safety Program and Their Training and Experience - Radiation Safety Officer" in NMS-LIC-01A, "X-Ray Fluorescence licenses."
- Statement that: "Before being named as the RSO, future RSOs will have successfully completed one of the training courses described in Criteria in the section titled "Individual(s) Responsible for Radiation Safety Program and Their Training and Experience - Radiation Safety Officer" in NMS-LIC-01A, X-Ray Fluorescence licenses.

OR

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

**Note:**

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

## 7.9 ITEM 8: TRAINING FOR INDIVIDUALS WORKING IN OR FREQUENTING RESTRICTED AREAS

**Rules:** Rule 3701:1-38-10 OAC.  
Rule 3701:1-40-05 OAC.  
Rule 3701:1-40-15 OAC.  
Chapter 3701:1-38 OAC.

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

- X-ray fluorescence device manufacturer's course for users.
- Equivalent course that meets the following criteria:
- 1.5 to 2 hours of radiation safety and regulatory requirements emphasizing practical subjects important to safe use of the XRF device: radiation vs. contamination; internal vs. external exposure; ALARA concept; use of time, distance and shielding to minimize exposure; control and surveillance of XRF devices; location of sealed source within the device; inventory; record keeping; incidents; licensing and inspection by regulatory agency; need for complete and accurate information; employee protection; deliberate misconduct.
- 1.5 to 2 hours of practical explanation of XRF device theory and operation; operating, emergency, maintenance and transportation procedures, and field training emphasizing radiation safety and including test runs of: setting up and making measurements; controlling and maintaining surveillance over the device; performing routine cleaning and lubrication; packaging and transporting the device; storage; and following emergency procedures.
- 25 to 50-question, closed-book written test; 70% passing grade, with emphasis on radiation safety, sealed source location within the device, maintenance, transportation and a review of correct answers to missed questions with the prospective user immediately following scoring of the test.
- Instructor has a bachelor's degree in a physical or life science or engineering, has successfully completed a portable XRF device user course and an 8-hour radiation safety course, and has 8 hours hands-on experience with portable XRF devices or has successfully completed the manufacturer's authorized user course and has 30 hours of hands-on experience with XRF devices.

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

**Response from Applicant:**

Provide either of the following:

- The statement: "Before using licensed materials, authorized users will have successfully completed one of the training courses described in Criteria in the section titled 'Training for Individuals Working In or Frequenting Restricted Areas' in NMS-LIC-01A, X-Ray Fluorescence licenses."

OR

- A description of the training and experience for proposed XRF device users.

**Note:**

- Records of training should be maintained.
- Alternative responses will be evaluated against the criteria listed above.

**7.10 ITEM 9: FACILITIES AND EQUIPMENT**

No information need be submitted in response to this item. The key elements for X-ray fluorescence device applicants are ensuring compliance with public dose limits and maintaining adequate security and control over the XRF devices. These issues are covered under "Radiation Safety Program - Public Dose" and "Radiation Safety Program - Operating and Emergency Procedures."

**7.11 ITEM 10: RADIATION SAFETY PROGRAM - AUDIT PROGRAM**

**Rules:** Paragraph (E) of rule 3701:1-38-11 OAC.  
Rule 3701:1-38-20 OAC.

**Criteria:** Licensees must review the content and implementation of their radiation protection programs annually to ensure the following:

- Compliance with BRP, NRC and DOT regulations, and the terms and conditions of the license.
- Occupational doses and doses to members of the public are ALARA (paragraph (E) of rule 3701:1-38-11 OAC).
- Records of audits and other reviews of program content are maintained for three years.

**Discussion:** Appendix D contains a suggested audit program that is specific to the use of XRF devices and is acceptable to the BRP. All areas indicated in Appendix D may not be applicable to every licensee and may not need to be addressed during each audit.

Currently the BRP's emphasis in inspections is to perform actual observations of work in progress. As a part of their audit programs, applicants should consider performing unannounced audits of their XRF device users in the field to determine if, for example, Operating and Emergency Procedures are available, are being followed, etc.

It is essential that once identified, problems be corrected comprehensively and in a timely manner. The BRP will review the licensee's audit results and determine if corrective actions are thorough, timely and sufficient to prevent recurrence. If violations are identified by the licensee and corrective steps are taken immediately by the licensee, the BRP can exercise discretion and may elect to indicate on the inspection report that the licensee audit uncovered a violation and the licensee corrected it immediately, therefore no further action is needed. The BRP's goal is to encourage prompt identification and prompt, comprehensive correction of violations and deficiencies. For additional information on the BRP's use of discretion on issuing violations, refer to rule 3701:1-38-06 OAC, "License or Registration Adjudication Orders; Late Fees; Impoundment; Administrative Monetary Penalty."

With regard to audit records, paragraph (B) of rule 3701:1-38-20 OAC requires licensees to maintain records of "... audits and other reviews of program content and implementation." The BRP has found audit records that contain the following information to be acceptable: date of audit, name of person(s) who conducted audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions and follow-up.

**Response From Applicant:**

The applicant is not required to, and should not, submit its audit program to the BRP for review during the licensing phase.

**7.12 ITEM 10: RADIATION SAFETY PROGRAM - INSTRUMENTS**

**Rules:** Paragraph (A)(2) of rule 3701:1-40-15 OAC.

**Criteria:** A radiation survey meter should:

- Be capable of detecting gamma radiation.
- Be checked for functionality before use (e.g., with the XRF device or a check source).

**Discussion:** Each year there are a number of incidents involving XRF devices at construction sites (e.g., construction equipment running over the XRF device). There have even been incidents where devices containing radioactive material have been left accessible to members of the public, including minors, who, unaware of the hazard, dismantled or damaged the device. It is important to determine as soon as possible after an incident, by the use of a radiation survey meter, whether the shielding and source are intact. Applicants should preplan how they

will obtain an instrument (e.g., use instrument located on site or obtain from the applicant's home office or a local emergency response organization).

**Response from Applicant:**

Provide either of the following:

- A statement that: "We will either possess and use, or have access to and use, a radiation survey meter that meets the Criteria in the section titled 'Radiation Safety Program - Instruments' in NMS-LIC-01A,' X-Ray Fluorescence licenses,' in the event of an incident."

OR

- A description of an alternative procedure for determining source integrity after an incident involving the XRF device.

**Note:**

- Alternative responses will be reviewed against the criteria listed above.
- Applicants who plan to perform non-routine maintenance that requires removing the source or source holder from the XRF device will need to possess and use a radiation survey meter that meets more stringent criteria. Refer to the section on Radiation Safety Program - Maintenance and Appendix F for more information.

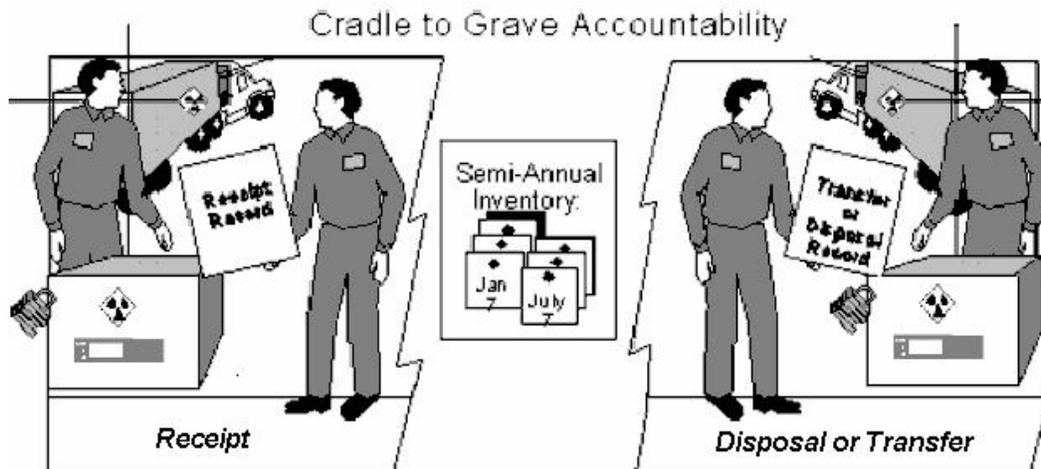
**7.13 ITEM 10: RADIATION SAFETY PROGRAM - MATERIAL RECEIPT AND ACCOUNTABILITY**

**Rules:** Paragraph (A)(2) of rule 3701:1-40-15 OAC.  
Paragraph (C) of rule 3701:1-40-16 OAC.  
Rule 3701:1-40-19 OAC.  
Rule 3701:1-40-21 OAC.

**Criteria:** Licensees must do the following:

- Maintain records of receipt, transfer and disposal of XRF devices.
- Conduct physical inventories at intervals not to exceed six months (or some other interval justified by the applicant) to account for all sealed sources.

**Discussion:** As illustrated in Figure 7.2, licensed materials must be tracked from "cradle to grave" in order to ensure XRF device accountability, identify when XRF devices could be lost, stolen or misplaced, and ensure that, if the licensee possesses XRF devices exceeding threshold amounts, the licensee complies with financial assurance requirements in rule 3701:1-40-17 OAC. Many licensees record daily use of XRF devices in a log book as part of their accountability program; see the suggested Operating Procedures in Appendix F.



**Figure 7.2 Material Receipt and Accountability.** Licensees must maintain records of receipt and disposal and conduct semiannual inventories.

**Response from Applicant:**

Provide either of the following:

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

OR

- A description of the frequency and procedures for ensuring no XRF device has been lost, stolen or misplaced and that, if the licensee possesses XRF devices exceeding threshold amounts, the licensee complies with financial assurance requirements in rule 3701:1-40-17 OAC.

**Note:**

- Alternative responses will be evaluated against the criteria listed above.
- Inventory records should be maintained and contain the following types of information:
- Radionuclide and amount (in units of becquerels or curies) of byproduct material in each sealed source.
- Manufacturer's name, model number and serial number (if appropriate) of each device containing byproduct or accelerator-produced material.
- Location of each sealed source and device.
- Date of the inventory.

## 7.14 ITEM 10: RADIATION SAFETY PROGRAM - OCCUPATIONAL DOSIMETRY

**Rules:** Paragraphs (A), (G), and (H) of rule 3701:1-38-12 OAC.  
Paragraph (B) of rule 3701:1-38-14 OAC.

**Criteria:** Applicants must do either of the following:

- Maintain, for inspection by the BRP, documentation demonstrating unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits as shown in Figure 7.3.

OR

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

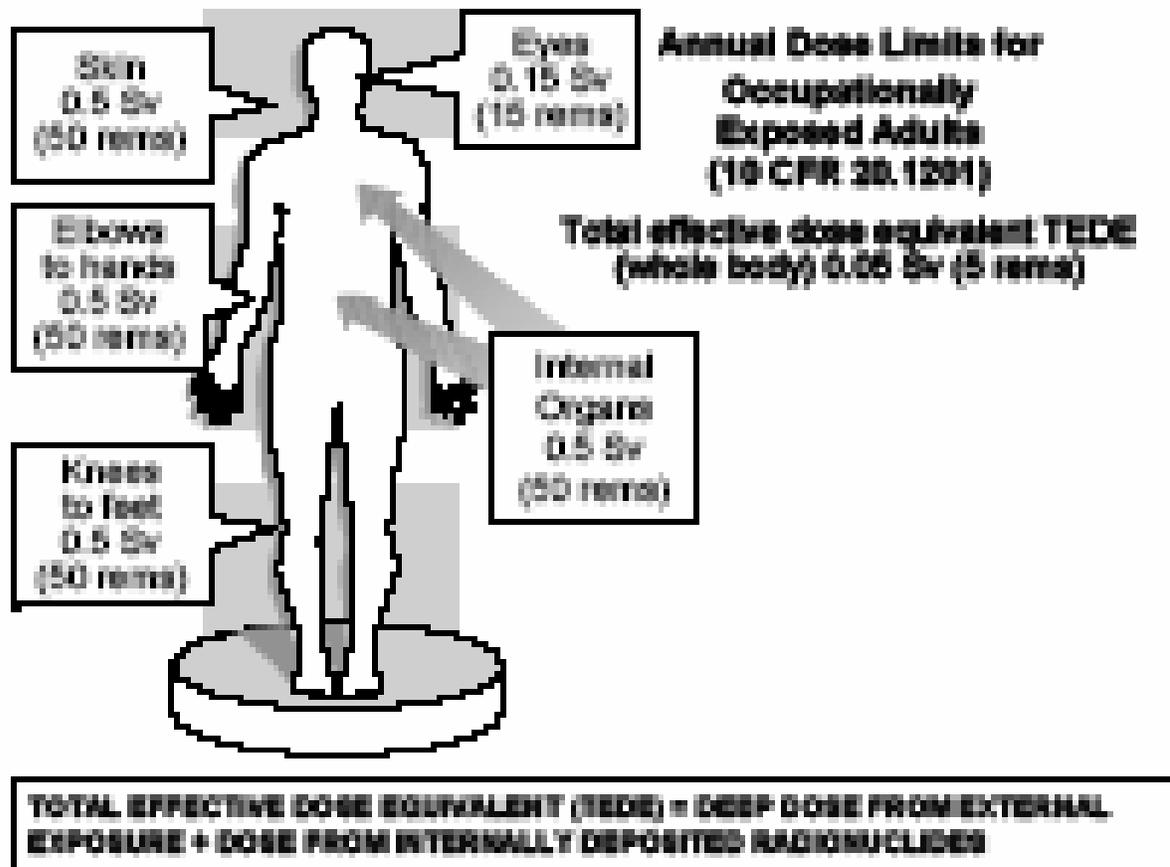


Figure 7.3 Annual Dose Limits.

**Discussion:** Under conditions of routine use (including routine cleaning according to the manufacturer's instructions), the typical X-ray fluorescence device user is unlikely to receive a dose that would require a personnel monitoring device (dosimetry). In most accidents where an XRF has been dropped, struck or run over and damaged, the shielding of the source remains intact. Therefore, an XRF user also does not normally require dosimetry when proper emergency procedures are used. Contact the manufacturer or the BRP, or refer to NMS-LIC-01, for guidance on preparing a written evaluation demonstrating that XRF users are not likely to exceed 10 percent of the applicable limits and thus, are not required to have personnel dosimetry.

When personnel monitoring is used, most licensees use either film badges, thermo-luminescent dosimeters (TLDs) or optically stimulated-luminescent dosimeters (OSLDs) that are supplied by an NVLAP approved processor. The exchange frequency for film badges is usually monthly due to technical concerns about film fading. The exchange frequency for TLDs and OSLDs is usually quarterly. Applicants should verify the processor is NVLAP approved. Consult the NVLAP approved processor for its recommendations for exchange frequency and proper use.

**Response from Applicant:**

Provide either of the following:

- "Either we will maintain, for inspection by BRP, documentation demonstrating that unmonitored individuals are not likely to receive, in one year, a radiation dose in excess of 10 percent of the allowable limits in Chapter 3701:1-38 of the Administrative Code, or we will provide dosimetry processed and evaluated by a NVLAP approved processor that is exchanged at a frequency recommended by the processor."

OR

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

**Note:**

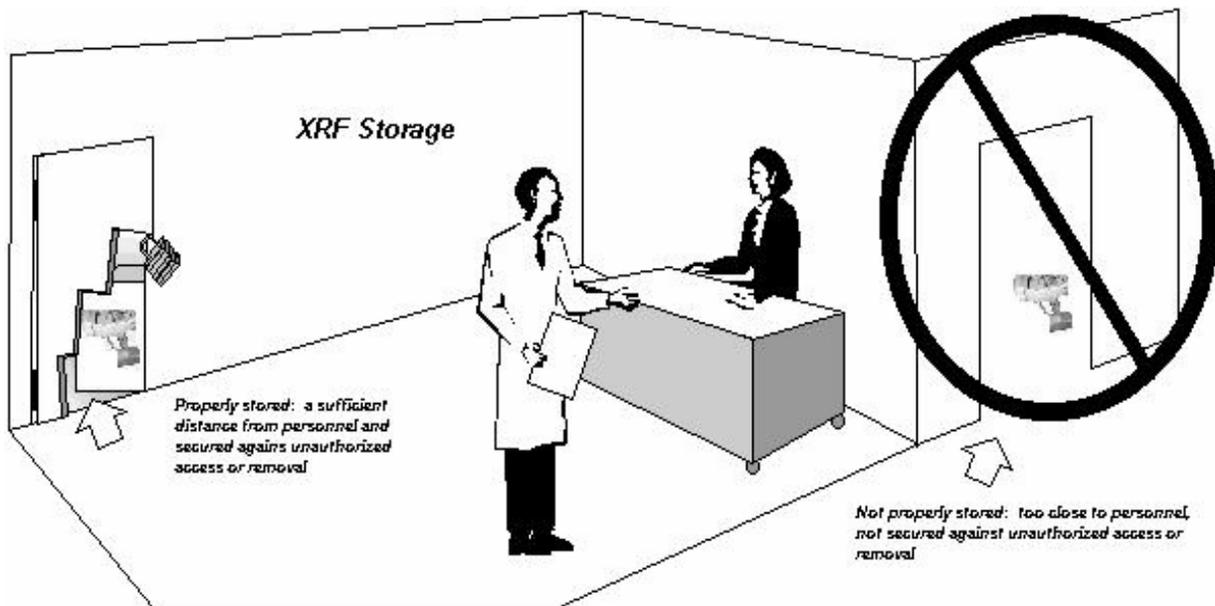
- Alternative responses will be evaluated against the criteria listed above.
- Many licensees choose to provide personnel dosimetry to their workers for reasons other than compliance with BRP requirements (e.g., to respond to worker requests).

**7.15 ITEM 10: RADIATION SAFETY PROGRAM - PUBLIC DOSE**

**Rules:** Rule 3701:1-38-01 OAC.  
Rule 3701:1-38-13 OAC.  
Paragraphs (A) and (B) of rule 3701:1-38-17 OAC.  
Paragraph (J) of rule 3701:1-38-20 OAC.

**Criteria:** Licensees must do the following:

- Ensure that licensed XRF 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 millisievert (mSv) [2 mrem (millirem)] in any one hour from licensed operations.
- Control and maintain constant surveillance over XRF devices that are not in storage and secure stored XRF devices from unauthorized removal or use.



**Figure 7.4 Storing XRF devices.** XRF devices should be stored away from occupied areas and secured against unauthorized removal.

**Discussion:** Members of the public include persons who live, work or may be near locations where XRF 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 XRF devices are used or stored.

Operating and emergency procedures regarding security and surveillance specified under that section of this document should be sufficient to limit the exposure to the public during use or storage and after accidents. Public dose is controlled, in part, by ensuring that XRF devices not in use are stored securely (e.g., stored in a locked area) to prevent unauthorized access or use. See Figure 7.4. If XRF devices are not in storage, then authorized users must maintain constant surveillance to ensure members of the public, including any co-workers who are not radiation workers, cannot get near the XRF devices nor use them, and thus receive unneeded radiation exposure.

Public dose is also affected by the choice of storage location and conditions. Because an XRF device may present a radiation field during storage, it must be stored so the radiation level in an unrestricted area (e.g., an office or the exterior surface of an outside wall) does not exceed 1 mSv (100 mrem) in a year or 0.02 mSv (2 mrem) in any one hour.

**Note:** This guide is intended for devices that can easily be stored near public areas without resulting in doses to the public in excess of 0.1 mSv (100 mrem). If the following example does not resemble your situation, do not use the responses in this guide.

**Example:** A device that normally is turned off and stored in a locked cabinet such that it causes a field of less than 0.05 mrem/h outside the cabinet will provide a whole body exposure to someone who is there for an entire working year (assuming two weeks' vacation per year for 2,000 working hours):

$$[< 0.05 \text{ millirem per hour}] \times [2000 \text{ hours per year}] < 100 \text{ millirem}$$

If, after making an initial evaluation, a licensee makes changes affecting the storage area (e.g., adding more devices, changing the occupancy of adjacent areas, moving the storage area to a new location, using the device far more frequently than as noted in the above example), then the licensee must ensure XRF devices are properly secured, perform a new evaluation to ensure the public dose limits are not exceeded and take corrective action as needed.

**Response from Applicant:**

No response is required from the applicant in a license application, but this matter will be examined during an inspection.

## 7.16 ITEM 10: RADIATION SAFETY PROGRAM - OPERATING AND EMERGENCY PROCEDURES

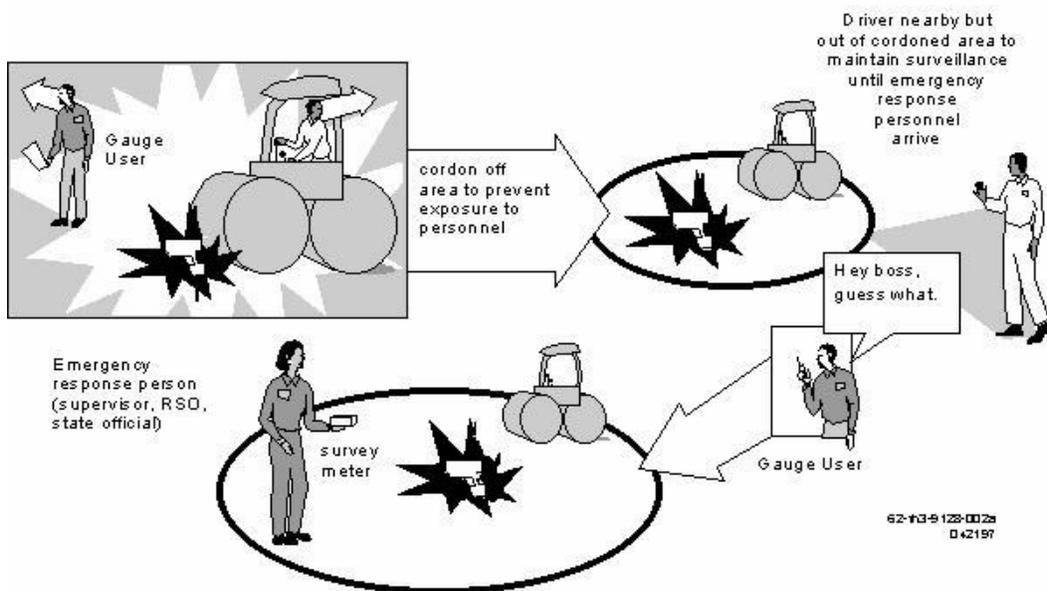
**Rules:** Paragraph (E) of rule 3701:1-38-11 OAC.  
Paragraphs (A) and (B) of rule 3701:1-38-17 OAC.  
Paragraphs (A) to (C) of rule 3701:1-38-21 OAC.  
Rule 3701:1-40-16 OAC.

**Criteria:** Each applicant must do the following:

- Develop, implement and maintain operating and emergency procedures containing the following elements:
- Instructions for using the X-ray fluorescence device and performing routine maintenance, according to the manufacturer's recommendations and instructions.
- Instructions for maintaining security during storage and transportation.

- Instructions to keep the XRF device under control and immediate surveillance during use.
- Steps to take to keep radiation exposures ALARA.
- Steps to maintain accountability during use.
- Steps to control access to a damaged XRF device.
- Steps to take and whom to contact when a XRF device has been damaged.
- This guide is not intended for XRF devices where the source extends unshielded from the device.
- Require reporting to the BRP, pursuant to Chapter 3701:1-38 OAC, when a stuck source cannot be restored to the unexposed position. The BRP's phone number is (614) 644-2727.

### Proper Handling of Incidents



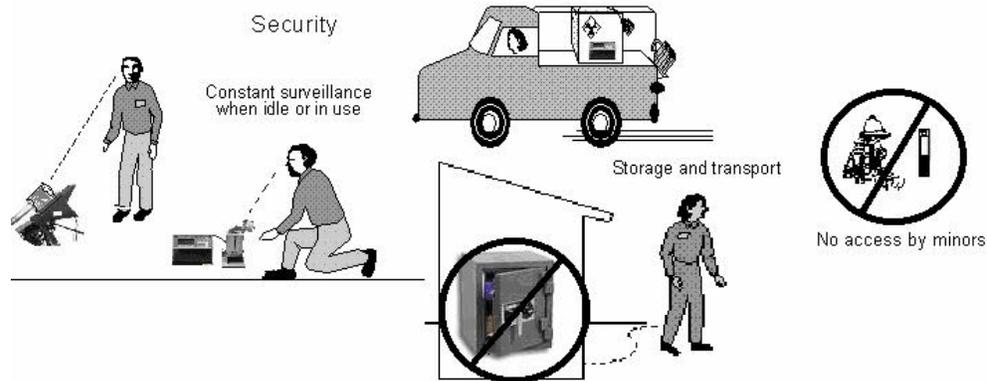
**Figure 7.5 Proper Handling of Incidents.** XRF devices are often damaged by heavy equipment or from being dropped at job sites and emergency procedures need to minimize radiation safety risk.

**Discussion:** Lost or stolen XRF devices and as illustrated in Figure 7.5 XRF devices damaged during use at job sites are the most common occurrences that present a potentially significant radiation safety risk. Figure 7.6 illustrates steps that should be taken to prevent loss, theft or unauthorized use. Operating and emergency procedures should be developed to minimize these risks. The BRP considers security of XRF devices to be extremely important and lack of security is a significant

violation for which licensees may be assessed administrative penalties and/or civil penalties. See Appendix F for sample procedures.

**Note:** Certain XRF devices are used to make measurements with the unshielded source extended outside the shutter of the device. Do not use this guide if your device is of this type.

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



**Figure 7.6 Security.** To avoid lost or stolen XRF devices, licensees must keep the XRF devices under constant surveillance, or secured against unauthorized use or removal.

**Response from Applicant:**

Do either of the following:

- State: "We will implement and maintain the operating and emergency procedures in Appendix F of NMS-LIC-01A, 'X-Ray Fluorescence licenses,' and provide copies of these procedures to all users and at each job site."

OR

- State: "Operating and emergency procedures will be developed, implemented and maintained, and will meet the criteria in the section titled "Radiation Safety Program - Operating and Emergency Procedures" in NMS-LIC-01A, "X-Ray Fluorescence licenses."

OR

- Submit alternative procedures.

**Note:** Alternative procedures will be reviewed against the criteria listed above. If a XRF device is lost or stolen, call the BRP at (614) 644-2727.

## 7.17 ITEM 10: RADIATION SAFETY PROGRAM - LEAK TESTS

**Rules:** Chapter 3701:1-38 OAC.

**Criteria:** The BRP requires testing to determine whether there is any radioactive leakage from the source in the device. The BRP finds testing to be acceptable if it is conducted by an organization licensed by the NRC or an Agreement State or according to procedures approved by the NRC or an Agreement State.

**Discussion:** When issued, a license will require performance of leak tests at intervals approved by the BRP, the NRC, or an Agreement State and specified in the SSD Registration Sheet. The measurement of the leak test sample is a quantitative analysis requiring that instrumentation used to analyze the sample be capable of detecting 185 becquerels (0.005 microcurie) of radioactivity.

Manufacturers, consultants and other organizations may be licensed by the NRC or an Agreement State to either perform the entire leak test sequence for other licensees or provide leak test kits to licensees. In the latter case, the licensee is expected to take the leak test sample according to the XRF device manufacturer's and the kit supplier's instructions and return it to the kit supplier for evaluation and reporting results. Licensees may also be authorized to conduct the entire leak test sequence themselves.

### Response from Applicant:

Do either of the following:

- State: "Leak tests will be performed at intervals approved by BRP, as specified in the Sealed Source and Device Registration Sheet. Leak tests will be performed by an organization licensed by the NRC or an Agreement State to provide leak testing services to other licensees or using a leak test kit supplied by an organization authorized by the NRC or an Agreement State to provide leak test kits to other licensees and according to the kit supplier's instructions."
- OR
- Provide sufficient information supporting a request to perform leak testing and sample analysis.

<p><b>Note:</b> Requests for authorization to perform leak testing and sample analysis will be reviewed on a case-by-case basis and, if approved, BRP staff will authorize via a license condition.</p>
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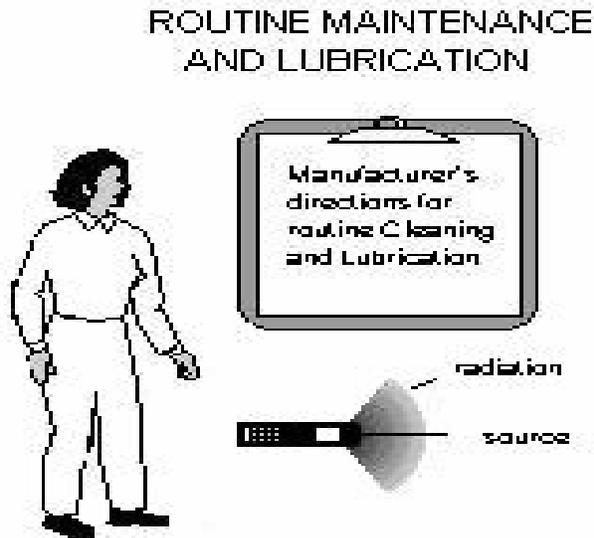
## 7.18 ITEM 10: RADIATION SAFETY PROGRAM - MAINTENANCE

**Rule:** Rule 3701:1-38-11 OAC.  
Paragraph (C) of rule 3701:1-40-16 OAC.

**Criteria:** Licensees must routinely clean and maintain XRF devices according to the manufacturer's recommendations and instructions. For XRF devices with a source holder, radiation safety procedures for routine cleaning and lubrication of the shutter mechanism (e.g., to remove caked dirt, mud, asphalt or residues from the source holder or shutter; lubricate the shutter mechanism) must consider ALARA and ensure the XRF device functions as designed and source integrity is not compromised.

Non-routine maintenance or repair (beyond routine cleaning and lubrication) that involves detaching the source or source holder from the device and any other activities during which personnel could receive radiation doses exceeding limits must be performed by the XRF device manufacturer or a person specifically licensed by the NRC or an Agreement State.

**Note:** Requests for authorization to perform non-routine maintenance will be reviewed on a case-by-case basis and, if approved, BRP staff will authorize via a license condition. However, this guide is not intended to provide guidance on non-routine maintenance. Do not use this guide in developing an application to include non-routine maintenance.



**Figure 7.7 Maintenance.** Licensees may need to perform routine cleaning and lubrication to ensure proper operation of the XRF device, but should not attempt any non-routine maintenance.

**Discussion:** Figure 7.7 illustrates routine cleaning and lubrication. Generally, the BRP permits X-ray Fluorescence licensees to perform routine maintenance of the XRF devices provided they follow the XRF device 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, repairing or replacing a handle. Routine maintenance does NOT include any activities that require removing the sealed source or source holder from the device or changing the shutter.

The license will state that any cleaning, maintenance or repair of XRF devices that requires detaching the source or source holder from the XRF device shall be performed only by the manufacturer or other persons specifically licensed to perform such services by the NRC or an Agreement State. Applicants seeking authorization to detach the source or source holder from the device should submit an application using the additional guidance in NMS-LIC-01.

**Response from applicant:**

For routine cleaning and lubrication: Submit either of the following:

- "We will implement and maintain procedures for routine maintenance of our XRF devices according to each manufacturer's recommendations and instructions."

OR

- Alternative procedures for bureau review.

For non-routine maintenance or repair operations that require detaching the source or source holder from the XRF device, submit the following:

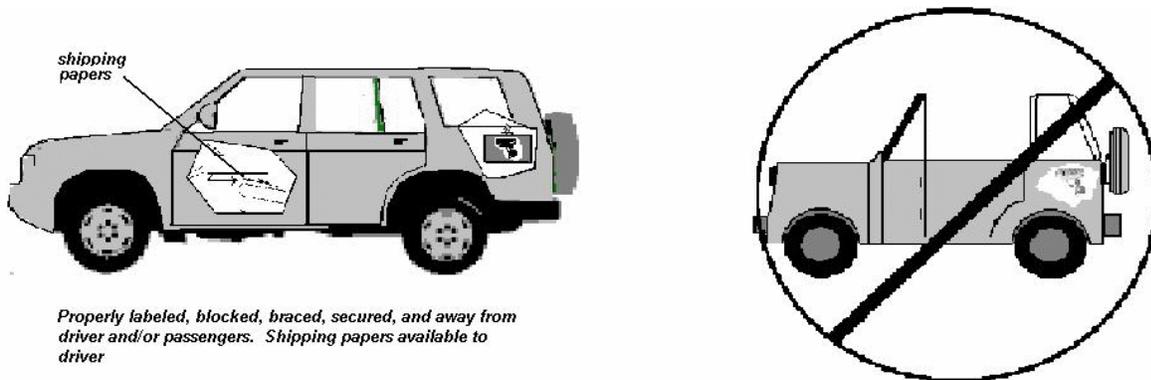
"We will send the XRF device to the manufacturer or other person authorized by the NRC or an Agreement State to perform non-routine maintenance or repair operations that require detaching the source or source holder from the XRF device."

**Note:** Applicants wishing to perform non-routine maintenance or repair operations that require detaching the source or source holder from the XRF device, or in any way disassembling the source holder, should not use this guide.

**7.19 ITEM 10: RADIATION SAFETY PROGRAM - TRANSPORTATION**

**Rules:** Rule 3701:1-38-11 OAC.  
Rule 3701:1-50-05 OAC.  
49 CFR Parts 171-177.

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



**Figure 7.8 Transportation.** Licensees often transport their XRF devices to and from job sites and must ensure compliance with DOT regulations.

**Discussion:** Figure 7.8 illustrates some DOT requirements often overlooked by X-ray fluorescence device licensees. During an inspection, the BRP uses the provisions of rule 3701:1-50-05 OAC to examine and enforce transportation requirements applicable to X-ray Fluorescence licensees. Appendix G lists major DOT regulations and provides a sample shipping paper.

**Response from Applicant:**

Applicants need not include this information in the application. This issue will be reviewed during inspection.

**7.20 ITEM 11: WASTE MANAGEMENT - DISPOSAL AND TRANSFER**

**Rules:** Rule 3701:1-38-19 OAC.  
Rule 3701:1-40-19 OAC.  
Rule 3701:1-40-21 OAC.

**Criteria:** Licensed materials must be disposed of in accordance with BRP requirements by transfer to a licensed recipient. Appropriate records must be maintained.

**Discussion:** When disposing of XRF devices, licensees must transfer them to a licensed recipient. Licensed recipients are the original manufacturer of the device, a commercial firm licensed by the NRC or an Agreement State to accept radioactive waste from other persons, or another specific licensee authorized to possess the licensed material (i.e., their license specifically authorizes the radionuclide and the use).

Before transferring radioactive material, a licensee must verify the recipient is properly licensed to receive it using one of the methods described in rule 3701:1-40-19 OAC. In addition, all packages containing radioactive sources must be prepared and shipped in accordance with BRP and DOT regulations. Records of the transfer must be maintained as required by rule 3701:1-40-21 OAC. Applicants may contact the BRP Decommissioning Section at (614) 644-2727 for details.

**Response from Applicant:**

Applicants need not include this information in the application. This issue will be reviewed during inspection.

Licensees should establish and include waste disposal procedures in their radiation safety program.

The next two items on the application form are to be completed on the form itself.

**7.21 ITEM 12: FEES**

Enter the license category – 03122 for XRF licenses - on the application form. The ODH will invoice licensees for the appropriate fees upon receipt of the application or amendment request.

Certain surcharges and discounts (e.g., small entities, public health districts, non-profit organizations) may also be applicable, and it is always best to contact the BRP to obtain the most current information.

**7.22 ITEM 13: CERTIFICATION**

Individuals acting in a private capacity are required to date and sign the application form. Otherwise, representatives of the corporation or legal entity filing the application should date and sign the application form. Representatives signing an application must be authorized to make binding commitments and to sign official documents on behalf of the applicant. As discussed previously in "Management Responsibility," signing the application acknowledges management's commitment and responsibilities for the radiation protection program. The BRP will return all unsigned applications for proper signature.

**Note:** When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

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## **8. AMENDMENTS AND RENEWALS TO A LICENSE**

It is the licensee's obligation to keep the license current. If any substantive information provided in the original application is to be modified or changed, the licensee must submit a request for a license amendment before the change takes place. Also, to continue the license, the licensee must submit an application for a license renewal at least 90 days before the expiration date (paragraph (A) of rule 3701:1-40-18 OAC).

The Bureau will invoice licensees the appropriate fee for a license amendment or renewal. For renewal and amendment requests, applicants must do the following:

- Be sure to use the most recent guidance in preparing an amendment or renewal request.
- Submit in duplicate the application form for renewal.
- Provide the license number.
- For renewals, provide a complete and up-to-date application, even if there are not many outdated documents referenced or there have been no significant changes in regulatory requirements, the BRP's guidance, the licensee's organization or radiation protection program. Make specific note of the exact nature of the changes, additions and deletions since the original application.

Deviations from the suggested wording of responses as shown in this document or submission of alternative procedures may require a custom review.

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## 9. RADIATION SAFETY PROGRAM - TERMINATION OF ACTIVITIES

**Rules:** Paragraph (A) of rule 3701:1-40-16 OAC.  
Rule 3701:1-40-17 OAC.  
Paragraphs (C) and (K) of rule 3701:1-40-18 OAC.  
Paragraph (F) 3701:1-40-21 OAC.

**Criteria:** The licensee must do the following:

- Notify the BRP in writing within 60 days, when principal activities have not been conducted for a period of 24 months or a decision is made to permanently cease licensed activities.
- Certify the disposition of licensed materials by submission of an amendment request to terminate the license, available from the Decommissioning Section of the BRP upon request.
- Before a license is terminated, send the records important to decommissioning (as required by paragraph (G) of rule 3701:1-40-17 OAC) to the BRP. If licensed activities are transferred or assigned in accordance with paragraph (A) of rule 3701:1-40-16 OAC, transfer records important to decommissioning to the new licensee. The BRP must be notified of any transfer.

**Discussion:** For guidance on the disposition of licensed material, see the section on Waste Management - XRF Device Disposal or Transfer. For guidance on decommissioning records, see the section on Radioactive Materials - Financial Assurance and Record Keeping for Decommissioning.

### **Response from Applicant:**

This section applies only when the license expires or at the time the licensee ceases operations. Then, an amendment request must be submitted.

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# Appendix A

## State of Ohio Application for a License for Radioactive Material

Ohio Department of Health  
**Application for a License for Radioactive Material**

<b>This is an application for:</b> <input type="checkbox"/> <b>Initial License</b> <input type="checkbox"/> <b>Renewal or</b> <input type="checkbox"/> <b>Amendment of License Number:</b>			
<b>1. Name of Licensee</b> (Person or firm proposing to conduct the activities described below.)		<b>2. Address of Licensee</b> (Mailing address of licensee. This may be a PO Box.)	
<b>3. Location(s) of Use or Storage</b> (May not be a PO Box, an actual street address is required. Use additional pages if necessary.)			
a. Address:			
b. Address:			
c. Address:			
<b>4. Licensee Contact Person</b> If consultant or other non-employee, so indicate <input type="checkbox"/>			
Name:	Phone: (    )	Fax: (    )	E-Mail:

Submit detailed information for items 5 through 11 on separate 8-1/2" x 11" plain paper.  
 See examples and instructions provided for type and scope of information requested.

<b>5. Radioactive Material</b>		
a. Element and Mass Number (e.g., Hydrogen-3)	b. Physical / Chemical Form (e.g., sealed source, liquid, metal foil)	c. Maximum Activity (in SI units)
<b>6. Purpose for which radioactive material will be used</b>		
<b>7. Radiation Safety Officer</b> (Include training and experience.)		
<b>8. Training Program</b> (Include topics to be covered, frequency of training, and recipients.)		
<b>9. Facilities and Equipment</b> (attach documentation and diagram of locations of use and storage.)		
<b>10. Radiation Protection Program</b> (Include personnel monitoring, instrumentation, and procedures.)		
<b>11. Waste Disposal / Waste Management</b> (List methods to be used by name or reference.)		
<b>12. Indicate whether licensee is a</b> <input type="checkbox"/> <b>Domestic (in-state)</b> or <input type="checkbox"/> <b>Foreign (out-of-state) corporation</b> If a Foreign corporation, show the Designated Agent		
Name:	Address:	Phone: (    )
<b>13. Application Certification</b>		
The applicant stated herein, or any official executing this application on behalf of the applicant, certifies that:		
a. This application is prepared in conformity with Chapter 3748 of the Revised Code and rules adopted thereunder.		
b. All information contained herein, including supplements and attachments is true and correct to the best of our knowledge and belief.		
Printed name and title of applicant/official executing this application	Signature	Date
<b>14. Licensee Federal Tax ID number</b> (If no Tax ID number, then Social Security Number):		
<b>15. License Reduced Fees Certification</b> (Attach financial documentation to indicate qualifications for reduced fees.)		
The applicant stated herein, or any official executing this application on behalf of the applicant, certifies that:		
a. This License Reduced Fees Certification is prepared in conformity with Chapter 3748 of the Revised Code and rules adopted thereunder.		
b. All information contained herein, including supplements and attachments is true and correct to the best of our knowledge and belief.		
c. The qualifications for reduced fees is based on OAC 3701:1-38-02, paragraph (J), subparagraph (    )		
Printed name and title of applicant/official executing this application	Signature	Date
Return completed application to: Ohio Department of Health Radiation Protection 246 North High Street Columbus, Ohio 43215	Make payment instrument payable to: <b>Treasurer, State of Ohio</b> Ohio Department of Health Accounts Receivable Unit P.O. Box 15278 Columbus, Ohio 43215	

HEA5133 (Rev. 03/2006)

## Appendix B

### Suggested Format for Providing Information Requested in Items 5 through 11 of the Application

## Suggested Format for Providing Information Requested in Items 5 through 11 of the Application

Item	Suggested Response	Agree to use App.	Description Attached
5.	<b>Radioactive Material</b>		
	Applicants for a Type A broad scope license should request any form of radioactive material with atomic numbers from 1 through 83. The applicant should state the maximum quantity of each radionuclide to be possessed at any one time and the total cumulative quantity for all radionuclides. The applicant should separately list individual radionuclides needed in much larger quantities or in much smaller quantities than those described in the atomic number 1-83 request. The maximum quantities of nuclides with atomic numbers above 83 also should be listed separately.	N/A	<input type="checkbox"/>
	A separate listing should also be submitted for sealed sources needed in larger quantities than described in the atomic number 1-83 request. Applicants must provide the manufacturer's name and model number for each requested sealed source and device so the BRP can verify that they have been evaluated in an SSD Registration Certificate or specifically approved on a license. This information need not be submitted if the licensee is authorized to possess the requested quantity of radioactive material in unsealed form and the licensee performs the required safety evaluation of the source and device.	N/A	<input type="checkbox"/>
	Possession requests should be categorized into general areas of use, e.g., research and development activities, routine gauging activities, self-shielded irradiators, instrument calibrators and medical applications.	N/A	<input type="checkbox"/>
	Applicants for a Type B or Type C broad scope license should request any chemical or physical form of radioactive material specified in OAC 3701:1-40-22, Appendix. Type B licensees should request the quantity of material specified in OAC 3701:1-40-22(C). Type C licensees should request the quantity of material specified in OAC 3701:1-40-22(D).	N/A	<input type="checkbox"/>
	<b>Financial Assurance and Recordkeeping for Decommissioning</b>		
	Applicants requesting authorization to possess licensed material in excess of the limits specified in OAC 3701:1-40-17 must submit a decommissioning funding plan (DFP) or certification of financial assurance for decommissioning.	N/A	<input type="checkbox"/>

Item	Suggested Response	Agree to use App.	Description Attached
6.	<b>PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED</b>		
	Describe in general terms the use or purpose of each requested radionuclide.	N/A	<input type="checkbox"/>
7.	<b>INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM</b>		
	<b>Executive Management</b>		
	The applicant must describe administrative controls and provisions relating to organization and management and management review necessary to assure safe operations. It is recommended that the applicant submit an organizational chart describing the management structure, reporting paths and the flow of authority between executive management, the RSC (for Type A broad scope) and the RSO (For Type A and Type B broad scope).	N/A	<input type="checkbox"/>
	<b>Radiation Safety Committee (RSC)</b>		
	<ul style="list-style-type: none"> <li>• Applicants for a Type A broad scope license should submit the following:</li> </ul>	N/A	N/A
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Description of the duties and responsibilities of the RSC.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Criteria used for selecting members to the RSC including what members and number of members constitute a quorum. Members should be indicated by position title rather than by name.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Criteria used by the RSC and RSO for approving new users and new uses.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>• A description of the duties and responsibilities of the RSC should include:</li> </ul>	N/A	N/A
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Review and approval of permitted program and procedural changes prior to implementation.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Implementation of program and procedural changes.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Audit of licensed operations to determine compliance.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li> <ul style="list-style-type: none"> <li>○ Taking appropriate actions when noncompliance is identified including analysis of the cause, corrective actions and actions to prevent recurrence.</li> </ul> </li> </ul>	N/A	<input type="checkbox"/>

Item	Suggested Response	Agree to use App.	Description Attached
	<ul style="list-style-type: none"> <li>A description of the process for procedure and program review and approval including documentation of the specific change. At a minimum, documentation shall state the reason for the change and summarize the radiation safety matters that were considered prior to approval of the change.</li> </ul>	N/A	<input type="checkbox"/>
	<b>Radiation Safety Officer</b>		
	<b>For Type A and Type B applicants:</b>		
	<ul style="list-style-type: none"> <li>Submit the name of the proposed RSO.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>Describe the training and experience for the proposed RSO that demonstrates the individual is qualified to perform the duties required under the license.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>Submit a statement delineating the RSO's duties and responsibilities.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>Submit a "Radiation Safety Officer Delegation of Authority" signed by the licensee's executive management.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
	<b>For Type B applicants:</b>		
	<ul style="list-style-type: none"> <li>Submit the criteria used by the RSO to approve new users and uses of radioactive material.</li> </ul>	N/A	<input type="checkbox"/>
	<b>For Type C applicants:</b>		
	Submit the name of the person who will serve as the individual responsible for the day-to-day operation of the radiation safety program, e.g., Radiation Safety Officer, who will be contacted if there are further questions about this application, and who is duly authorized to act for the applicant or licensee as required by OAC 3701:1-40-14(C).	N/A	<input type="checkbox"/>
8.	<b>TRAINING</b>		
	<ul style="list-style-type: none"> <li>Submit a description of the radiation safety training program developed for each group of workers including topics covered, qualifications of the instructors, method of training, method for assessing the success of the training and the frequency of training and refresher training.</li> </ul>	N/A	<input type="checkbox"/>
	<b>or</b>		

Item	Suggested Response	Agree to use App.	Description Attached
	<ul style="list-style-type: none"> <li>Identify the model training program described in the appropriate guide corresponding to your particular type of licensed program and submit a statement that this training program will be implemented.</li> </ul>	<input type="checkbox"/>	<input type="checkbox"/>
9.	<b>FACILITIES AND EQUIPMENT</b>		
	Describe the criteria your RSC and/or RSO, as appropriate, will use to review and approve facilities and equipment. Your description will need to include your method of classifying laboratories based on type, toxicity and quantity of byproduct material being requested. Sample diagrams should be provided for each classification scheme. These should take into consideration shielding, the proximity of radiation sources to unrestricted areas and other items related to radiation safety. When reviewing facilities where radioactive materials may become airborne, sample diagrams should take into consideration description of the ventilation systems, including pertinent airflow rates, pressures, filtration equipment and monitoring systems. For special application facilities, you will need to specify their locations, (i.e. buildings and room numbers) and special considerations that your RSC and/or RSO will use in authorizing byproduct material use. Also describe your procedures for control, review and approval of significant facilities or equipment modifications.	N/A	<input type="checkbox"/>
10.	<b>RADIATION SAFETY PROGRAM</b>		
	<b>Audit Program</b>		
	Describe the mechanisms used by executive management to ensure adequate oversight of the program is exercised. In addition, if you are upgrading your limited scope license to a Type A broad scope license or you are renewing your Type A broad scope license, describe the RSC's involvement in these oversight mechanisms.	<input type="checkbox"/>	<input type="checkbox"/>
	The applicant is not required to, and should not submit its program for conducting the annual audit required by OAC 3701:1-38-11 to the BRP for review during the licensing phase. The adequacy of this audit program will be reviewed during inspection.	<input type="checkbox"/>	<input type="checkbox"/>

Item	Suggested Response	Agree to use App.	Description Attached
	Describe the audit mechanism implemented by the RSO or other responsible individual to determine user compliance with regulations, the terms and conditions of the license, the requirements of the RSC- or RSO-approved permits (as appropriate) and good health physics practices.		
	<b>Instruments</b>		
	Provide the criteria used by your RSC and/or RSO, as appropriate, to review and approve radiation monitoring instrumentation to assure appropriate radiation monitoring equipment will be used during licensed activities.	<input type="checkbox"/>	<input type="checkbox"/>
	Discuss how the RSC and/or RSO, as appropriate, will assure instruments are properly calibrated at prescribed frequencies.	<input type="checkbox"/>	<input type="checkbox"/>
	Submit procedures for instrument calibration or state that instruments will be calibrated by a vendor who is licensed by the director, NRC or an Agreement State to perform instrument calibrations. Licensees who want authorization to calibrate their own survey instruments may commit to implementing the model procedures published in Appendix J of this document.	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Material Receipt and Accountability</b>		
	Describe your administrative procedures to assure control of procurement and use of radioactive material.	<input type="checkbox"/>	<input type="checkbox"/>
	While the applicant is required to develop and implement safe opening procedures for packages containing radioactive material, the applicant need not submit the procedures during the licensing process. These procedures will be reviewed during inspection.	<input type="checkbox"/>	<input type="checkbox"/>
	Describe your administrative controls and provisions relating to materials control, accounting and security.	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Occupational Dose</b>		
	Submit a description of the method for demonstrating compliance with the referenced regulations or a statement that an evaluation has disclosed that individuals do not require monitoring.	N/A	<input type="checkbox"/>
	<b>Public Dose</b>		

Item	Suggested Response	Agree to use App.	Description Attached
	No response is required from the applicant, but records and written materials documenting compliance will be examined during inspection. During inspections, licensees must be able to provide documentation demonstrating, by measurement or calculation, that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual limit for members of the public. For guidance about accepted methodologies for determining doses to members of the public, see Appendix L of this document.	N/A	N/A
	<b>Safe Use of Radionuclides and Emergency Procedures</b>		
	Provide your procedures for safe use of radionuclides including security of materials and emergencies. As an alternative you may state, "We will adopt the procedures for the safe use of radionuclides and emergencies as published in Appendix M of NMS-LIC-11, 'Program-Specific Guidance About Licenses of Broad Scope.'"	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Surveys</b>		
	Submit procedures to evaluate radiological hazards, both external and internal. If you wish you may state "We will survey our facility and maintain contamination levels and perform bioassays of occupationally exposed workers in accordance with the survey frequencies and contamination levels published in Appendix N of NMS-LIC-11, 'Program-Specific Guidance About Licenses of Broad Scope.'"	<input type="checkbox"/>	<input type="checkbox"/>
	Submit your leak test procedures, or, as an alternative, you may state, "We will implement the model leak test program published in Appendix O of NMS-LIC-11, 'Program-Specific Guidance About Licenses of Broad Scope'."	<input type="checkbox"/>	<input type="checkbox"/>
	<b>Transportation</b>		
	<ul style="list-style-type: none"> <li>• The applicant must provide procedures used to ensure compliance with, and document the following transportation requirements:</li> </ul>	N/A	N/A
	<ul style="list-style-type: none"> <li>o Contamination and dose rate limits.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>o Shipping papers.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>o Marking.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>o Labeling.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>o Placarding.</li> </ul>	N/A	<input type="checkbox"/>

Item	Suggested Response	Agree to use App.	Description Attached
	<ul style="list-style-type: none"> <li>o Emergency response information.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>o Training.</li> </ul>	N/A	<input type="checkbox"/>
11.	<b>WASTE MANAGEMENT</b>		
	Provide procedures for waste collection, storage and disposal by any of the authorized methods described in this section. Applicants should contact the BRP for guidance to obtain approval of any method(s) of waste disposal other than those discussed in this section.	N/A	<input type="checkbox"/>

# Appendix C

## Information Needed for Transfer of Control Application

### **Information Needed for Transfer of Control Application**

Licensees must provide full information and obtain the director's prior written consent before transferring ownership or control of the license; some licensees refer to this as "transferring the license." Call the BRP Decommissioning Section at (614)644-2727 for further information.

## Appendix D

# Information Needed for Field Use of Radioactive Material

## **Information Needed for Field Use of Radioactive Material**

OAC 3701:1-40-30(C)(2)(e) identifies as a categorical exclusion (from the requirement to prepare an environmental assessment or impact statement) the use of radioactive material for research and development and for educational purposes. However, this categorical exclusion does not encompass, among other things, performance of field studies in which licensed material is deliberately released directly into the environment for purposes of the study (e.g., tagging of animals or insects that remain in the wild). These types of requests may require an environmental report filed by the applicant and an environmental assessment by the BRP pursuant to OAC 3701:1-40-31. Field studies that do not deliberately release radioactive material into the environment such as tagging of animals and penning them to prevent escape may be eligible for a categorical exclusion pursuant to OAC 3701:1-40-30(C)(2)(p).

If you desire to perform field studies in which licensed material is deliberately released to the environment for the purposes of studies please provide the following information:

1. A complete application describing the type and amount of material to be used, the location of use and training and experience of the individual using the material.
2. A complete experimental protocol.
3. A description of the amount of radioactive material to be released in the field, decontamination procedures at the conclusion of the experiment, if appropriate, and procedures for minimizing releases.
4. A description of the expected radiation dose to humans.
5. Written permission from the property owner to use radioactive materials at the proposed site.
6. A letter from the appropriate state health authorities indicating that they have reviewed your application and concur with your request.

# Appendix E

## Model Delegation of Authority for Radiation Safety Officer

## **MODEL DELEGATION OF AUTHORITY RADIATION SAFETY OFFICER**

Memorandum To: All Employees

From: Chief Executive Officer

Subject: Delegation of Authority for Radiation Safety Officer

\_\_\_\_\_ has been appointed Radiation Safety Officer and is responsible for ensuring the safe use of radioactive material. The Radiation Safety Officer is responsible for managing the radiation safety program; identifying radiation safety problems; initiating, recommending or providing corrective actions; verifying implementation of corrective actions and ensuring compliance with regulations for the use of radioactive material. The Radiation Safety Officer is hereby delegated the authority necessary to meet these responsibilities.

The Radiation Safety Officer has the authority to immediately stop any operations involving the use of radioactive material in which health and safety may be compromised or may result in non-compliance with ODH, BRP requirements.

# Appendix F

## Facilities and Equipment Considerations

## Facilities and Equipment Considerations

Below is a list of topics that should be considered when developing a description of the facilities and equipment that a licensee will use or otherwise have available. Not every applicant will need to address each topic in its application.

- Restricted areas are defined as areas to which access is limited by the licensee to protect individuals against undue risks from exposure to radiation and radioactive materials. The application should contain detailed descriptions and diagrams of the facilities, including information about the shielding properties of the construction materials used. Scaled drawings and sketches should be submitted showing the relationship between restricted areas and unrestricted areas and the location of all pertinent safety-related equipment.
- Bench top or open work areas may be used for sealed sources, for small quantities of solid materials in a form not likely to become airborne or dispersed and for small quantities of liquids of such low volatility as not to cause airborne contamination or toxicity problems. Trays and/or absorbent surface covers to catch and retain spilled liquids should be used on these open work surfaces and inside closed systems discussed below. Surfaces should be smooth and non-porous to facilitate decontamination.
- Radioactive materials that are handled or used in unsealed forms should be confined to control the release of material and to prevent the spread of contamination. Gaseous, volatile, and fine particulate solid materials should be handled in closed or isolated systems such as fume hoods or glove boxes with controlled and possibly filtered exhaust systems.

Chemical-type fume hoods provide a working area with controlled inward airflow from the room to the hood exhaust system. Hoods are used for gases, for unsealed volatile licensed materials and for processes such as evaporation that may release gases and vapors. Fume hoods provide emergency ventilation and exhaust for unplanned releases such as accidental spills and ruptures as well as routine exhaust of effluents. Filters may be required in the exhaust stream unless monitoring and/or calculations demonstrate that any planned or likely effluent will be in accordance with the limits found in OAC 3701:1-38-12, Appendix C.

Glove boxes are sealed boxes with transparent viewing windows, sealable ports or doors for transferring materials and equipment and gloves sealed to the box through which licensed materials are handled. Glove boxes are used for the containment during storage and use of liquids and solids that can become airborne particulates or aerosols. Glove boxes can be closed or exhausted with filtration systems if appropriate to prevent contamination.

Sink faucets should be designed where possible for operation by foot, knee or elbow rather than by hand.

- Plumbing and ductwork should be designed to avoid radioactive contamination build up. This build up of contamination can create external radiation exposure hazards and problems for decommissioning.
- Shielding consisting of lead or other high-density material in the form of bricks, panels, L-shields, storage containers or other shapes may be used on bench tops, in fume hoods or in glove boxes to reduce radiation exposure from gamma-emitting radioactive materials. Similarly, shielding of low atomic number material such as high-density plastic may be used to reduce the exposure from high-energy beta-emitting materials. Shielded shipping containers are frequently used for continued storage after receipt of materials.

- A particular sink should be designated for disposal of liquid radioactive waste to the sanitary sewerage system. In some cases, depending on number of users and distance between areas of use, more than one sink may need to be designated.
- Labeled waste containers should be used. These containers may be shielded as necessary, placed near the waste-generating areas and away from areas frequently occupied by personnel. Additionally, these containers should be effectively enclosed to prevent airborne contamination from radioactive materials deposited.
- Remote-handling tools such as forceps or extension handles should be used to provide distance in the handling of radioactive materials ALARA. In addition, shielded handling devices such as shielded syringes can be used to protect workers from materials that cannot be handled remotely. Pipetting should be done using appropriate devices. Pipetting by mouth should be strictly forbidden.
- Where appropriate, ventilation systems should be designed so they can be shut down and isolated to contain radioactivity in the event of an accident.
- Designated areas should be provided for coats and personal belongings to avoid contamination.
- Areas with the lowest possible background radiation levels should be designated for personnel dosimetry storage when not in use.
- Areas of use should be well-lighted to avoid spills and other accidents that could result in contamination build up.
- Observation of activities conducted behind shielding with remote tools (or with extended arms and hands, within limits consistent with permissible occupational exposures) can be accomplished by mirrors, through shielded (e.g., leaded glass) windows, through transparent plastic beta shields, or by remote video monitoring.
- The combination of containment, shielding and handling devices proposed for any use of radioactive materials should be appropriate to the type and quantity of materials to be used and to the type and duration of operations to be conducted.
- If respiratory protective equipment will be used to limit inhalation of airborne licensed material, follow the provisions of OAC 3701:1-38-16.

# Appendix G

## Sample Audit Program

## Sample Audit Program

The following audit form may be used by licensees to self-assess the adequacy of the licensed program, identify program weaknesses and allow licensees to take early corrective actions (before an inspection). This form is not intended to be all inclusive. During an audit, the auditor needs to keep in mind not only the requirements of the ODH's regulations but also the licensee's commitments in its applications and other correspondence with the ODH. Licensees are encouraged to modify the audit form as needed to include items specific to their licensed program. The auditor should also evaluate whether the licensee is maintaining exposures to workers and the general public as low as is reasonably achievable (ALARA) and if not make suggestions for improvement. References are included at the end of this audit form.

1. **MANAGEMENT OVERSIGHT:**  
(Management support to radiation safety; RSC; RSO; program audits, including annual reviews of program and ALARA reviews; control by authorized users; appropriate follow-up on events and previous audit/inspection findings)
2. **AMENDMENTS AND PROGRAM CHANGES:**  
(Amendments to the license were properly implemented; if applicable, program and procedural changes were approved and implemented in accordance with license condition)
3. **FACILITIES:**  
(Facilities as described in license; uses; control of access; engineering controls; calibration facilities; shielding; air flow)
4. **EQUIPMENT AND INSTRUMENTATION:**  
(Operable and calibrated survey equipment; procedures; OAC 3701:1-38-23)
5. **MATERIAL USE, CONTROL, AND TRANSFER:**  
(Materials and uses authorized; security and control of licensed materials; and procedures for receipt and transfer of licensed material)
6. **AREA RADIATION SURVEYS AND CONTAMINATION CONTROL:**  
(Radiological surveys; air sampling; leak tests; inventories; handling of radioactive materials; contamination controls; records; and public doses)
7. **TRAINING AND INSTRUCTIONS TO WORKERS:**  
(Training and retraining requirements and documentation; interviews and observations of routine work; staff knowledge of all routine activities; OAC 3701:1-38 requirements; emergency situations; and supervision by authorized users)
8. **RADIATION PROTECTION:**  
(Radiation protection program with ALARA provisions; external and internal dosimetry; exposure evaluations; dose and survey records and reports; annual notifications to workers; bulletins and other generic communications)
9. **RADIOACTIVE WASTE MANAGEMENT:**  
(Disposal; effluent pathways and control; storage areas; transfer; packaging, control, and tracking procedures; equipment; incinerators, hoods, vents, and compactors; license conditions for special disposal method)

**10. DECOMMISSIONING:**

(Records relevant to decommissioning; decommissioning plan/schedule; notification requirements; cost estimates; funding methods; financial assurance; and Timeliness Rule requirements; changes in radiological conditions since decommissioning plan was submitted)

**11. TRANSPORTATION:**

(Quantities and types of licensed material shipped; packaging design requirements; shipping papers; hazardous materials (HAZMAT) communication procedures; return of sources; procedures for monitoring radiation and contamination levels of packages; HAZMAT training; and records and reports)

**12. NOTIFICATIONS AND REPORTS:**

(Reporting and follow-up of theft, loss, incidents and overexposures. Notification of change in RSO and/or authorized user. Radiation exposure reports provided to individuals.)

**13. POSTING AND LABELING:**

(Notices; license documents; regulations; bulletins and generic information; posting of radiation areas; and labeling of containers of licensed material)

**14. INDEPENDENT AND CONFIRMATORY MEASUREMENTS:**

(Areas surveyed, both restricted and unrestricted, and measurements made; comparison of data with staff's results and regulations)

**15. AUDIT FINDINGS:**

A. Management Oversight

1. Radiation Safety Committee

Applicable license conditions

2. Radiation Safety Officer

Applicable license conditions

3. Audits, Reviews, or Inspections

OAC 3701:1-38-11 Radiation protection programs

OAC 3701:1-38-20(B) Records of radiation protection programs

4. ALARA

OAC 3701:1-38-11 Radiation protection programs

5. Authorized Users

Applicable license conditions

B. Amendments and Program Changes:

Applicable license conditions

C. Facilities

1. Access Control

<input type="checkbox"/>	OAC 3701:1-38-15	Control of access to high/very high radiation areas
<input type="checkbox"/>	OAC 3701:1-38-17	Security of stored material
<input type="checkbox"/>	OAC 3701:1-38-17(B)	Control of material not in storage
<input type="checkbox"/>	Applicable license conditions	

2. Engineering Controls

<input type="checkbox"/>	OAC 3701:1-38-11	Radiation protection programs
<input type="checkbox"/>	OAC 3701:1-38-16(A)	Use of process or other engineering controls
<input type="checkbox"/>	Applicable license conditions	

D. Equipment and Instrumentation

1. Survey Instruments

<input type="checkbox"/>	OAC 3701:1-38-14	General
<input type="checkbox"/>	OAC 3701:1-38-16(A)	Use of Process or Other Engineering Controls
<input type="checkbox"/>	OAC 3701:1-38-20(C)	Calibration Records
<input type="checkbox"/>	Applicable license conditions	

2. Safety Component Defects

<input type="checkbox"/>	OAC 3701:1-38-23(E)	Notification of failure to comply or existence of a defect and its evaluation
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E. Material Use, Control and Transfer

1. License and applicable license conditions

2. Security and Control

<input type="checkbox"/>	OAC 3701:1-38-01	Definitions (restricted area and unrestricted area)
<input type="checkbox"/>	OAC 3701:1-38-17	Security of stored material
<input type="checkbox"/>	OAC 3701:1-38-17(B)	Control of material not in storage

3. Receipt and Transfer of Licensed Material

<input type="checkbox"/>	OAC 3701:1-38-13(E)	Compliance with dose limits for individual members of the public
<input type="checkbox"/>	OAC 3701:1-38-18	Procedures for receiving and opening packages
<input type="checkbox"/>	OAC 3701:1-38-14	Surveys
<input type="checkbox"/>	OAC 3701:1-38-20(C)	Records of surveys

<input type="checkbox"/>	OAC 3701:1-40-19	Transfer of byproduct material
<input type="checkbox"/>	OAC 3701:1-40-21(A)	Records of receipt and transfer

F. Area Radiation Surveys And Contamination Control

1. Area Surveys

<input type="checkbox"/>	OAC 3701:1-38-13(E)	Compliance with dose limits for individual members of the public
<input type="checkbox"/>	OAC 3701:1-38-14	General
<input type="checkbox"/>	OAC 3701:1-38-20(C)	Records of surveys
<input type="checkbox"/>	OAC 3701:1-38-20(J)	Records of dose to individual members of the public
<input type="checkbox"/>	Applicable license conditions	

2. Leak Tests and Inventories

<input type="checkbox"/>	Applicable license conditions
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G. Training And Instructions To Workers

1. General

<input type="checkbox"/>	OAC 3701:1-38-10(B)	Instruction to workers
<input type="checkbox"/>	Knowledge of OAC 3701:1-38 radiation protection procedures and requirements	
<input type="checkbox"/>	Applicable license conditions	

H. Radiation Protection

1. Radiation Protection Program

**Exposure Evaluation**

<input type="checkbox"/>	OAC 3701:1-38-14	General
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**Programs**

<input type="checkbox"/>	OAC 3701:1-38-11	Radiation protection programs
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2. Dosimetry

**Dose Limits**

<input type="checkbox"/>	OAC 3701:1-38-12(A)	Occupational dose limits for adults
<input type="checkbox"/>	OAC 3701:1-38-12(B)	Compliance with requirements for summation of external and internal doses
<input type="checkbox"/>	OAC 3701:1-38-12(G)	Occupational dose limits for minors
<input type="checkbox"/>	OAC 3701:1-38-12(H)	Doses to an embryo/fetus

<b>External</b>		
<input type="checkbox"/>	OAC 3701:1-38-12(C)	Determination of external dose from airborne radioactive material
<input type="checkbox"/>	OAC 3701:1-38-14	General
<input type="checkbox"/>	OAC 3701:1-38-14(B)	Conditions requiring individual monitoring of external and internal occupational dose
<input type="checkbox"/>	Applicable license conditions	
<b>Internal</b>		
<input type="checkbox"/>	OAC 3701:1-38-12(D)	Determination of internal exposure
<input type="checkbox"/>	OAC 3701:1-38-14(B)	Conditions requiring individual monitoring of external and internal occupational dose
<input type="checkbox"/>	OAC 3701:1-38-16	Respiratory protection and controls to restrict internal exposure in restricted areas
3.	Records	
<input type="checkbox"/>	OAC 3701:1-38-20(B)	Records of radiation protection programs
<input type="checkbox"/>	OAC 3701:1-38-20(C)	Records of surveys
<input type="checkbox"/>	OAC 3701:1-38-20	Determination of prior occupational dose
<input type="checkbox"/>	OAC 3701:1-38-20(H)	Records of individual monitoring results

I. Radioactive Waste Management

1. Disposal

<input type="checkbox"/>	OAC 3701:1-38-18(C)(1)	Labeling containers
<input type="checkbox"/>	OAC 3701:1-38-19(A)	General requirements
<input type="checkbox"/>	OAC 3701:1-38-20(C)	Records of surveys
<input type="checkbox"/>	OAC 3701:1-38-20(K)	Records of waste disposal
<input type="checkbox"/>	OAC 3701:1-38-19(D)	Disposal by release into sanitary sewerage

2. Effluents

**General**

<input type="checkbox"/>	Applicable license conditions
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**Release to septic tanks**

<input type="checkbox"/>	OAC 3701:1-38-01	Definitions (sanitary sewerage)
<input type="checkbox"/>	OAC 3701:1-38-12, App. C, Table 2	Effluent Concentrations

**Incineration of waste**

OAC 3701:1-38-19(F) Treatment or disposal by incineration

**Control of air effluents and ashes**

- OAC 3701:1-38-12(A) Occupational dose limits for adults
- OAC 3701:1-38-13(A) Dose limits for individual members of the public
- OAC 3701:1-38-14 General
- OAC 3701:1-38-16(A) Use of process or other engineering controls
- Applicable license conditions

3. Waste Management

**General**

OAC 3701:1-38-19(A) General requirements

**Waste compacted**

Applicable license conditions

**Waste storage areas**

- OAC 3701:1-38-17 Security of stored material
- OAC 3701:1-38-18(A) Posting requirements
- OAC 3701:1-38-18(C) Labeling containers
- Applicable license conditions

**Packaging, Control and Tracking**

- OAC 3701:1-38-19 App. A Requirements for Low-Level Waste Transfer for Disposal at Land Disposal Facilities and manifests
- OAC 3701:1-38-19(H) Transfer for disposal and manifests

**Transfer**

- OAC 3701:1-38-19 App. A Requirements for Low-Level Waste Transfer for Disposal at Land Disposal Facilities and Manifests
- OAC 3701:1-38-19(A) General requirements
- OAC 3701:1-38-19(H) Transfer for disposal and manifests

**Records**

- OAC 3701:1-38-20(C) Records of surveys
- OAC 3701:1-38-20(K) Records of waste disposal

J. Decommissioning

	OAC 3701:1-40-17	Financial assurance and record keeping for Decommissioning
	OAC 3701:1-40-18	Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas

K. Transportation

1. General

	OAC 3701:1-50-05	Transportation of licensed material
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2. Shippers - Requirements for Shipments and Packaging

**General Requirements**

	49 CFR 173, Sub. I	Class 7 (radioactive) materials
	49 CFR 173.24	General requirements for packaging and packages
	49 CFR 173.448	General transportation requirements
	49 CFR 173.435	Table of A1 and A2 values for radionuclides

**Transport Quantities**

	OAC 3701:1-50-01	Definitions
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**All Quantities**

	49 CFR 173.410	General design requirements
	49 CFR 173.431	Activity limits Type A and Type B
	49 CFR 173.441	Radiation level limitations
	49 CFR 173.443	Contamination control
	49 CFR 173.475	Quality control requirements prior to each shipment of Class 7 (radioactive) materials
	49 CFR 173.476	Approval of special form Class 7 (radioactive) materials

**Limited quantities**

	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

**Type A quantities**

	49 CFR 173.412	Additional design requirements for Type A packages
	49 CFR 173.415	Authorized Type A packages

<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 178.350	Specification 7A; general packaging, Type A
<b>Type B quantities</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 173.416	Authorized Type B packages
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 173.467	Package testing
<b>LSA material and SCO</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 173.403	Definitions
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 173.427	Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO)
<b>3. HAZMAT Communication Requirements</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.200-205	Shipping Papers
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.300-338	Marking
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.400-450	Labeling
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.500-560	Placarding
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.600-604	Emergency response information
<b>4. HAZMAT Training</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.702	Applicability and responsibility for training and testing
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 172.704	Training requirements
<b>5. Transportation by Public Highway</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 171.15	Immediate notice of certain hazardous materials incidents
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 171.16	Detailed hazardous materials incident reports
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 177.800	Purpose and scope of this part and responsibility for compliance and training
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 177.816	Driver training
<input style="width: 40px; height: 20px;" type="checkbox"/>	49 CFR 177.842	Class 7 (radioactive) material
<b>L. Notifications And Reports</b>		
<input style="width: 40px; height: 20px;" type="checkbox"/>	OAC 3701:1-38-10(C)	Notifications and reports to individuals
<input style="width: 40px; height: 20px;" type="checkbox"/>	OAC 3701:1-38-21	Reports of theft or loss of licensed material
<input style="width: 40px; height: 20px;" type="checkbox"/>	OAC 3701:1-38-21(B)	Notification of incidents

	OAC 3701:1-38-21(C)	Reports of exposures, radiation levels, and concentrations of radioactive material exceeding the constraints or limits
	OAC 3701:1-40-20	Reporting requirements

M. Posting And Labeling

	OAC 3701:1-38-10(A)	Posting of notices to workers
	OAC 3701:1-38-23(E)	Posting requirements
	OAC 3701:1-38-18(A)	Posting requirements
	OAC 3701:1-38-18(B)	Exemptions to posting requirements
	OAC 3701:1-38-18(C)	Labeling containers
	OAC 3701:1-38-18(D)	Exemptions to labeling containers

# Appendix H

## Reporting Requirements

**Table H.1 Reporting Requirements**

<b>Event</b>	<b>Telephone Notification</b>	<b>Written Report</b>	<b>Regulatory Requirement</b>
Theft or loss of material	immediate	30 days	OAC 3701:1-38-21(A)(1)(b)(i)
Whole body dose greater than 0.25 Sv (25 rems)	immediate	30 days	OAC 3701:1-38-21(B)(1)(a)(i)
Extremity dose greater than 2.5 Sv (250 rems)	immediate	30 days	OAC 3701:1-38-21(B)(1)(b)(iii)
Whole body dose greater than 0.05 Sv (5 rems) in 24 hours	24 hours	30 days	OAC 3701:1-38-21(B)(2)(a)(i)
Extremity dose greater than 0.5 Sv (50 rems) in 24 hours	24 hours	30 days	OAC 3701:1-38-21(B)(2)(a)(iii)
Whole body dose greater than 0.05 Sv (5 rems)	none	30 days	OAC 3701:1-38-21(C)(1)(a)(i)
Dose to individual member of public greater than 1 mSv (100 mrems)	none	30 days	OAC 3701:1-38-21(C)(1)(a)(iv)
Defect in equipment that could create a substantial safety hazard	2 days	30 days	OAC 3701:1-38-23(B)(1)
Event that prevents immediate protective actions necessary to avoid exposure to radioactive materials that could exceed regulatory limits	immediate	30 days	OAC 3701:1-40-20(A)
Equipment is disabled or fails to function as designed when required to prevent radiation exposure in excess of regulatory limits	24 hours	30 days	OAC 3701:1-40-20(B)(2)
Unplanned fire or explosion that affects the integrity of any licensed material or device, container or equipment with licensed material	24 hours	30 days	OAC 3701:1-40-20(B)(4)

# Appendix I

## General Topics for Safe Use of Radionuclides and Model Emergency Procedures

## GENERAL TOPICS FOR SAFE USE OF RADIONUCLIDES

Each laboratory or area where radioactive material is used or stored should have general rules so that workers know what is required. Typical instructions should include:

- Wear a laboratory coat or other protective clothing at all times in areas where licensed materials are used.
- Wear disposable gloves at all times when handling licensed materials.
- After each procedure or before leaving the area, monitor hands, shoes and clothing for contamination in a low-background area.
- Do not eat, drink, smoke or apply cosmetics in any area where licensed material is stored or used.
- Do not store food, drink or personal effects in areas where licensed material is stored or used.
- Wear personnel monitoring devices, if required, at all times while in areas where licensed materials are used or stored.
- Dispose of radioactive waste only in designated, labeled and properly shielded receptacles.
- Never pipette by mouth.
- Store radioactive solutions in clearly labeled containers.
- Secure all licensed material when it is not under the constant surveillance and immediate control of the user(s).

### Radionuclides-specific Procedures

Licensees should develop written procedures for use of different radionuclides so that users know the types of shielding, protective clothing, survey instruments, surveys and decontamination activities that are required. Examples of such procedures are included below.

#### Example 1:

If requesting more than 37 MBq (1 mCi) of iodine-125 or iodine-131, special safety instructions should be provided to users, including the following:

- A mandatory radiation survey and wipe test for radioactive contamination after each use.
- Bioassay procedures for individuals working with millicurie quantities of radioiodine.
- The use of vented hoods for iodination and for the storage of millicurie quantities of radioiodine.
- A dry run prior to the performance of unfamiliar procedures, in order to preclude unexpected complications. In addition, it is recommended that the RSO be present during new procedures.
- Procedures for measuring the concentration of radioiodine effluents from the hoods.

**Example 2:**

If requesting more than 37 MBq (1 mCi) of phosphorus-32, special safety instructions should be provided to users, including the following:

- The use of low-density plastic shielding in order to keep bremsstrahlung radiation to a minimum.
- A mandatory radiation survey and wipe test for radioactive contamination after each use.
- The use of extremity monitors for procedures that involve one millicurie or more.
- A dry run prior to the performance of unfamiliar procedures, in order to preclude unexpected complications.
- In addition, it is recommended that the RSO be present during new procedures.
- The use of eye protection for procedures that involve 10 millicuries or more.

## MODEL PROCEDURES FOR HANDLING EMERGENCIES

### General Safety Procedures to Handle Spills

- Name and telephone number of RSO or an alternate person(s) should be posted conspicuously in areas of use, so it is readily available to workers in case of emergencies.
- Licensee should have emergency equipment readily available for handling spills. Spill kits should include the following:
  - Disposable gloves.
  - Housekeeping gloves.
  - Disposable lab coats.
  - Disposable head coverings.
  - Disposable shoe covers.
  - Roll of absorbent paper with plastic backing.
  - Masking tape.
  - Plastic trash bags with twist ties.
  - "Radioactive Material" labeling tape.
  - Marking pen.
  - Pre-strung "Radioactive Material" labeling tags.
  - Box of Wipes.
  - Instructions for "Emergency Procedures."
  - Clipboard with a copy of the Radioactive Spill Report Form for the facility.
  - Pencil.
  - Appropriate survey instruments, including batteries (for survey meters).

The decision to implement a major spill procedure instead of a minor spill procedure depends on many incident-specific variables, such as the number of individuals affected; other hazards present; the likelihood of spread of contamination and types of surfaces contaminated as well as the radiotoxicity of the spilled material. For some spills of short-lived radionuclides, the best spill procedure may be restricted access pending complete decay. The applicant should establish criteria for determining when the major spill procedure and minor spill procedure should be utilized.

## Minor Spills of Liquids and Solids

- Instructions to Workers
  - Notify persons in the area that a spill has occurred.
  - Prevent the spread of contamination by covering the spill with absorbent paper. (Paper should be dampened if solids are spilled.)
  - Clean up the spill, wearing disposable gloves and using absorbent paper.
  - Carefully fold the absorbent paper with the clean side out and place in a plastic bag for transfer to a radioactive waste container. Put contaminated gloves and any other contaminated disposable material in the bag.
  - Survey the area with an appropriate low-range radiation detector survey meter or other appropriate technique. Check the area around the spill for contamination. Also check hands, clothing and shoes for contamination.
  - Report the incident to the RSO promptly.
  - Allow no one to return to work in the area unless approved by the RSO.
  - Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
  - Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Reminders to RSO
  - Follow up on the decontamination activities and document the results.
  - As appropriate, determine cause and corrective actions needed; consider bioassays, if there is a potential for internal contamination.
  - If necessary, notify the ODH.

## Major Spills of Liquids and Solids

- Instructions to Workers
  - Clear the area. If appropriate, survey all persons not involved in the spill and vacate the room.
  - Prevent the spread of contamination by covering the spill with absorbent paper (paper should be dampened if solids are spilled), but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all personnel who may be contaminated.
  - Shield the source only if it can be done without further contamination or significant increase in radiation exposure.
  - Close the room and lock or otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to enter that a spill of radioactive material has occurred.
  - Notify the RSO immediately.
  - Survey all personnel who could possibly have been contaminated. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with a mild soap.

- Allow no one to return to work in the area unless approved by the RSO.
- Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Reminders to RSO
  - Confirm decontamination of personnel. If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
  - Supervise decontamination activities and document the results. Documentation should include location of surveys and decontamination results.
  - Determine cause and needed corrective actions; consider need for bioassays if licensed material is suspected to have been ingested, inhaled or absorbed through or injected under the skin. (Document incident)
  - If necessary, notify the ODH.

### **Incidents Involving Radioactive Dusts, Mists, Fumes, Organic Vapors and Gases**

- Instructions to Workers
  - Notify all personnel to vacate the room immediately.
  - Shut down ventilation system, if possible, unless it is determined that the room ventilation system needs to be used to clear the air for access purposes.
  - Vacate the room. Seal the area, if possible.
  - Notify the RSO immediately.
  - Ensure all access doors to the area are closed and posted with radiation warning signs, or post guards (trained) at all access doors to prevent accidental opening of the doors or entry to the area.
  - Survey all persons who could have possibly been contaminated. Decontaminate as directed by the RSO.
  - Promptly report suspected inhalations and ingestions of licensed material to the RSO.
  - Decontaminate the area only when advised and/or supervised by the RSO.
  - Allow no one to return to work in the area unless approved by the RSO.
  - Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
  - Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision and collection of bioassay samples, requested documentation).
- Reminders to RSO
  - Supervise decontamination activities.
  - Perform air sample surveys in the area before permitting resumption of work with licensed materials.

- Provide written directions to potentially contaminated individuals about providing and collecting urine, breath, blood or fecal samples, etc.
- Consider need for medical exam and/or whole body count before permitting involved individuals to return to work with licensed material.
- Determine cause and corrective actions needed; consider need for bioassays if licensed material is suspected to have been ingested, inhaled, or absorbed through or injected under the skin. (Document incident)
- If necessary, notify the ODH.

### **Minor Fires**

- Instructions to Workers
  - Immediately attempt to put out the fire by approved methods (e.g., fire extinguisher) if other fire hazards or radiation hazards are not present.
  - Notify all persons present to vacate the area and have one individual immediately call the RSO and fire department (as instructed by RSO).
  - Once the fire is out, isolate the area to prevent the spread of possible contamination.
  - Survey all persons involved in combating the fire for possible contamination.
  - Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water, then washing with a mild soap.
  - In consultation with the RSO, determine a plan of decontamination and the types of protective devices and survey equipment that will be necessary to decontaminate the area.
  - Allow no one to return to work in the area unless approved by the RSO.
  - Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
  - Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Reminders to RSO
  - Supervise decontamination activities.
  - If decontamination of personnel was not fully successful, consider inducing perspiration by covering the area with plastic. Then wash the affected area again to remove any contamination that was released by the perspiration.
  - Consult with fire safety officials to assure there is no other possibility of another fire starting.
  - Determine cause and needed corrective actions; consider need for bioassays if licensed material is suspected to have been ingested, inhaled or absorbed through or injected under the skin. (Document incident)
  - If necessary, notify the ODH.

### **Fires, Explosions, or Major Emergencies**

- Instructions to Workers
  - Notify all persons in the area to leave immediately.

- Notify the fire department.
- Notify the RSO and other facility safety personnel.
- Upon arrival of firefighters, inform them where radioactive materials are stored or where radioactive materials were being used; inform them of the present location of the licensed material and the best possible entrance route to the radiation area, as well as any precautions to avoid exposure or risk of creating radioactive contamination by use of high pressure water, etc.
- Cooperate with the RSO and/or the RSO's staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Allow no one to return to work in the area unless approved by the RSO.
- Follow the instructions of the RSO and/or the RSO's staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).
- Reminders to RSO
  - Coordinate activities with facility's industrial hygienist or environmental health & safety office and with local fire department.
  - Consult with the firefighting personnel and set up a controlled area where the firefighters can be surveyed for contamination of their protective clothing and equipment after the fire is extinguished.
  - Once the fire is extinguished, advise the firefighters not to enter potentially contaminated areas or areas where radioactive sources may be present until a thorough evaluation and survey are performed to determine the extent of the damage to the licensed material use and storage areas.
  - Perform thorough contamination surveys of the firefighters and their equipment before they leave the controlled area and decontaminate if necessary. Supervise decontamination activities.
  - Consider bioassays if licensed material is suspected to have been ingested, inhaled or absorbed through or injected under the skin. (Document incident)
  - If necessary, notify the ODH.

Copies of emergency procedures should be provided to all users. Post a current copy in each laboratory or other area where radioactive material is used.

### **Procedures for Collecting Bioassay Samples**

In the event of an emergency where an individual may become contaminated and radioactive material was taken into the body through skin absorption or other means, or is suspected of having ingested or inhaled radioactive material, an estimate of the amount of material taken into the body may be required. The following items should be considered in developing your procedures:

- The type of bioassay that must be performed (direct or indirect).
- The number of samples or data points to be collected.
- The frequency of sampling (hourly, daily, weekly, once, etc.).
- The size of the sample to be collected (24-hour urine collection).

- The ease/difficulty of sample collection.
- The need for written instructions to be provided to the sample collector, who may be the contaminated individual.

## Appendix J

# Transportation Requirements

## **Selected outline of DOT regulations applying radioactive materials**

### **49 CFR PART 172--HAZARDOUS MATERIALS TABLE, SPECIAL PROVISIONS, HAZARDOUS MATERIALS COMMUNICATIONS, EMERGENCY RESPONSE INFORMATION AND TRAINING REQUIREMENTS**

#### Subpart A - GENERAL

§172.1 Purpose and scope.

§172.3 Applicability.

#### Subpart B - TABLE OF HAZARDOUS MATERIALS AND SPECIAL PROVISIONS

§172.101 Purpose and use of hazardous materials table.

§172.102 Special provisions.

#### Subpart C - SHIPPING PAPERS

§172.200 Applicability.

§172.201 Preparation and retention of shipping papers.

§172.202 Description of hazardous material on shipping papers.

§172.203 Additional description requirements.

§172.204 Shipper's certification.

§172.205 Hazardous waste manifest.

#### Subpart D - MARKING

§172.300 Applicability.

§172.301 General marking requirements for non-bulk packagings.

§172.302 General marking requirements for bulk packagings.

§172.303 Prohibited marking.

§172.304 Marking requirements.

§172.308 Authorized abbreviations.

§172.310 Class 7 (radioactive) materials.

§172.312 Liquid hazardous materials in non-bulk packagings.

§172.315 Packages containing limited quantities.

§172.317 KEEP AWAY FROM HEAT handling mark.

§172.324 Hazardous substances in non-bulk packagings.

§172.325 Elevated temperature materials.

§172.326 Portable tanks.

§172.328 Cargo tanks.

§172.330 Tank cars and multi-unit tank car tanks.

§172.331 Bulk packagings other than portable tanks, cargo tanks, tank cars and multi-unit tank car tanks.

§172.332 Identification number markings.

§172.334 Identification numbers; prohibited display.

§172.336 Identification numbers; special provisions.

§172.338 Replacement of identification numbers.

#### Subpart E - LABELING

§172.400 General labeling requirements.

§172.400a Exceptions from labeling.

- §172.401 Prohibited labeling.
- §172.402 Additional labeling requirements.
- §172.403 Class 7 (radioactive) material.
- §172.404 Labels for mixed and consolidated packaging.
- §172.405 Authorized label modifications.
- §172.406 Placement of labels.
- §172.407 Label specifications.
- §172.436 RADIOACTIVE WHITE-I label.
- §172.438 RADIOACTIVE YELLOW-II label.
- §172.440 RADIOACTIVE YELLOW-III label.
- §172.441 FISSILE label.
- §172.448 CARGO AIRCRAFT ONLY label.
- §172.450 EMPTY label.

#### Subpart F - PLACARDING

- §172.500 Applicability of placarding requirements.
- §172.502 Prohibited and permissive placarding.
- §172.503 Identification number display on placards.
- §172.504 General placarding requirements.
- §172.505 Placarding for subsidiary hazards.
- §172.506 Providing and affixing placards: Highway.
- §172.507 Special placarding provisions: Highway.
- §172.508 Placarding and affixing placards: Rail.
- §172.510 Special placarding provisions: Rail.
- §172.512 Freight containers and aircraft unit load devices.
- §172.514 Bulk packagings.
- §172.516 Visibility and display of placards.
- §172.519 General specifications for placards.
- §172.527 Background requirements for certain placards.

#### Subpart G - EMERGENCY RESPONSE INFORMATION

- §172.600 Applicability and general requirements.
- §172.602 Emergency response information.
- §172.604 Emergency response telephone number.
- §172.606 Carrier information contact.

#### Subpart H - TRAINING

- §172.700 Purpose and scope.
- §172.701 Federal-State relationship.
- §172.702 Applicability and responsibility for training and testing.
- §172.704 Training requirements.

#### Subpart I - SECURITY PLANS

- §172.800 Purpose and applicability.
- §172.802 Components of a security plan.
- §172.804 Relationship to other Federal requirements.

Appendix A to Part 172 --Office of Hazardous Materials Transportation Color Tolerance Charts and Tables

Appendix B to Part 172 --Trefoil Symbol

**49 CFR PART 173 - SHIPPERS - GENERAL REQUIREMENTS FOR SHIPMENTS AND PACKAGINGS**

Subpart A - GENERAL

- §173.1 Purpose and scope.
- §173.2 Hazardous materials classes and index to hazard class definitions.
- §173.2a Classification of a material having more than one hazard.
- §173.3 Packaging and exceptions.
- §173.4 Small quantity exceptions.
- §173.6 Materials of trade exceptions.
- §173.12 Exceptions for shipment of waste materials.

Subpart B - PREPARATION OF HAZARDOUS MATERIALS FOR TRANSPORTATION

- §173.21 Forbidden materials and packages.
- §173.22 Shipper's responsibility.
- §173.22a Use of packagings authorized under exemptions.
- §173.23 Previously authorized packaging.
- §173.24 General requirements for packagings and packages.
- §173.24a Additional general requirements for non-bulk packagings and packages.
- §173.24b Additional general requirements for bulk packagings.
- §173.25 Authorized packagings and overpacks.
- §173.26 Quantity limitations.
- §173.27 General requirements for transportation by aircraft.
- §173.28 Reuse, reconditioning and remanufacture of packagings.
- §173.29 Empty packagings.
- §173.30 Loading and unloading of transport vehicles.
- §173.31 Use of tank cars.
- §173.32 Requirements for the use of portable tanks.
- §173.33 Hazardous materials in cargo tank motor vehicles.
- §173.35 Hazardous materials in IBCs.
- §173.40 General packaging requirements for toxic materials packaged in cylinders.

Subpart I - CLASS 7 (RADIOACTIVE) MATERIALS

- §173.401 Scope.
- §173.403 Definitions.
- §173.410 General design requirements.
- §173.411 Industrial packagings.
- §173.412 Additional design requirements for Type A packages.
- §173.413 Requirements for Type B packages.
- §173.415 Authorized Type A packages.
- §173.416 Authorized Type B packages.
- §173.417 Authorized fissile materials packages.
- §173.418 Authorized packages--pyrophoric Class 7 (radioactive) materials.
- §173.419 Authorized packages--oxidizing Class 7 (radioactive) materials.
- §173.420 Uranium hexafluoride (fissile, fissile excepted and non-fissile).
- §173.421 Excepted packages for limited quantities of Class 7 (radioactive) materials.
- §173.422 Additional requirements for excepted packages containing Class 7 (radioactive) materials.
- §173.423 Requirements for multiple hazard limited quantity Class 7 (radioactive) materials.

§173.424 Excepted packages for radioactive instruments and articles.  
§173.425 Table of activity limits--excepted quantities and articles.  
§173.426 Excepted packages for articles containing natural uranium or thorium.  
§173.427 Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO).  
§173.428 Empty Class 7 (radioactive) materials packaging.  
§173.431 Activity limits for Type A and Type B packages.  
§173.433 Requirements for determining basic radionuclide values, and for the listing of radionuclides on shipping papers and labels.  
§173.434 Activity-mass relationships for uranium and natural thorium.  
§173.435 Table of A1 and A2 values for radionuclides.  
§173.436 Exempt material activity concentrations and exempt consignment activity limits for radionuclides.  
§173.441 Radiation level limitations and exclusive use provisions.  
§173.442 Thermal limitations.  
§173.443 Contamination control.  
§173.447 Storage incident to transportation--general requirements.  
§173.448 General transportation requirements.  
§173.453 Fissile materials--exceptions.  
§173.457 Transportation of fissile material packages--specific requirements.  
§173.459 Mixing of fissile material packages with non-fissile or fissile-excepted material packages.  
§173.461 Demonstration of compliance with tests.  
§173.462 Preparation of specimens for testing.  
§173.465 Type A packaging tests.  
§173.466 Additional tests for Type A packagings designed for liquids and gases.  
§173.467 Tests for demonstrating the ability of Type B and fissile materials packagings to withstand accident conditions in transportation.  
§173.468 Test for LSA-III material.  
§173.469 Tests for special form Class 7 (radioactive) materials.  
§173.471 Requirements for U.S. Nuclear Regulatory Commission approved packages.  
§173.472 Requirements for exporting DOT Specification Type B and fissile packages.  
§173.473 Requirements for foreign-made packages.  
§173.474 Quality control for construction of packaging.  
§173.475 Quality control requirements prior to each shipment of Class 7 (radioactive) materials.  
§173.476 Approval of special form Class 7 (radioactive) materials.  
§173.477 Approval of packagings containing greater than 0.1 kg of non-fissile or fissile-excepted uranium hexafluoride.

Appendix B to Part 173 --Procedure for Testing Chemical Compatibility and Rate of Permeation in Plastic Packaging and Receptacles

Appendix C to Part 173 --Procedure for Base-level Vibration Testing

Appendix H to Part 173 --Method of Testing for Sustained Combustibility

## **49 CFR PART 177 - CARRIAGE BY PUBLIC HIGHWAY**

### **Subpart A - GENERAL INFORMATION AND REGULATIONS**

§ 177.800 Purpose and scope of this part and responsibility for compliance and training.  
§ 177.801 Unacceptable hazardous materials shipments.  
§ 177.802 Inspection.  
§ 177.804 Compliance with Federal Motor Carrier Safety Regulations.  
§ 177.810 Vehicular tunnels.

- § 177.816 Driver training.
- § 177.817 Shipping papers.
- § 177.823 Movement of motor vehicles in emergency situations.

#### Subpart B - LOADING AND UNLOADING

- § 177.834 General requirements.
- § 177.842 Class 7 (radioactive) material.
- § 177.843 Contamination of vehicles.

#### Subpart C - SEGREGATION AND SEPARATION CHART OF HAZARDOUS MATERIALS

- § 177.848 Segregation of hazardous materials.

#### Subpart D - VEHICLES AND SHIPMENTS IN TRANSIT; ACCIDENTS

- § 177.854 Disabled vehicles and broken or leaking packages; repairs.

#### Subpart E - REGULATIONS APPLYING TO HAZARDOUS MATERIAL ON MOTOR VEHICLES CARRYING PASSENGERS FOR HIRE

- § 177.870 Regulations for passenger carrying vehicles.

### **49 CFR PART 178 - SPECIFICATIONS FOR PACKAGINGS**

- § 178.1 Purpose and scope.
- § 178.2 Applicability and responsibility.
- § 178.3 Marking of packagings.

Subpart B - Specifications for Inside Containers, and Linings

Subpart C - Specifications for Cylinders

Subpart H - Specifications for Portable Tanks

Subpart J - Specifications for Containers for Motor Vehicle Transportation

#### Subpart K - SPECIFICATIONS FOR PACKAGINGS FOR CLASS 7 (RADIOACTIVE) MATERIALS

- § 178.350 Specification 7A; general packaging, Type A.
- § 178.356 Specification 20PF phenolic-foam insulated, metal overpack.
  - § 178.356-1 General requirements.
  - § 178.356-2 Materials of construction and other requirements.
  - § 178.356-3 Tests.
  - § 178.356-4 Required markings.
  - § 178.356-5 Typical assembly detail.
- § 178.358 Specification 21PF fire and shock resistant, phenolic-foam insulated, metal overpack.
  - § 178.358-1 General requirements.
  - § 178.358-2 Materials of construction and other requirements.
  - § 178.358-3 Modification of Specification 21PF-1 overpacks.
  - § 178.358-4 Construction of Specification 21PF-1B overpacks.
  - § 178.358-5 Required markings.
  - § 178.358-6 Typical assembly detail.

- § 178.360 Specification 2R; inside containment vessel.
- § 178.360-1 General requirements.
- § 178.360-2 Manufacture.
- § 178.360-3 Dimensions.
- § 178.360-4 Closure devices.

#### Subpart L - NON-BULK PERFORMANCE-ORIENTED PACKAGING STANDARDS

- § 178.500 Purpose, scope and definitions.
- § 178.502 Identification codes for packagings.
- § 178.503 Marking of packagings.
- § 178.504 Standards for steel drums.
- § 178.505 Standards for aluminum drums.
- § 178.506 Standards for metal drums other than steel or aluminum.
- § 178.507 Standards for plywood drums.
- § 178.508 Standards for fiber drums.
- § 178.509 Standards for plastic drums and jerricans.
- § 178.510 Standards for wooden barrels.
- § 178.511 Standards for aluminum and steel jerricans.
- § 178.512 Standards for steel or aluminum boxes.
- § 178.513 Standards for boxes of natural wood.
- § 178.514 Standards for plywood boxes.
- § 178.515 Standards for reconstituted wood boxes.
- § 178.516 Standards for fiberboard boxes.
- § 178.517 Standards for plastic boxes.
- § 178.518 Standards for woven plastic bags.
- § 178.519 Standards for plastic film bags.
- § 178.520 Standards for textile bags.
- § 178.521 Standards for paper bags.
- § 178.522 Standards for composite packagings with inner plastic receptacles.
- § 178.523 Standards for composite packagings with inner glass, porcelain, or stoneware receptacles.

#### Subpart M - TESTING OF NON-BULK PACKAGINGS AND PACKAGES

- § 178.600 Purpose and scope.
- § 178.601 General requirements.
- § 178.602 Preparation of packagings and packages for testing.
- § 178.603 Drop test.
- § 178.604 Leakproofness test. << "packing group" >>
- § 178.605 Hydrostatic pressure test.
- § 178.606 Stacking test.
- § 178.607 Cooperage test for bung-type wooden barrels.
- § 178.608 Vibration standard.
- § 178.609 Test requirements for packagings for infectious substances.

#### Subpart N - IBC Performance-Oriented Standards

#### Subpart O - Testing of IBCs

#### Appendix A to Part 178 - Specifications for Steel

#### Appendix B to Part 178 - Alternative Leakproofness Test Methods

#### Appendix C to Part 178 - Nominal and Minimum Thicknesses of Steel Drums and Jerricans

<b>Minimum Required Packaging For Class 7 (Radioactive) Materials</b>				
Packaging Based on Activity <sup>1</sup>				
Category	Excepted Quantity <sup>2</sup>	Type A	Type B	Type B - HRCQ
Activity	< Table 4 <sup>3</sup>	≤ A1 or A2	>A1 or A2	> 3000 A1 or > 3000 A2 or > 1000 TBq (whichever is least)
Packaging	Excepted Package <sup>4</sup>	Type A <sup>5</sup>	Type B <sup>6</sup>	Type B <sup>6</sup>

1. For material defined as Class 7 (radioactive) material in §173.403.
2. Includes Limited Quantity [§173.421] and Instruments and Articles [§173.424].
3. Activity limits for Limited Quantities and Instruments and Articles [§173.425].
4. Excepted package must meet the general design requirements of §173.410.
5. Except for LSA or SCO, a Type A package may not contain a quantity of radioactive material greater than A1 or A2 [ §173.431(a)].
6. Type B(U) or Type B(M).

LSA and SCO are defined in §173.403.

Packaging Options of LSA or SCO are listed in §173.427.

Note: This reference guide, last updated January 2006, is not a substitute for DOT regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at <http://www.gpoaccess.gov>.

Package and Vehicle Radiation Level Limits (49 CFR 173.441) <sup>1</sup>				
Transport Vehicle Use	Non-Exclusive	Exclusive		
Transport Vehicle Type	Open or Closed	Open (flat-bed)	Open w/Enclosure <sup>2</sup>	Closed
Package (or freight container) Limits:				
External Surface	2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	10 mSv/hr (1000 mrem/hr)	10 mSv/hr (1000 mrem/hr)
Transport Index (TI) <sup>3</sup>	10	No limit		
Criticality Safety Index (CSI) <sup>6</sup>	50	No limit		
Roadway or Railway Vehicle (or freight container) Limits:				
Any point on the outer surface	N/A	N/A	N/A	2 mSv/hr (200 mrem/hr)
Vertical planes projected from outer edges		2 mSv/hr (200 mrem/hr)	2 mSv/hr (200 mrem/hr)	N/A
Top of		load: 2mSv/hr (200 mrem/hr)	enclosure: 2 mSv/hr (200 mrem/hr)	vehicle: 2 mSv/hr (200 mrem/hr)
2 meters from		vertical planes: 0.1 mSv/hr (10 mrem/hr)	vertical planes: 0.1 mSv/hr (10 mrem/hr)	outer lateral surfaces: 0.1 mSv/hr (10 mrem/hr)
Underside		2 mSv/hr (200 mrem/hr)		
Occupied position	N/A <sup>4</sup>	0.02 mSv/hr (2 mrem/hr) <sup>5</sup>		
Sum of package TI's	50	No limit		
Sum of package CSI's <sup>6, 7</sup>	50	100		

1. The limits in this table do not apply to excepted packages (§§173.421, 173.424, 173.426, 173.428).
2. Securely attached (to vehicle), access-limiting enclosure; package personnel barriers

are considered as enclosures.

3. The dimensionless number equivalent to maximum radiation level at 1 m (3.3 feet) from the exterior package surface, in millirem/hour rounded up to the next tenth (§ 173.403).
4. No dose limit is specified, but separation distances apply to Radioactive Yellow-II, Radioactive Yellow-III, or CSI labeled packages (§ 177.842).
5. Does not apply to carriers if operating under a state or federally regulated radiation protection program and if personnel wear radiation dosimetry devices (§ 173.441(b)(4)).
6. These provisions do not apply to shipment by vessel - see §§176.700-720 for vessel requirements.
7. The number of packages containing fissile material stored in transit in any one storage area must be limited so that the total sum of the CSI's does not exceed 50, and such groups of packages must be spaced at least 6 m (20 ft) from other such groups [§§173.457 and 173.459].

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**Package and Vehicle Contamination Limits (49 CFR 173.443)**

NOTE: All values for contamination in DOT rules are to be averaged over each 300 cm<sup>2</sup>. Sufficient measurements must be taken in the appropriate locations to yield representative assessments. Wipe efficiency must be applied, and determined in accordance with §173.443(a) or assumed to be 0.1.

Non-fixed Radioactive Contamination Limits for Packages §173.443(a)(Table 9)	Maximum Permissible Limit		
βγ - means the sum of beta emitters, gamma emitters and low-toxicity alpha emitters.	4 Bq/cm <sup>2</sup>	1x10 <sup>-4</sup> uCi/cm <sup>2</sup>	220 dpm/cm <sup>2</sup>
α - means the sum of all other alpha emitters (i.e., other than low-toxicity alpha emitters).	0.4 Bq/cm <sup>2</sup>	1x10 <sup>-5</sup> uCi/cm <sup>2</sup>	22 dpm/cm <sup>2</sup>

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

The following exceptions from the above limits exist:  
Applicable conditions which must be met:

In an exclusive use shipment, contamination on a package:  
 (1) May not exceed the values in §173.443(a) at the beginning of transport.  
 (2) May not exceed 10 times the values in §173.443(a) during transport.  
 The vehicle must not be returned to service until the radiation level is shown to be < 0.005 mSv/hr (0.5 mrem/hr) at any accessible surface, and there is no significant removable (non-fixed) contamination.

In a closed transport vehicle used solely for transporting radioactive materials packages, the contamination levels on the packages may not exceed 10 times the values in §173.443(a). Additional conditions include:  
 (1) A survey of the interior surfaces of the empty vehicle must show that the radiation level at any point does not exceed 0.1 mSv/hr (10 mrem/hr) at the surface, or 0.02 mSv/hr (2 mrem/hr) at 1 meter (3.3 ft).  
 (2) Exterior of vehicle must be conspicuously stenciled, "For Radioactive Materials Use Only" in letters at least 76 mm (3 inches) high, on both sides of the exterior.  
 (3) Vehicle must be kept closed except for loading and unloading.

Excepted package-empty packaging [§173.428]. Conditions include:  
 (1) Internal contamination may not exceed 100 times §173.443(a) (Table 9).  
 (2) External contamination on the package may not exceed §173.443(a) (Table 9).  
 (3) Radiation level must be < 0.005 mSv/hr (0.5 mrem/hr) at any external surface.  
 (4) Package must be marked with UN 2908 in accordance with §173.422(a) and §172.101.  
 (5) Packaging is in unimpaired condition and securely closed to prevent leakage.  
 (6) Labels are removed, obliterated, or covered, and the "Empty" label (§172.450) is affixed to the packaging .

In addition, after any incident involving spillage, breakage or suspected radioactive contamination, the modal-specific DOT regulations (§174.750(a), railway; §175.700(b), air; and §177.843(c), highway) specify that vehicles, buildings, areas or equipment have “no significant removable surface contamination,” before being returned to service or routinely occupied. The carrier must also notify offeror at the earliest practicable moment after each incident. In the event of certain hazardous materials incidents, the regulations (§§171.15 and 171.16) specify the criteria for immediate notice and detailed hazardous materials incident reports.

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Hazard Communications for Class 7 (Radioactive) Materials Shipping Papers (49 CFR Part 172, Subpart C)		
Entries Always Required	Entries Sometimes Required	Optional Entries
<ul style="list-style-type: none"> <li>▪ The basic description, in sequence: Proper Shipping Name, Hazard Class (7), U.N. Identification Number [§172.202(a)&amp;(b)]</li> <li>▪ Proper page numbering (i.e., Page 1 of 4) [§172.201(c)]</li> <li>▪ 24-hour emergency response telephone number (Use of a number that requires a call back - e.g., answering machine - is not authorized)[§§ 172.201(d) and 172.604]</li> <li>▪ The total quantity of the material described (mass, volume or activity) in appropriate units (lbs, mL) [§172.202(a)(5)]</li> <li>▪ The number and type of packages [§172.202(a)(6)]</li> <li>▪ The name of each radionuclide (as determined by §173.433(g)). The activity must be in SI units (e.g., Bq, TBq), and may be in customary units (e.g., Ci, mCi) in parentheses following SI units. Abbreviations are authorized. [§172.203(d)(1)&amp;(3)]</li> </ul>	<p><u>Materials-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ If Hazardous substance (§171.8), "RQ" as part of the basic description [§172.203(c)(2)]</li> <li>▪ "Highway Route Controlled Quantity" or "HRCQ", entered in association with the basic description [§172.203(d)(10)]</li> <li>▪ For a package containing fissile material, the words "Fissile Exempted", if the package is exempted by §173.453 or otherwise the criticality safety index for that package [§ 172.203(d)(6)]</li> <li>▪ If the material is considered hazardous waste and the word "waste" does not appear in the shipping name, then "waste" must precede the shipping name (e.g., Waste Radioactive material, Type A package, 7, UN2915) [§172.101(c)(9)]</li> </ul> <p><u>Package-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ Package identification marking for DOE- or NRC-certified packages [§172.203(d)(7)]</li> <li>▪ IAEA Certificate of Competent Authority ID number for export shipments or shipments using</li> </ul>	<ul style="list-style-type: none"> <li>▪ Additional information is permitted (e.g., functional description of the product), provided it is not inconsistent with the required basic description [§172.201(a)(4)]</li> <li>▪ 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 weighting of fissile radionuclides maybe inserted in addition to activity units [§172.203(d)(3)]</li> <li>▪ Emergency response information may</li> </ul>

<ul style="list-style-type: none"> <li>▪ If not special form, a description of chemical and physical form [§172.203(d)(2)]</li> <li>▪ For each labeled package: <ul style="list-style-type: none"> <li>-The category of label used;</li> <li>-The transport index of each package with a Yellow-II or Yellow-III label [§172.203(d)(5)]</li> <li>-The criticality safety index of a package with a Fissile label [§172.203(d)(6)]</li> </ul> </li> <li>▪ Shipper's certification (not required for private carriers) and signature[§172.204]</li> </ul>	<p>foreign-made packaging [§172.203(d)(8)] (see §173.473)</p> <p><u>Administrative-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ "Exclusive Use-Shipment" [§172.203(d)(9)]</li> <li>▪ If a DOT exemption is being used, "DOT-E" followed by the exemption number [§ 172.203(a)]</li> <li>▪ "Cargo Aircraft Only" [§172.203(f)]</li> <li>▪ If subsidiary hazard is present, the hazard class or division number [§172.202(a)(2)]</li> </ul>	<p>be entered on the shipping papers, or may be a separate document carried with the shipping papers [§ 172.602(b)]</p>
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**Hazard Communications for Class 7 (Radioactive) Materials  
Shipping Papers (49 CFR Part 172, Subpart C) continued**

Special Considerations/Exceptions for Shipping Papers

- Excepted packages, [e.g., Limited quantity (UN 2910), Instruments or Articles (UN 2911), Manufactured articles of uranium and thorium (UN 2909), and Empty packages (UN 2908)] are excepted from shipping papers. For limited quantities, this is true only if the limited quantity is not a hazardous substance (RQ) or hazardous waste [§173.422(e)].
- Shipping paper accessibility - accident or inspection [§177.817(e)].
- For shipments of multiple cargo types, any HAZMAT entries must appear as the first entries on the shipping papers, be designated by an "X" (or "RQ") in the hazardous material column or be highlighted in a contrasting color [§172.201(a)].
- Instructions for maintenance of exclusive use shipment controls for LSA or SCO material must be included with the shipping papers [§§ 173.403 and 173.427(a)(6)(iv)].
- Shipping paper retention, two years as of Dec. 9, 2005, (previously 375 days) [§172.201(e)] for shipper. Each mode of transport has a similar requirement (Rail § 174.24(b); Air § 175.30(a)(2); Vessel § 176.24(b); Highway § 178.817(f)).

NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.

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<b>Hazard Communications for Class 7 (Radioactive) Materials Marking (49 CFR Part 172, Subpart D)</b>		
Markings Always Required	Additional Markings Sometimes Required	Optional Markings
<p><u>Bulk Packages</u> (i.e., a maximum capacity greater than 119 gallons as a receptacle for liquid; a maximum net mass greater than 882 lbs and a maximum capacity greater than 119 gallons as a receptacle for solid; or a water capacity greater than 1,000 lbs as a receptacle for a gas, with no intermediate form of containment) [§171.8]</p> <ul style="list-style-type: none"> <li>▪ U.N. identification number on: <ul style="list-style-type: none"> <li>- orange panels or</li> <li>- white square-on-point display [§172.332]</li> </ul> </li> </ul> <p><u>Non-Bulk Packages</u> (§ 171.8)</p> <ul style="list-style-type: none"> <li>▪ Proper shipping name [§172.301]</li> <li>▪ U.N. identification number [§172.301]</li> <li>▪ Name and address of consignor or consignee, unless: <ul style="list-style-type: none"> <li>- highway only and no motor carrier transfers, <u>or</u></li> <li>- part of carload or truckload lot or freight container load and entire contents of railcar, truck, or freight container are shipped from one consignor to one consignee[§172.301(d)]</li> </ul> </li> </ul> <p><u>Excepted Packages</u></p> <ul style="list-style-type: none"> <li>▪ Limited Quantity: <ul style="list-style-type: none"> <li>- UN 2910 [§173.422(a)]</li> <li>- "Radioactive" [§173.421(a)(4)]</li> </ul> </li> <li>▪ Instruments and Articles - UN 2911 [§173.422(a)]</li> <li>▪ Manufactured Articles containing natural</li> </ul>	<p><u>Materials-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ Each package with a gross mass greater than 50 kg (110 lbs), must have its gross mass including the unit of measurement marked on the outside of the package [§172.310(a)]</li> <li>▪ If non-bulk combination package containing liquid, use underlined double arrows indicating upright orientation (two opposite sides) [ISO Std 7801985 marking] [§172.312]</li> <li>▪ If a Hazardous substance (§171.8) in non-bulk package, the letters "RQ" in association with the proper shipping name[§173.427(a)(6)(vi) for LSA/SCO or §172.324(b) for other material]</li> </ul> <p><u>Package-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ The package type as TYPE IP-1, TYPE IP-2, TYPE IP-3, TYPE A, TYPE B(U) or TYPE B(M), as appropriate in letters 13 mm (0.5 in) high or greater [§172.310(b)]</li> <li>▪ "USA DOT 7A Type A" for Specification 7A packagings §178.350 and markings required by §178.3)</li> <li>▪ For NRC-approved Type B(U), B(M), or fissile material packages the package identification marking from the CoC (e.g., USA/9166/B(U), USA/9150/B(U)-85) [§173.471(b)]</li> <li>▪ For Type B(U) or B(M) the trefoil symbol per 49 CFR Part 172 App. B [§172.310(d)]</li> <li>▪ Marked with the international vehicle registration code of the country of origin of the design, for IP-1, IP-2, IP-3, or a Type A package (e.g., USA) [§172.310(c)] For NRC certified packages, the model number, gross weight, serial number and package ID number [10 CFR 71.85]</li> </ul> <p><u>Administrative-Based Requirements:</u></p> <ul style="list-style-type: none"> <li>▪ If a DOT exemption is being used, the outside of the package must be marked "DOT-E", followed by the exemption</li> </ul>	<p>Both the name and address of consignor and consignee are recommended</p>

uranium or thorium - UN 2909 [§173.422(a)] - "Radioactive" [§173.421(a)(4)] ▪ Empty Packaging - UN 2908 [§173.422(a)]	number [§§172.301(c) and 172.302(c)] ▪ Each Type B(U), B(M), or fissile material package destined for export, "USA" in conjunction with the specification markings or certificate identification [§172.310(e)]	
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NOTE: IAEA, ICAO, and IMO may require additional hazard communication information for international shipments.

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**Hazard Communications for Class 7 (Radioactive) Materials  
Marking (49 CFR Part 172, Subpart D) continued**

Special Considerations/Exceptions for Marking

Markings are required to be:

- (1) durable, printed in English on a package surface, label, tag, or sign;
- (2) displayed on a background of sharply contrasting color;
- (3) unobscured by labels or attachments; and
- (4) isolated from other marks (such as advertising) [§172.304].

Shipment of LSA or SCO consigned as exclusive use by §173.427 are excepted from the marking requirements (i.e., proper shipping name and identification number) except that the exterior of each packaged or unpackaged material must be marked "Radioactive-LSA" or "Radioactive-SCO", as appropriate.

For bulk packages, marking (i.e., orange panels) may be required on more than one side of the package [§172.302(a), §172.331(c)] and must be displayed in proximity to any required placards [§172.334(f)].

For an over pack, a statement that the contained packages comply with prescribed specifications [§173.25(a)(4)].

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**Hazardous Communications for Class 7 (Radioactive) Materials  
Labeling (49 CFR 172 Subpart E)**

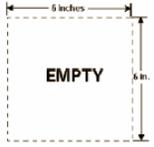
Placement of Radioactive Labels

Labeling is required to be: (1) printed or affixed to the package surface (not the bottom); (2) placed near the proper shipping name marking; (3) multiple labels must be within 150 mm (6 in) of each other; (4) in contrast with its background; (5) unobscured by markings or attachments; (6) within color, design and size tolerance; and (7) representative of the HAZMAT contents of the package [§172.406, §172.407]

Packages of radioactive material must have two labels affixed to opposite sides. [§172.403]

For radioactive material, the label to apply must be the highest category required for any of the two determining conditions (i.e. TI and maximum radiation level on the package surface). RADIOACTIVE WHITE-I is the lowest category, and RADIOACTIVE YELLOW-III is the highest category.

Determination of Required Label [§172.403]

 49 CFR 172.436	 49 CFR 172.438	 49 CFR 172.440	 49 CFR 172.441	 49 CFR 172.450
<b>WHITE-I</b>	<b>YELLOW-II</b>	<b>YELLOW-III</b>	<b>FISSILE</b>	<b>EMPTY</b>
Surface radiation level	Surface radiation level	Surface radiation level	Each package containing fissile material (other than fissile excepted) must be labeled with two FISSILE labels, affixed adjacent to the appropriate RADIOACTIVE labels [§172.402(d)(2)]	The EMPTY label is required for shipments of empty Class 7 (radioactive) packages made pursuant to §173.428. It must cover any previous labels, or they must be removed or obliterated.
$\leq 0.005$ mSv/hr (0.5 mRem/hr)	$> 0.005$ mSv/hr (0.5 mRem/hr) but $\leq 0.5$ mSv/hr (50 mRem/hr)	$> 0.5$ mSv/hr (50 mRem/hr) but $\leq 2$ mSv/hr (200 mRem/hr) or $> 2$ mSv/hr (200 mRem/hr), but $\leq 10$ mSv/hr (1000 mRem/hr) must be exclusive use closed transport [§172.441(b)]		
TI = 0 (if the measured TI $\leq 0.05$ the value may be considered to be 0)	TI $> 0$ but $\leq 1$	TI $> 1$ but $\leq 10$ or $> 10$ [exclusive use]	CSI = As defined by §173.403 and as determined by 10 CFR 71.22, 71.23, and 71.59.	

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located through the internet at <http://www.gpoaccess.gov>.

**Hazardous Communications for Class 7 (Radioactive) Materials  
Labeling (49 CFR 172 Subpart E) continued**

Contents on Radioactive Labels

RADIOACTIVE and FISSILE labels must contain (entered using a durable, weather-resistant means):

- Except for LSA-I material, the names of the radionuclides in the package [§§ 172.403(g)(1) and 173.433(g)]. The term “LSA-I” may be used in place of the names of the radionuclides. Symbols (e.g. Co-60) are acceptable [§172.403(g)].
- The activity of the package expressed in SI units (e.g. Bq, TBq), or in customary units (e.g. Ci, mCi) in parentheses following the SI units. Abbreviations are authorized. 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 activity units.
- The Transport Index (TI) is entered only on YELLOW-II AND YELLOW-III labels [§172.403(g)].
- The Criticality Safety Index (CSI) is entered only on the FISSILE label [§172.403(e)].

Special Considerations/Exceptions for Labeling

Any package containing a Highway Route Controlled Quantity must be labeled RADIOACTIVE YELLOW-III [§172.403(c)].

For materials meeting the definition of another hazard class, labels for each secondary hazard class need to be affixed to the package. The subsidiary label *may* not be required on opposite sides, but must display the hazard class or division number in the lower corner [§172.402].

When one or more packages of Class 7 (radioactive) material are placed in an overpack, the overpack must be labeled in accordance with [§172.403(h)].

**Overpacks [§173.403(h)]**

- The contents entry may state “mixed” in place of the names of the radionuclides, unless each inside package contains the same radionuclide(s).
- The “activity” entry must be determined by adding together the activity of the contained packages.
- The TI may be determined by adding together the TIs of the contained packages or determined by direct measurement.
- A different RADIOACTIVE label may be assigned based on the surface contact reading and TI of the overpack.
- For fissile material, the CSI for the FISSILE label on the overpack is the sum of the CSIs present on the packages in the overpack.

A label is not required on a package of LSA or SCO when transported under §173.427(a)(6)(vi).

Excepted packages [e.g., Limited quantity (UN 2910), Instruments or Articles (UN 2911), and Manufactured articles of uranium and thorium (UN 2909) are excepted from labeling. However if a limited quantity meets the definition for another hazard, it is re-classed for that hazard. Hazard communication requirements for the other class are required [§173.423].

Empty packages (UN2908) are required to be labeled “EMPTY” in accordance with §173.428.

The “Cargo Aircraft Only” label is typically required for radioactive materials packages shipped by air [§172.402(c)].

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**Hazard Communications for Class 7 (Radioactive) Materials  
Placarding (49 CFR Part 172, Subpart F)**

Visibility and Display of Radioactive Placard

Placards are required to be displayed:

- on four sides of the vehicle [§172.504(a)]
- visible from the direction they face on each side and each end of the vehicle (i.e., four placards) [§172.516(a)]  
on the front of a motor vehicle instead of, or in addition to on the front of the cargo body (i.e., five placards) [§172.516(b)]
- securely attached or affixed to the vehicle, or in a holder [§172.516(c))(1)]
- clear of appurtenances and devices (e.g., ladders, pipes, tarpaulins) [§172.516(c))(2)]

- so far as practicable, be located so that dirt or water is not directed to it from the wheels of the transport vehicle [§172.516(c)(3)]
- at least 3 inches from any markings (such as advertisements) which may reduce placard's effectiveness [§172.516(c)(4)]
- upright and on-point such that the words read horizontally, left to right [§172.516(c)(5)]
- in contrast with the background, or have a solid or dotted line border which contrasts with the background [§172.516(c)(7)]

Placards must be maintained by carrier to maintain format, color, legibility and visibility [§172.516(c)(6)]

**Conditions Requiring Placarding**

Placards are required for any vehicle containing a package with a RADIOACTIVE Yellow-III label [§172.504(e) Table 1]

Placards are required for shipment of LSA or SCO consigned as exclusive use [§173.427(a)(6)(v)]

Placards are required for a Highway Route Controlled Quantity (HRCQ) of radioactive material, and

- must be displayed on a square background [§§ 172.507 and 172.527]
- HRCQ packages must be labeled with RADIOACTIVE Yellow III labels [§172.403(c)]

**Radioactive Placard**

		
49 CFR 172.556	IAEA TS-R-1 (1996) paras. 546-548	49 CFR 172.527 and 556
RADIOACTIVE PLACARD (Domestic) Radioactive Placard	RADIOACTIVE PLACARD (International)	RADIOACTIVE PLACARD FOR HIGHWAY ROUTE CONTROLLED QUANTITY (either domestic or international placard could be in middle)

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**Hazard Communications for Class 7 (Radioactive) Materials Placarding (49 CFR Part 172, Subpart F) continued**

Special Considerations/Exceptions for Placarding

Domestically, substitution of the UN ID number for the word "RADIOACTIVE" on the placard is prohibited for Class 7 materials [§172.503]. However, some import shipments may have this substitution in accordance with international regulations [§171.12].

If placarding for more than one hazard class, both placards must display the hazard class number [§172.519(b)(4)].

Uranium Hexafluoride (UF<sub>6</sub>) shipments > 454 kg (1001 lbs) gross weight require both RADIOACTIVE and CORROSIVE (Class 8) placards on each side and each end [§172.505(b)].

For shipments of radiography cameras in convenience overpacks, if the overpack does not require a RADIOACTIVE - YELLOW III label, vehicle placarding is not required (regardless of the label that must be placed on the camera) [§172.403(h)(5)].

A placard or placard holder may be hinged provided the required format, color and legibility of the placard are maintained [§172.516(e)].

Placards must conform to the specifications in §§172.519 and 172.556. Rev. 1 October 1, 2004.

NOTE: IAEA, ICAO and IMO may require additional hazard communication information for international shipments.

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**Hazard Communications for Class 7 (Radioactive) Materials  
Emergency Response Information (49 CFR 172 Subpart G)**

ER telephone number [§172.604]

Shipper must provide an emergency response telephone number that is:

- Monitored at all times
- Is answered by a person knowledgeable of hazardous material and has comprehensive emergency response and incident mitigation information
- Entered on shipping paper

ER information [§172.602(a)]

- Information needed in the mitigation of an incident
- Contain basic description and technical name of hazardous material, immediate hazards to health, risk of fire or explosion, immediate precautions to be taken, immediate method for handling fires, initial methods for handling spills or leaks and preliminary first aid measures.

Form of information [§172.602(b)]

- Printed legibly in English
- Available for use away from the hazardous material container
- Presented on shipping paper or another document related to shipping paper

**Hazard Communications for Class 7 (Radioactive) Materials  
Security Plans (49 CFR 172 Subpart I)**

Applicability [§172.800]

- Highway route controlled quantities of Class 7 (radioactive) material
- Quantity of hazardous material [includes radioactive] that requires placarding

Components of security plan [§172.802]

- Include assessment of possible transport security risks and appropriate measures to address assessed risks
- Must be in writing and available to employees responsible for implementing security plan, consistent with personnel clearance and demonstrated need to know
- Security plan must include following elements - personnel security; unauthorized access; and en route security

Non-DOT transportation security measures for select licensees

- NRC Orders to Panoramic and Underwater Irradiators [68FR35458 on June 13, 2003]
- NRC Orders to Manufacturers and Distributors [69FR3397 on Jan. 23, 2004]
- NRC Transportation Orders [70FR44948 on Aug. 4, 2005]
- ODH Director's Orders for Increased Controls [Nov. 16, 2005]
- NRC Orders for Increased Controls [70FR72128 on Dec. 1, 2005]

*Note: This reference guide, last updated January 2006, is not a substitute for DOT*

regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at <http://www.gpoaccess.gov>.

<b>Hazard Communications for Class 7 (Radioactive) Materials Training (49 CFR 172 Subpart H)</b>
Responsibility for training and testing [§172.702] <ul style="list-style-type: none"><li>▪ The employer shall ensure each hazmat employee is trained</li><li>▪ Any hazmat employee who performs any hazmat function must be instructed in that function</li><li>▪ Training may be provided by the employer or other outside source</li><li>▪ The employer shall ensure that the hazmat employee is tested by appropriate means on the training subjects covered</li><li>▪ Initial training and retrain every three years thereafter [§172.704(c)]</li></ul>
Hazmat employee training must include the following [§172.704(a)]: <ul style="list-style-type: none"><li>▪ General awareness/familiarization training</li><li>▪ Function-specific training</li><li>▪ Safety training</li><li>▪ Security awareness training</li><li>▪ In-depth security training</li><li>▪ Training must include modal specific training [§172.701]</li></ul>
Recordkeeping <ul style="list-style-type: none"><li>▪ Keep training records three years [§172.704(d)]</li></ul>

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