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STATE OF OHIO  
DEPARTMENT OF HEALTH

## **GUIDANCE ABOUT LICENSES OF BROAD SCOPE**

### **NMS-LIC-11**

**Rev. 1**

**Effective Date: November 1, 2007**

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This consolidated guidance is based on the NRC's NUREG 1556, Volume 11, and along with the State of Ohio Radioactive Materials Licensing Program provides the applicants and reviewers with information concerning how to file a request, a listing of the applicable regulations and industry standards, policies affecting evaluation and licensing, 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
ALI	Annual Limit on Intake
ANSI	American National Standards Institute
BRP	Bureau of Radiation Protection
Bq	Becquerel
CD-ROM	Compact Disk-read Only Memory
cpm	Counts Per Minute
Ci	Curie
DFP	Decommissioning Funding Plan
dpm	Disintegrations Per Minute
DIS	Decay-in-Storage
DOE	United States Department of Energy
DOT	United States Department of Transportation
GBq	Gigabecquerel
G-M	Geiger-Mueller
GPO	Government Printing Office
IAEA	International Atomic Energy Agency
IN	Information Notice
kBq	Kilobecquerel
LLW	Low-level [radioactive] Waste
MBq	Megabecquerel
mCi	Millicurie
mR	Milliroentgen
mrem	Millirem
mSv	Millisievert
$\mu$ Ci	Microcurie [greek letter mu-Ci]
NIST	National Institute of Standards and Technology
NMSS	NRC's Office of Nuclear Materials Safety and Safeguards
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
R	Roentgen
RSC	Radiation Safety Committee
RSO	Radiation Safety Officer
SI	International System of Units
SSD	Sealed Source and Device
TEDE	Total Effective Dose Equivalent

# 1 PURPOSE OF REPORT

This document provides guidance to an applicant in preparing a broad scope license application and describes the criteria used by Ohio Department of Health (ODH) staff when evaluating the application. Whereas the applicant for a limited scope license generally must submit to the ODH, for review and approval, the specific training and experience of each proposed user and the facilities and equipment available to support each proposed use, the applicant for a broad scope license normally must submit to the ODH, for review and approval, a description of the internal review process and criteria that will be used to approve users and uses. As opposed to limited scope licenses, which typically identify specific isotopes that may be possessed, the broad scope license generally authorizes the possession and use of a wide range of radioactive materials.

Because the ODH grants significant decision making authority to broad scope licensees through the license, a broad scope license is not normally issued to a new licensee. An applicant for a broad scope license typically has several years of experience operating under a limited scope license and a good regulatory performance history. This document is intended to provide the additional guidance required by the experienced limited scope licensee to prepare an application for a broad scope license. Guidance related to specific program areas, which may not apply to all broad scope licensees, is not included in this document but can be found in other guides, often referred to in this document as “the base documents.”

Applicants are expected to have first established limited scope licensed programs in accordance with the guidance described in the appropriate base document(s) and then use this document to complete the application for broad scope license. For example, applicants for a broad scope license who use radioactive material for research and development should review NMS-LIC-07, “Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,” for guidance. Similarly, applicants for broad scope license who use radioactive material for medical purposes should review NMS-LIC-09, “Program-Specific Guidance About Medical Use Licenses.” All currently available base documents may be obtained by contacting the ODH by calling the Bureau of Radiation Protection at (614)644-2727.

Chapter 3701:1-40 “Licensing of Byproduct or Accelerator Produced Material” of the Ohio Administrative Code (OAC) provides for three distinct categories of broad scope license, i.e., Type A, Type B and Type C, which are defined in OAC 3701:1-40-22.

Type A licenses of broad scope are typically the largest licensed programs and encompass a broad range of uses. Type A broad scope licensees use a radiation safety committee (RSC), radiation safety officer (RSO), and criteria developed and submitted by the licensee and approved by the ODH during the licensing process, to review and approve all uses and users under the license. The requirements for issuance of a Type A broad scope license are described in OAC 3701:1-40-23. An applicant for a Type A broad scope license must establish administrative controls and provisions relating to organization and management, procedures, recordkeeping, material control and

accounting and management review that are necessary to assure safe operations, including:

- Establishment of a RSC.
- Appointment of a qualified RSO.
- Establishment of appropriate administrative procedures to assure:
  - Control of procurement and use of radioactive material.
  - Completion of safety evaluations of proposed uses that take into consideration adequacy of facilities and equipment, training and experience of the user and operating and handling procedures.
  - Review, approval and recording by the RSC of safety evaluations of proposed uses.

Types B broad scope licensed programs are normally smaller and less diverse than Type A broad scope programs. Type B broad scope licensees use an RSO and criteria developed and submitted by the licensee and approved by ODH during the licensing process, to review and approve all uses and users under the license. Because the RSO reviews and approves all uses and users under the license, and not a full RSC as established for Type A broad scope programs, the types and quantities of radioactive material authorized by the Type B broad scope license are limited to those described in OAC 3701:1-40-22(C) and 3701:1-40-22 Appendix, Column I. While the quantities of individual radionuclides described in OAC 3701:1-40-22 Appendix, Column I may be large, total license possession limits are further restricted by the Unity Rule (see Section 7.5.1 for additional information on license possession limits and the Unity Rule). Generally, the scope of authorization for Type B licenses is limited to the experience and knowledge of the RSO. The requirements for issuance of a Type B broad scope license are described in OAC 3701:1-40-24.

An applicant for a Type B broad scope license must also establish administrative controls and provisions relating to organization and management, procedures, recordkeeping, material control and accounting and management review that are necessary to assure safe operations, including:

- Appointment of a qualified RSO.
- Establishment of appropriate administrative procedures to assure:
  - Control of procurement and use of radioactive material.
  - Completion of safety evaluations of proposed uses that take into consideration adequacy of facilities and equipment, training and experience of the user, and operating and handling procedures.
  - Review, approval, and recording by the RSO of safety evaluations of proposed uses.

Type C broad scope licensed programs are typically issued to institutions that do not require significant quantities of radioactive material but need the flexibility to possess a variety of different radioactive materials. Users of licensed material under these programs are approved by the licensee based on training and experience criteria described in OAC 3701:1-40-25(B). The types and quantities of radioactive material authorized by the Type C broad scope license are limited to those described in OAC 3701:1-40-22 Appendix, Column II, again, considering the Unity Rule. The requirements for issuance of a Type C broad scope license are described in OAC 3701:1-40-25. While OAC 3701:1-40-25 does not require Type C broad scope licensees to appoint an RSO, the licensee must establish administrative controls and provisions relating to procurement of radioactive material, procedures, recordkeeping, material control and accounting and management review to assure safe operations. This should include the appointment of someone responsible for the day-to-day operation of the Radiation Safety Program such as an RSO.

Except for activities specifically excluded from broad scope licenses by OAC 3701:1-40-26 (A), a Type A broad scope license can include any licensed material the applicant needs and for which it qualifies. An application for a Type A broad scope license can include uses of source material and special nuclear material under the same program (e.g., laboratory-scale research and development or the use of uranium as shielding) as the radioactive material to be possessed under the provisions of OAC 3701:1-38-02(D). However, applicants should submit separate applications for the use of source and special nuclear materials for purposes not directly related to the use of radioactive material under the Type A broad scope license (e.g., use of source material in subcritical assemblies and special nuclear material in cardiac pacemakers).

Types B and C broad scope licenses are restricted in their possession of radioactive material by OAC 3701:1-40-22(C), 22(D) and 22 Appendix. Type B and Type C licensees who require materials not specified in OAC 3701:1-40-22 Appendix will need to: (1) develop Type A broad scope programs, which would require a license amendment; or (2) carry these additional materials under a separate specific license of limited scope. The latter option would require the licensee to review the base document related to the specific use of this material and submit the information required by the license reviewer as described in that document. For example, applicants who require materials not specified in OAC 3701:1-40-22 Appendix for purposes of research and development should review NMS-LIC-07, "Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope" and submit the information described therein. Licensees are reminded that changes to the specific license of limited scope require amendment of the license.

Type B licensees who require quantities of material specified in OAC 3701:1-40-22 Appendix, but in excess of that prescribed by OAC 3701:1-40-22(C), will need to: (1) develop a Type A broad scope program; or (2) carry these additional materials under a separate specific license of limited scope, as described in the previous paragraph. Type C licensees who require quantities of material specified in OAC 3701:1-40-22 Appendix, but in excess of that prescribed by OAC 3701:1-40-22(D), will need to: (1) develop, as appropriate, a Type A or Type B broad scope program; or (2) carry these additional

materials under a specific license of limited scope. Once again, changes to the specific license of limited scope require amendment of the license.

In practice, rules 3701:1-40-22 through 26 of the OAC reduce the administrative burden for both licensees and the ODH without reducing the safety standards or lessening the licensing requirements for training, experience, facilities and equipment. Both the ODH and the licensee benefit from the reduction in license amendments that might otherwise be needed to change authorized radionuclides, quantities or names of individuals who may use, or supervise the use of, radioactive material.

ODH provides the greatest flexibility to Type A broad scope licensees who have developed an adequate radiation safety program oversight structure. Type A broad scope licensees and applicants for Type A broad scope license who specify the duties and responsibilities of management, the RSC and the RSO, including: (1) review and approval of program and procedural changes by the RSC; (2) implementation of program and procedural changes; (3) audit of licensed operations to determine compliance; and (4) taking appropriate actions when noncompliance is identified, including analysis of the cause, corrective actions and actions to prevent recurrence, will be authorized through use of the license condition listed below, to make some program changes and to revise some procedures previously approved by the ODH without amendment of the license as long as the program change or revised procedure:

- Is reviewed and approved by the RSC prior to implementation,
- Satisfies regulatory requirements.
- Does not change existing license conditions.
- Does not decrease the effectiveness of the Radiation Safety Program.

For Type A broad scope applicants or licensees requesting this additional flexibility, a clear description of the process for procedure and program review and approval must be provided. Applicants must describe how specific changes will be documented. At a minimum, documentation shall state the reason for the change and summarize the radiation safety matters that were considered prior to the approval of each change.

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

**Regulations** - references the regulations applicable to the item.

**Criteria** - outlines the criteria used to judge the adequacy of the applicant's response.

**Discussion** - provides additional information on the topic sufficient to meet the needs of most readers.

**Response from Applicant** - provides suggested response(s), offers the option of an alternative reply or indicates that no response is needed on that topic during the licensing process. Notes and References are self-explanatory and may not be found for each item on the Application Form.

The Application Form does not have sufficient space for applicants to provide full responses to Items 5 through 11; as indicated on the form, the answers to those items are to be provided on separate sheets of paper and submitted with the completed the application form. For the convenience of applicants and for streamlined handling of applications in the new materials licensing process, use Appendix B to provide supporting information, attach it to the application form, and submit them to the ODH. Appendix B may also be used by applicants to check applications for completeness. Appendices E through Q contain additional information on various radiation safety topics.

## 2 AGREEMENT STATES

Certain states have entered into agreements with the Nuclear Regulatory Commission (NRC) as authorized by section 274(b) of the “Atomic Energy Act of 1954” 68 Stat 919, 42 USC 2011, as amended that gives Agreement States 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, or through the internet at <http://www.nrc.gov>. 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.

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.

Ohio Revised Code (ORC), Chapter 3748 “Radiation Control Program” provides the statutory basis for the regulatory control of radioactive materials and radiation generating equipment in the State of Ohio.

Ohio became an Agreement State in August 1999 with the NRC in accordance with ORC 3748.03. The Department of Health (hereafter “department”) is designated the Ohio radiation control agency in ORC 3748.02.

The governor-appointed Public Health Council is granted authority in ORC 3748.04 including, but not limited to: adopt, amend or rescind rules; radiation standards; set fees; and other regulatory items.

The duties and authority of the director of health (hereafter “director”) are identified in ORC 3748.05.

Within the department Bureau of Radiation Protection (BRP) is the designated agency to handle day-to-day activities on behalf of the director and the department.

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 [OAC 3701:1-40-06])	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 exclusive federal jurisdiction.	NRC

### 3 MANAGEMENT RESPONSIBILITY

The department recognizes that effective radiation safety program management is vital to achieving safe and compliant operations. The department 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 the ODH (OAC 3701:1-40-05).
- 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 qualified individuals to serve on the Radiation Safety Committee, if required, and to serve as radiation safety officer (RSO) for their licensed activities.
- Prohibition against discrimination of employees engaged in protected activities.
- Commitment to provide information to employees regarding the employee protection and deliberate misconduct provisions in OAC 3701:1-38-09.
- Obtaining the ODH’s prior written consent before transferring control of the license.
- Notifying the ODH in writing, within 10 business days following filing of petition for voluntary or involuntary bankruptcy.

For further discussion of management responsibilities, see section 7.7. For information on inspection, investigation, enforcement and other compliance issues, contact the BRP at (614) 644-2727, or visit the ODH Web site at <http://www.odh.ohio.gov>, and look for “Nuclear Material Safety” under ODH Programs and the OAC under “Rules.”

## 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 through 4 and 12 through 15 on the form itself.
- Complete the application form items 5 through 11 on supplementary pages or use Appendix A.
- 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, 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 ODH Office of Public Affairs. Employee personal information, i.e., home address, home telephone number, Social Security number, date of birth, radiation dose<sup>1</sup> information, should not be submitted unless specifically requested.

The ODH's licensing process involves pre-payment of the application fee to the Treasurer, State of Ohio. Therefore, processing of electronic applications is not currently possible. However, submission of the signed application form, specifying that the amplifying information is in electronic form, is acceptable.

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<sup>1</sup> In this document, dose or radiation dose is used as defined in 3701:1-38-01, 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.

To ensure a smooth process, applicants are requested to follow these suggestions for attachments:

- Submit printed or typewritten, not handwritten, text on smooth, crisp paper that will feed easily into a copier.
- Choose 12-point or larger font size.
- Avoid stylized characters such as script, italic, etc.
- Be sure the print is clear and sharp.
- Be sure there is high contrast between the ink and paper (black ink on white paper is best).

## **5 WHERE TO FILE**

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

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

In general, applicants wishing to possess or use licensed material in Ohio must file an application with the department, 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.

## **6 LICENSE FEES**

Each application, for which a fee is specified including applications for new licenses and license amendments, must be accompanied by the appropriate fee. Refer to Appendix A of Rule 3701:1-38-02 of the OAC, to determine the amount of the fee. ODH will not review the license application prior to fee receipt, except those designated full cost. 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 OAC 3701:1-38-02 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 “Reduced Fees Certification” 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.

## 7 CONTENTS OF AN APPLICATION

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

All items in the application should be completed in enough detail for the director to determine that the proposed equipment, facilities, training and experience and radiation safety program satisfy regulatory requirements and are adequate to protect health and minimize danger to life and property. Consideration shall be given, when developing your application, to the concepts of as low as reasonably achievable (ALARA) and the minimization of contamination.

Regarding ALARA, OAC 3701:1-38-11(E)(2) states, “The licensee or registrant shall use, to the extent practicable, procedures and engineering controls based upon sound radiation protection principles to achieve occupational doses and public doses that are as low as is reasonably achievable (ALARA).” Broad scope licenses must address ALARA considerations in all aspects of their programs (e.g., monitoring and controlling external and internal personnel exposure, monitoring and controlling air and liquid effluents). ALARA considerations, including establishing administrative action levels and monitoring programs, need to be documented in the application.

OAC 3701:1-38-22(G) requires that license applicants describe how facility design and procedures for operation will minimize, to the extent practicable, contamination of the facility and the environment, facilitate eventual decommissioning and minimize, to the extent practicable, the generation of radioactive waste. Like ALARA, the applicant must address these concerns in all aspects of their programs.

After an application for broad scope authority has been reviewed by department staff and found to be generally complete and responsive to the application form (Appendix A) and this guidance, a pre-licensing visit may be scheduled by the department at the licensee’s facility. A visit or conference may also be scheduled as part of the license renewal process. A pre-licensing visit provides department staff with an opportunity to better evaluate the proposed program and the necessity for a broad scope license. It also provides the staff an opportunity to meet with licensee management and others responsible for the radiation protection program and stress the importance of their responsibilities under a broad license and to discuss and agree on additional information and commitments that may be needed. If a broad license is not warranted, continuation of the program with an appropriate specific license can be discussed.

All information submitted to the department during the licensing process will be incorporated as part of the license and will be subject to review during periodic inspections.

## 7.1 TYPE OF APPLICATION

This is an application for:  Initial License  Renewal or  Amendment of License Number:

Check box “Initial License” if the application is for a new broad scope license. As stated in the chapter titled “Purpose of this Report,” the director will not normally issue a broad scope license to a new licensee.

Check “Amendment to License No.” if the application is for an amendment<sup>2</sup> to an existing broad scope license or if the application is to upgrade a limited scope license into a broad scope license. Provide the license number.

Check “Renewal of License No.” if the application is for the renewal<sup>2</sup> of an existing broad scope license and provide the license number.

## 7.2 ITEMS 1 and 2: NAME AND MAILING ADDRESS OF APPLICANT

<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.)
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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. Because of the significant authority given a broad scope licensee to oversee licensed activities, it is not appropriate for an individual to apply for a broad scope license. No individual other than the duly authorized applicant may, for any licensing matter, act on behalf of the applicant or provide information without written authorization of the applicant.

**Note:** The bureau (on behalf of the director and department) must be notified in the event of change of ownership or control and bankruptcy proceedings; see the next page for more details.

Provide the mailing address where correspondence should be sent. A post office box number is an acceptable mailing address. The department should be notified of changes in mailing address so that the license can be amended.

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

**Regulations:** OAC 3701:1-40-16(A)

<sup>2</sup> See “Amendments and Renewals to a License” later in this document. Licensees are required to request and obtain an amendment to the license before making changes in their radiation safety program. Examples of changes that require amendment are change of radiation safety officer (RSO) and increases in the license possession limit.

**Criteria:** The regulations require that, “A license or any right contained therein may not be transferred or conveyed without the written authorization of the director.” Therefore, control of licenses cannot be transferred without the prior written consent of the director. Licensees must provide full information and obtain written concurrence from the director when transferring ownership or control of the license. A corporate ownership change is a major amendment.

Notes:

- The department must be notified before control of the license is changed, and the licensee must receive written consent prior to the change.
- The department must also be notified when bankruptcy proceedings have been initiated.

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

- Radioactive materials are possessed, used or controlled only by persons who have valid department, NRC or Agreement State licenses.
- Materials are properly handled and secured.
- Persons using these materials are competent and committed to implementing appropriate radiological controls.
- A clear chain of custody is established to identify who is responsible for final disposal of the radioactive material.
- The transferee has the financial resources to decommission the license, if necessary.
- Public health and safety are not compromised by the use of such materials.

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

## Notification of Bankruptcy Proceedings

**Regulation:** OAC 3701:1-40-16(F)

**Criteria:** Within 10 business days following filing of voluntary or involuntary petition for bankruptcy for or against a licensee, the licensee must notify the department, in writing, identifying the bankruptcy court in which the petition was filed and the date of filing.

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

**Response from Applicant:** None at time of application for a new license. Licensees must notify the department within 10 business days of filing of a voluntary or involuntary petition for bankruptcy for or against the licensee.

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

<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:

Specify each proposed location of use by the street address, city and state or other descriptive address (e.g., on Highway 10, five miles east of the intersection of Highway 10 and State Route 234, Anytown, State). The descriptive address should be sufficient to allow an inspector to find the facility location. A post office box address is not acceptable. If radioactive material is to be used at more than one location, give the specific address of each location. Applicants for a broad scope license need not identify each facility at a particular address where radioactive material will be used. For example, applicants can specify that radioactive material will be used on the Main Campus of ABC University located in Anytown, State.

Applicants should identify the location of all facilities designed or established for special uses, e.g., panoramic irradiators, interim or long-term waste storage facilities, high activity laboratories, iodination facilities, alpha laboratories, incinerators and animal facilities.

If radioactive material is to be used in field studies, the activities must be specifically identified and authorized on the license. Appendix D contains information required of

applicants prior to granting authorization for field use of licensed material. To conduct operations at temporary job sites (e.g., portable gauging devices at locations where work is conducted for limited periods of time) specify “temporary job sites throughout Ohio.”

A director-approved license amendment identifying a new location of use, which is not encompassed by a location described on the existing license, is required before receiving, using and storing licensed material at that location.

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; a local ordinance requiring registration of radioactive material).

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, written descriptions of the specific locations or room numbers where licensed material is used or stored and any records of spills or other unusual occurrences involving the spread of contamination in or around the licensee’s facilities.

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

<b>4. Licensee Contact Person</b>			
If consultant or other non-employee, so indicate <input type="checkbox"/>			
Name:	Phone: (    )	Fax: (    )	E-Mail:

Identify the individual who can answer questions about the application and include their telephone number. This individual, usually the radiation safety officer (RSO), will serve as the point of contact during the review of the application and during the period of the license. If this individual is not a full-time employee of the licensed entity, their position and relationship should be specified. No individual other than the duly authorized applicant may, for any licensing matter, act on behalf of the applicant or provide information without the applicant’s written authorization. The department should be notified if the person assigned to this function changes or if their telephone number changes. Notification of a contact change is for information only and would not be considered an application for license amendment (or require a fee), unless the notification involves a change in the contact person who is also the RSO.

As indicated on the application form (Appendix A), items 5 through 11 should be submitted on separate sheets of paper. Applicants may use Appendix B for this purpose and should note that using the suggested wording of responses and committing to using the model procedures in this report and others will expedite the department’s review.

## 7.5 ITEM 5: RADIOACTIVE MATERIAL

5. Radioactive Material		
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)

### 7.5.1 Unsealed And/Or Sealed Radioactive Material

**Regulations:** OAC 3701:1-40-11; OAC 3701:1-38-02(D); OAC 3701:1-40-14(E); OAC 3701:1-40-14(G); OAC 3701:1-40-15(A)(2); OAC 3701:1-46-49; OAC 3701:1-40-22; OAC 3701:1-40-23; OAC 3701:1-40-24; OAC 3701:1-40-25; and OAC 3701:1-40-27

**Criteria:** An application for a license will be approved if the requirements of OAC 3701:1-40-14; OAC 3701:1-40-15; OAC 3701:1-40-22; OAC 3701:1-40-23; OAC 3701:1-40-24; OAC 3701:1-40-25; and OAC 3701:1-40-26 are met.

**Discussion:** Applicants for a Type A broad scope license typically 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. When establishing individual radionuclide and total cumulative quantities, all materials possessed under the license should be included (i.e., materials received awaiting use, materials in use/process and those categorized as waste awaiting disposal). The maximum quantity for each individual radionuclide and total cumulative possession should be commensurate with the applicant's needs, facilities, procedures and demonstrated experience/capability. If certain individual radionuclides will be needed in much larger quantities than described in the atomic number 1-83 request, they should be listed separately rather than increasing the possession limit for all radionuclides. Similarly, if it is known that certain relatively more hazardous radionuclides (e.g., strontium-90) are needed only in smaller quantities, they should be listed separately.

If needed, an applicant for a Type A broad scope license may request authorization to possess radioactive materials with atomic numbers greater than 83 (e.g., atomic numbers 84 to 96). For this request, 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. Note that authorization to possess radioactive materials with atomic numbers 84 through 96 does not authorize the possession of uranium, thorium or plutonium because, even though these elements have atomic numbers within the range of 84 through 96, these materials are either source material or special nuclear material and not byproduct or other radioactive material.

Licensees may request source material and special nuclear material when use of these materials is directly related to the use of radioactive material under the broad scope license (e.g. laboratory-scale research and development or the use of depleted uranium as shielding). Applicants should submit separate applications for the use of source and special nuclear materials for purposes not directly related to the use of radioactive

material under the broad scope license (e.g., sub-critical assemblies and nuclear pacemakers).

A separate listing should also be submitted for sealed sources needed in quantities larger than that described in the atomic number 1-83 request (e.g., self-contained irradiators, instrument calibrators, sealed sources used for medical therapy, portable and non-portable gauging devices, etc.). Applicants should provide the manufacturer's name and model number for each requested sealed source and device so the department can verify they have been evaluated in a Sealed Source and Device (SSD) Registration Certificate or specifically approved on a license. Before the formalization of the SSD registration process, some older sources or devices may have been specifically approved on a license. Licensees can continue to use those sources and devices specifically listed on their licenses. Sealed sources or devices containing sealed sources that are intended for use solely under broad scope licenses and are not transferred to another licensee need not be evaluated prior to use if: (1) the licensee is authorized to possess the requested quantity of radioactive material in unsealed form; and (2) the licensee performs its own safety evaluation in accordance with the administrative procedures required by OAC 3701:1-40-23(C)(3)(b), 24(B)(2)(b) or 25(C), as appropriate. For example, a broad scope licensee who is authorized to possess and use any form of iridium-192 or cobalt-60 in the fabrication of sources and devices for industrial radiography may use the fabricated sources and devices to conduct its own licensed activities without first submitting the sources and devices to the NRC or an Agreement State for evaluation and registration.

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.

Applicants for Type A broad scope license should review the requirements for financial assurance and decommissioning before specifying possession limits for radioisotopes with a half life greater than 120 days. These requirements are discussed in Section 7.5.2 of this document.

Licensees who possess radioactive materials in excess of the quantities listed in OAC 3701:1-40-14 Appendix provide with the application either of the following:

- An evaluation showing that the maximum off-site dose due to a release of radioactive materials would not exceed 0.01 Sv (1 rem) effective dose equivalent or 0.05 Sv (5 rem) to the thyroid.
- An emergency response plan for responding to the release in accordance with the criteria listed in OAC 3701:1-40-14(G)(3).

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. The possession limit for a Type B broad scope license, if only one radionuclide is possessed, is the quantity specified for that radionuclide in OAC 3701:1-40-22, Appendix, Column I. If two or more radionuclides are possessed, the possession limit is determined as

follows. For each radionuclide, determine the ratio of the quantity possessed to the applicable quantity specified in OAC 3701:1-40-22, Appendix, Column I, for that radionuclide. The sum of the ratios for all radionuclides possessed under the license shall not exceed unity. The possession limit for a Type C broad scope license, if only one radionuclide is possessed, is the quantity specified for that radionuclide in OAC 3701:1-40-22, Appendix, Column II. If two or more radionuclides are possessed, the sum of the ratios, determined in the same manner as discussed above, for all radionuclides possessed under the license shall not exceed unity.

Type B and Type C broad scope licensees who require materials not specified in OAC 3701:1-40-22, Appendix will need to: (1) develop Type A broad scope programs; or (2) carry these additional materials under a separate specific license of limited scope. The latter option would require the licensee to review the base guidance related to the specific use of this material and submit the information required by the license reviewer as described in that document. For example, applicants who require materials not specified in Schedule A for purposes of research and development should review NMS-LIC-07, "Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope," and submit the information described therein.

Type B licensees who require quantities of material in excess of that permitted by OAC 3701:1-40-22(C) will need to: (1) develop a Type A broad scope program; or (2) carry these additional quantities under a separate specific license of limited scope, as described in the previous paragraph. Type C licensees who require quantities of material in excess of that permitted by OAC 3701:1-40-22(D), will need to: (1) develop, as appropriate, a Type A or Type B broad scope program; or (2) carry these additional materials under a separate specific license of limited scope.

Applicants for Type B or Type C broad scope license may consider limiting their possession of isotopes described in OAC 3701:1-40-22, Appendix with half lives greater than 120 days below that amount permitted by OAC 3701:1-40-22(C) or 22(D) respectively, to avoid being required to submit certification of financial assurance or a decommissioning funding plan. See Section 7.5.2 of this document for a discussion of Financial Assurance and Record Keeping for Decommissioning.

**Response from applicant:** 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 that described in the atomic number 1-83 request. The maximum quantities of nuclides with atomic numbers above 83 also should be listed separately.

A separate listing should also be submitted for sealed sources needed in larger quantities than that 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 department 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.

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.

Licensees who possess radioactive materials in excess of the quantities listed in OAC 3701:1-40-14 Appendix must provide with the application either of the following:

- An evaluation showing that the maximum off-site dose due to a release of radioactive materials would not exceed 0.01 Sv (1 rem) effective dose equivalent or 0.05 Sv (5 rem) to the thyroid.
- An emergency response plan for responding to the release in accordance with the criteria listed in OAC 3701:1-40-14(G)(3).

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).

## **7.5.2 RADIOACTIVE MATERIAL - FINANCIAL ASSURANCE AND RECORD KEEPING FOR DECOMMISSIONING**

**Regulations:** OAC 3701:1-40-14(F); OAC 3701:1-40-16(A); OAC 3701:1-40-17; OAC 3701:1-40-18(E); OAC 3701:1-40-18(H)(5); OAC 3701:1-40-21(D); OAC 3701:1-40-21(E); OAC 3701:1-40-21(F); OAC 3710:1-44-14(G) ; OAC 3710:1-44-18; OAC 3710:1-44-20(E) ; OAC 3710:1-44-20(G)(4)(e) ; OAC 3710:1-44-23(D) ; OAC 3710:1-44-23(E) ; OAC 3710:1-44-23(F) ; OAC 3710:1-56-04; and OAC 3710:1-56-10(B).

**Criteria:** A licensee authorized to possess licensed material in excess of the limits specified in OAC 3701:1-40-17 and OAC 3701:1-44-18 must meet the requirements for decommissioning financial assurance. All licensees are required to maintain records of information important to the decommissioning of the facility in an identified location until the site, or any area, is released for unrestricted use. Licensees must transfer these records either to the new licensee, when licensed activities are transferred or assigned or to the department when the license is terminated.

**Discussion:** The department wants to ensure decommissioning will be carried out with minimum impact on public and occupational health and safety and the environment. There are two parts to the rule: financial assurance that applies to some licensees and record keeping that applies to all licensees. Financial assurance regulations are designed to provide reasonable assurance that the decommissioning of licensed facilities will be

accomplished in a safe and timely manner and those licensees will provide adequate funds to cover all costs associated with decommissioning. These requirements, if applicable, specify that a licensee either set aside funds for decommissioning activities or provide a guarantee that funds will be available. Applicants are required to provide financial assurance when the possession of radioactive material of half life (T1/2) greater than 120 days exceeds certain limits. Criteria for determining whether an applicant is required to submit a decommissioning funding plan (DFP) or has an option of submitting either a DFP or a Certification of Financial Assurance are stated in OAC 3701:1-40-17 and OAC 3701:1-44-18(F). A DFP contains a site-specific cost estimate and a certification of financial assurance. A Certification of Financial Assurance includes a certification that the licensee has provided the required financial assurance and an acceptable financial assurance instrument.

Acceptable financial assurance includes prepayment options (trusts, escrow accounts, government funds, certificates of deposit or deposits of government securities); surety, insurance or other guarantee methods (letters of credit, surety bonds, lines of credit, parent company guarantees, insurance policies); and statements of intent for government entities. Criteria for parent company guarantees can be found in OAC 3701:1-40-17 Appendix (B), Appendix (C), Appendix (D), and Appendix (E).

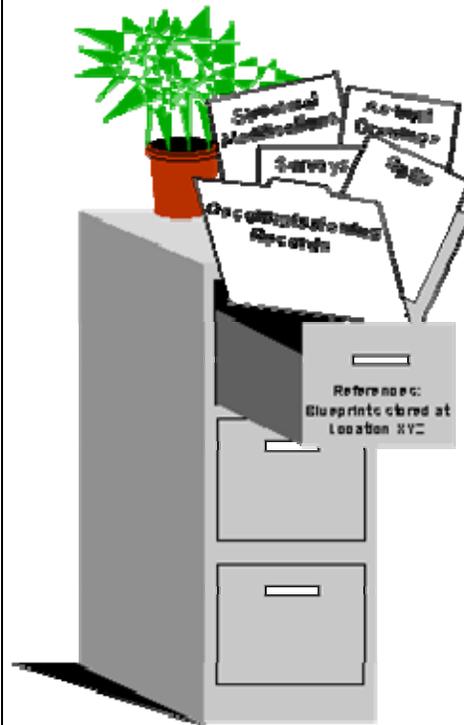
The requirements for maintaining records important to decommissioning, including the type of information required, are stated in OAC 3701:1-40-17(I), OAC 3701:1-44-18(F), and OAC 3701:1-56-10(B). All licensees are required to maintain these records in an identified location until the site is released for unrestricted use. Careful record keeping of radionuclides used, including form, amount and area used, will facilitate area release and license termination. In the event that the licensed activities are transferred to another person or entity, these records shall be transferred to the new licensee when the transfer of the licensed activities takes place. The new licensee is responsible for maintaining these records until the license is terminated. When the license is terminated, these records must be transferred to the department.

**OAC 3701:1-40-17(I), Requirements for Disposition of Records Important to Decommissioning**

- Before licensed activities are transferred or assigned according to OAC 3701:1-40-16(B), transfer to the new licensee

**OR**

- Before the license is terminated, transfer records to the department



**Response from applicants:** If a DFP or certification of financial assurance is required, submit the required documents.

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

6. Purpose for which radioactive material will be used

**Regulations:** OAC 3701:1-40-01; OAC 3701:1-38-02(D); OAC 3701:1-40-15(A)(1) ; OAC 3701:1-40-22; and OAC 3701:1-40-26.

**Criteria:** Requested radioisotopes should be used for purposes authorized. Sealed sources and devices containing licensed material provided by a separate manufacturer or distributor should be used only for the purpose for which they are designed and according to the manufacturer's (distributor's) instructions and recommendations for use as specified in the SSD Registration Certificate obtained from the manufacturer.

Sealed sources or devices containing sealed sources that are intended for use solely under broad scope licenses, and that will not be transferred to another licensee, need not be evaluated by the director prior to use if the licensee is authorized to possess the requested quantity of radioactive material in unsealed form and the licensee performs its own safety evaluation. Applicants desiring activities not permitted by OAC 3701:1-40-26(A) should apply for specific authorization.

**Discussion:** The applicant should describe in general terms the purposes for which the licensed material will be used. New applicants should describe why a broad scope license is needed rather than amendments to an existing limited scope license. The uses should be consistent with prior licensed activities. Sufficient information should be provided to enable the reviewer to have a clear understanding of each use and to determine the potential for exposure of workers and members of the public to radiation and radioactive materials. The information provided regarding “Purpose of Use” is understood by department staff as a self-imposed limitation contained within the application. If a broad scope licensee desires to initiate a use other than those described in its application and committed to in its license, the licensee must submit an amendment to the license to modify or expand the “purpose.”

The exclusions stated in OAC 3701:1-40-26(A) provide that, unless specifically authorized by other parts of the regulations, persons licensed under broad licenses will not do any of the following:

- Conduct tracer studies in the environment involving direct release of byproduct or accelerator produced material.
- Receive, acquire, own, possess, use, transfer, or import devices containing – 3,700 terabecquerels (100,000 curies) or more of byproduct or accelerator produced material in sealed sources used for irradiation of materials.
- Conduct activities for which a specific license issued by the director under this chapter or Chapter 3701:1-46, 3701:1-48, or 3701:1-58 of the OAC is required.
- Add or cause the addition of byproduct or accelerator produced material to any food, beverage, cosmetic, drug or other product designed for ingestion or inhalation by, or application to, a human being.

Applicants desiring these activities should review the appropriate guide (i.e., that volume of NMS-LIC-NN that most closely applies) and request specific authorization in accordance with the guidance contained therein. For example, broad scope licensees who wish to perform industrial radiography should review NMS-LIC-02, “Program-Specific Guidance About Radiography Licenses,” and provide necessary information, as specified.

**Response from Applicant:** Describe in general terms the purposes for which the licensed material will be used.

## 7.7 ITEM 7: INDIVIDUAL(S) RESPONSIBLE FOR RADIATION SAFETY PROGRAM AND THEIR TRAINING AND EXPERIENCE

7. Radiation Safety Officer (Include training and experience.)

Executive management; the Radiation Safety Committee (RSC), if required; and the Radiation Safety Officer (RSO); and their staff; as necessary; work as a team to oversee the broad scope program. Each plays a critical role within its area of responsibility. The roles and responsibilities of executive management, the RSC, the RSO and the radiation safety office staff are discussed in the sections that follow.

### 7.7.1 Executive Management

**Regulations:** OAC 3701-38-11(E)(1); OAC 3701:1-40-23(C); OAC 3701:1-40-24(B); and OAC 3701:1-40-25(C).

**Criteria:** The applicant must have administrative controls and provisions relating to organization and management and management review necessary to assure safe operations.

**Discussion:** Executive management is the individual at the senior management level who is responsible for oversight of the facility's radiation safety program and has the ultimate responsibility for the license and the activities associated with the license. Executive management has an important role in implementing and managing the radiation safety program. The department expects executive management to be knowledgeable of the program.

Due to the various structures of different organizations, the department recognizes that executive management may need to delegate certain responsibilities to other managers for the day-to-day oversight of the program. For example, a large company may have several licenses issued to it for different facilities or for different activities. In this case, a company may choose to establish a senior level manager with responsibility for all of the licenses issued to that company, with the day-to-day responsibility for each license designated to the facility senior manager or program area senior manager. There are numerous ways in which an applicant may wish to structure its management oversight to meet the needs of the organization. However, there must still be one level of management, as the licensee's representative, with ultimate responsibility for the radiation safety program.

In a Type A broad scope program, executive management or her/his delegate is a vital member of the RSC and should attend committee meetings. In all licensed programs, executive management should be knowledgeable of the results of periodic audits and the annual review of the licensed program to ensure all activities are in compliance with regulatory requirements and the conditions of the license, and that activities are being conducted in a safe manner. Annual reviews and audits are discussed in more detail in Section 7.10.1 of this guidance document.

The licensee should consider several factors when selecting executive management for the radiation safety program. This individual represents the highest level of facility management and has the authority to delegate resources for the program and appropriate funds in a timely manner. This individual must be available to facilitate effective and immediate action on behalf of management, the RSC (for Type A broad scope programs), and the RSO, particularly in the event of an emergency. Executive management must have the authority to make prompt decisions without having to consult with higher management officials, including the authority to take whatever action is necessary to ensure that all radiation safety practices are in accordance with the regulations and conditions of the license.

Executive management is involved in selecting the chairperson and members of the RSC (for Type A broad scope) and the RSO (for Type A and Type B broad scope), and defines the role, duties and responsibilities of each. Executive management should support the RSC and the RSO, creating an atmosphere of cooperation and professionalism such that individuals feel comfortable raising radiation safety concerns. Authority will be enhanced if authorized users clearly understand there is strong management support for, and participation in, the licensed program. Many problems can be avoided if management takes proactive steps before radiation safety problems escalate. Individuals should understand management's expectations regarding internal enforcement of program requirements and the consequences for non-compliance.

**Response from Applicant:** 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).

### **7.7.2 Radiation Safety Committee**

**Regulations:** OAC 3701:1-40-23(C)(1) and 23(C)(3)(c).

**Criteria:** Type A broad scope licensees must establish a RSC, which works with executive management and the RSO in implementing the radiation safety program. Type B and Type C broad scope licensees are not required to establish an RSC.

**Discussion:** An applicant for a Type A broad scope license must establish an RSC pursuant to OAC 3701:1-40-23(C)(1). The RSC works with executive management and the RSO in implementing the radiation safety program, and will be involved in establishing policies and procedures for managing the radiation safety program. The RSC, through the executive management, must have the authority and flexibility necessary so that it may effectively fulfill its role in managing the radiation safety program.

The RSC for a Type A broad scope program is composed of such persons as the RSO, executive management and persons trained and experienced in the safe use of radioactive materials. Each area of use under the license should be represented on the RSC.

A chairperson for the committee should be selected. There are several factors to consider when selecting a chairperson for the RSC. An individual with a knowledge of radiation safety issues, good leadership abilities, the authority and credibility by virtue of their position within the facility and a desire to serve as chairperson will facilitate the effectiveness of the RSC. Additionally, the individual chosen as the chairperson must have the time to devote to the position in addition to other responsibilities he or she might have within the facility. Executive management should delegate a level of authority to the position so the chairperson is effective. In general, the RSO should not be appointed as the chairperson of the committee, because the RSO is responsible for the day-to-day operation of the radiation safety program and may be too closely involved with the licensed activities to be objective.

The RSC should establish a quorum for RSC meetings. A quorum consisting of the chairperson of the committee (or his/her designee), the RSO, the executive management (or his/her alternate), a representative from each area of use from which specific issues will be discussed and any other member whose field of expertise is necessary for the discussion is considered acceptable.

The meeting frequency for RSC meetings for broad scope programs is not specified in OAC 3701:1-40. The RSC should meet as often as needed to ensure the radiation safety program is operating in compliance with the license, established procedures and the regulations. For most programs, quarterly RSC meetings are needed to adequately oversee the program.

The RSC should maintain minutes of its meetings. The minutes should include the date of the meeting, the members present and absent to demonstrate a quorum was present, a summary of the discussions, recommendations and the results of votes. The RSC should also document its review of new users, uses and program changes. The minutes should also include information related to the ALARA program reviews and the annual audit review.

### **Duties and Responsibilities**

The committee is responsible for reviewing personnel dosimetry data, discussing the results of required radiation surveys and any significant incidents including spills, contamination, misadministration, etc. The RSC is also required to review the program for maintaining doses ALARA and providing any necessary recommendations to ensure doses are ALARA. The overall compliance status for authorized users should be thoroughly reviewed. The RSC, working with the executive management, shares responsibility with the RSO for conducting periodic audits of the radiation safety program. Additionally, the committee reviews any consultant's audit findings and acts upon those findings. The RSC also reviews the results of the annual audit of the radiation safety program. Possible trends should be analyzed and suggestions for timely and

corrective action should be made. Problems should be clearly defined and reviewed in the future as open items. An assessment of the effectiveness of corrective actions is also helpful in deterring or eliminating future problems and violations.

One of the primary responsibilities of the RSC for a broad scope program is to evaluate new users and new uses of radioactive material. The RSC needs to consider all available information in making decisions. This includes evaluating the training and experience of applicants who request authorization to use radioactive material at the facility, using criteria developed by the RSC. The RSC members should be aware of the regulatory training and experience criteria that apply to each type of use at their institution. For example, OAC 3701:1-58 contains the training and experience required for authorized users in medical programs. The criteria developed by the committee should include such information as the requester's training and experience, the proposed facilities, the protocol for using radioactive material to ensure that all procedures are in accordance with good radiation safety practices and waste disposal.

For Type A broad scope licensees or applicants for a Type A broad scope license who desire the flexibility to make certain program changes and changes to certain procedures as discussed in Section 1 of this document, the RSC, along with executive management and the RSO, will review and approve program and procedural changes in accordance with criteria developed and approved by the RSC. The criteria for reviewing and approving such changes should include provisions for training staff before implementing new procedures and ensure the proposed changes will not degrade the effectiveness of the currently approved program. Additionally, the audit program should include an evaluation process that will assure changes have been properly implemented by the staff and will determine the effectiveness of changes made in achieving program goals. For medical broad scope programs, the requirements of OAC 3701:1-58 must be met.

**Response from Applicant:** Applicants for a Type A broad scope license should submit the following:

- Description of the duties and responsibilities of the RSC.
- Criteria used for selecting members of the RSC including what members and the number of members constituting a quorum. Members should be indicated by position title, rather than by name.
- Criteria used by the RSC and RSO for approving new users and new uses.

In addition, applicants for a Type A broad scope license who are requesting the flexibility to make some program changes and revise some procedures previously approved by the department without amendment of the license should submit the following:

- Description of the duties and responsibilities of the RSC, including:
  - Review and approval of permitted program and procedural changes prior to implementation.

- Implementation of program and procedural changes.
- Audit of licensed operations to determine compliance.
- Taking appropriate actions when noncompliance is identified, including analysis of the cause, corrective actions, and actions to prevent recurrence.
- 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.

### 7.7.3 Radiation Safety Officer

**Regulations:** 3701:1-40-15(A)(3); OAC 3701:1-40-23(C)(2); OAC 3701:1-40-24(B)(1); OAC 3701: 1-48-15; OAC 3701:1-58-12; and 3701:1-52-04(D).

**Criteria:** Type A and Type B broad scope licensees must have an RSO who is qualified by training and experience in radiation protection, and who is available for advice and assistance on radiological safety matters. The RSO’s training and experience must include the types and quantities of licensed material to be authorized on the license. While regulation does not require Type C broad scope licensees to have an RSO, OAC 3701:1-40-25 requires that the licensee establish administrative controls and provisions relating to procurement of radioactive material, procedures, record keeping, material control and accounting and management review to assure safe operations. Type C broad scope licensee management should appoint someone responsible for the day-to-day operation of the radiation safety program, such as an RSO.<sup>3</sup>

**Discussion:** Each Type A and Type B program in which radioactive materials are used must appoint an RSO who is responsible for radiation safety and compliance with the regulations for the use of radioactive material. Each Type C broad scope program should appoint an individual who is responsible for the day-to-day operation of the radiation safety program. In a Type A broad scope license the RSO is a member of the RSC and works closely with the RSC and executive management in implementing the radiation safety program. The RSO must ensure radiation safety activities are being performed safely according to approved policies and procedures, and that all regulatory requirements are met. The RSO should have full access to all activities involving the use of radioactive material and the authority to terminate any activity in which health and safety appear to be compromised without consulting with executive management or the RSC, if required. The applicant should submit a “Radiation Safety Officer Delegation of Authority” signed by executive management. Appendix E contains a model “Delegation of Authority” that is acceptable to the department.

In a Type A broad scope-licensed program, the RSO typically performs a preliminary review of proposed new uses and users, prior to formally discussing the proposal with the

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<sup>3</sup> “Radiation Safety Officer” or “RSO” means an individual designated by the licensee who has the knowledge and responsibility for the overall radiation safety program at the facility, to include the implementation of the daily radiation safety operations and compliance with the rules.

RSC. The RSC grants the formal approval of new users and uses in a Type A broad scope license. The task of reviewing and approving proposed uses and users in a Type B broad scope-licensed program is the responsibility of the RSO. In a Type C broad scope program, individuals are qualified as users if they meet the training and experience criteria described in OAC 3701:1-40-25(B). While no licensee committee or individual is required by regulation to make the determination that an individual is qualified to use the material possessed under the Type C broad scope license, or that a particular use of radioactive material is safe, licensee management is ultimately responsible for assuring safe operations.

The RSO performs audits of all areas of use and individuals who are authorized to use radioactive material to ensure work is done in accordance with the license, regulations and user permit conditions. Specific duties and responsibilities of the RSO include:

- Monitoring and surveys of all areas in which radioactive material is used.
- Oversight of ordering, receipt, surveys, and delivery of radioactive material.
- Packaging, labeling, surveys, etc., of all shipments of radioactive material leaving the institution.
- Personnel monitoring program including determining the need for and evaluating bioassays, monitoring personnel exposure records and developing corrective actions for those exposures approaching maximum permissible limits.
- Training of all personnel.
- Waste disposal program.
- Inventory and leak tests of sealed sources.
- Decontamination.
- Investigating any incidents and responding to any emergencies.
- Maintaining all required records.

The responsibilities of the RSO may not be transferred to other individuals. Many tasks and duties associated with managing the program may be assigned or delegated to other qualified individuals; however, the responsibility for these tasks and duties is with the RSO. The department does recognize that a qualified individual will have to fill in for the RSO when the RSO will be away for short periods of time for professional conferences, vacation or illness. However, this should not occur for extended or indefinite periods of time. Consideration should also be given to how this individual would be contacted in the event of an emergency.

When selecting an RSO, the applicant should keep in mind the duties and responsibilities of the position and select an individual who is qualified to serve as the RSO. The RSO will need a basic technical knowledge sufficient to understand, in general, the majority of the work being done with radioactive materials under their responsibility. The department recognizes that an RSO cannot be an expert in all areas that might be involved in a broad

scope program. The RSO should be qualified by training and experience to perform the duties required for the position. Executive management should ensure enough time is allocated to the individual selected as the RSO to carry out the responsibilities of the position.

The applicant should review the RSO guidance provided in the guide corresponding to the particular type of licensed program. For example, NMS-LIC-07, “Program Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,” contains guidance that is appropriate for broad scope licensees who are involved in research and development.

The applicant should also be aware of specific regulatory requirements for the RSO which may apply to their licensed program. For example, OAC 3701:1-58 contains specific requirements for an RSO in a medical program. However, an individual who qualifies as a medical RSO is not necessarily qualified to be RSO in a broad scope program.

**Response from Applicant:** For Type A and Type B applicants:

- Submit the name of the proposed RSO.
- Describe the training and experience for the proposed RSO that demonstrates the individual is qualified to perform the duties required under the license.
- Submit a statement delineating the RSO’s duties and responsibilities.
- Submit a Radiation Safety Officer Delegation of Authority signed by the licensee’s executive management.

For Type B Applicants, submit the criteria used by the RSO to approve of new users and uses of radioactive material.

For Type C Applicants, 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., the RSO, 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).

**NOTES:**

- Applicants should provide specific information about the proposed RSO's training and experience that is relative to the licensed material requested in the application. Applicants should not submit extraneous information such as unrelated lists of publications, research grants, committee and society memberships, etc. This only serves to slow down the review process.
- It is important to notify the department as soon as possible, typically within 30 days, of changes in the designation of the RSO. The name and qualifications of the replacement RSO must be submitted as part of an amendment request. Applicants should review the regulations for specific program areas such as medical uses that have specific requirements regarding changes in the RSO.

**7.7.4 Radiation Safety Office Staff**

**Criteria:** Licensees should provide sufficient staff to assist the RSO in implementing the radiation safety program.

**Discussion:** The licensee should provide the RSO with a sufficient staff of professional and administrative support personnel. The number of staff and their qualifications will vary depending on the scope of the program. For small programs, the RSO may not require any assistance. Licensees should evaluate the licensed program and ensure the RSO has adequate resources to effectively manage the program.

**Response from Applicant:** No response is required.

**7.8 ITEM 8: TRAINING**

**8. Training Program** (Include topics to be covered, frequency of training, and recipients.)

**Regulations:** OAC 3701:1-38-10; OAC 3701:1-40-15(A)(3); and OAC 3701:1-40-16(C).

**Criteria:** Before beginning work with or in a restricted area; all individuals who are likely to receive an occupational dose in excess of 1 mSv (100 mrem) in a year must receive radiation safety training commensurate with their assigned duties and specific to the licensee's radiation safety program. Each individual should also receive periodic refresher training.

**Discussion:** OAC 3701:1-38-10(B)(1) describes the training that licensees are required to provide individuals who in the course of their employment are likely to receive in a year an occupational dose in excess of 1 mSv (100 mrem). OAC 3701:1-38-10(B)(2) requires that the licensee, in determining which individuals are subject to the training requirements of OAC 3701:1-38-10(B)(1), consider assigned activities during both normal and abnormal situations involving exposure to radiation and/or radioactive

material that can reasonably be expected to occur during the life of a licensed facility. While many licensees can demonstrate that it is not likely during a normal situation for a laboratory worker, manufacturing technician, hospital technologist or environmental services worker at their facility to receive in a year an occupational dose in excess of 1 mSv (100 mrem), these individuals and others could reasonably be expected to receive this level of exposure during abnormal situations (e.g., radioactive material left unsecured, a contamination event or improper disposal of radioactive material in the regular trash) or, by their actions, cause others to receive this level of exposure. Untrained workers represent a potential hazard to themselves, other individuals and property.

Licensees should not assume safety instruction has been adequately covered by prior employment or academic training. Practical, site-specific training should be provided for all individuals prior to beginning work with or in the vicinity of licensed material. Periodic refresher training should also be provided. Topics covered should, at a minimum, include those described in OAC 3701:1-38-10(B)(1). The training may take any form. Many licensees utilize video tapes or interactive online or off-line computer programs to provide training. The licensee should determine whether the training succeeded in conveying the desired information and adjust the training program as necessary. The person conducting the training should be a qualified individual who is familiar with the licensee's program.

Retraining should be performed whenever there is a change in duties or the work environment and at a frequency sufficient to ensure all staff is adequately trained.

Applicants should review the model training program described in the appropriate guide corresponding to the particular type of licensed program. For example, NMS-LIC-07 describes a training program that is acceptable to the department for licensees who are involved in research and development.

The applicant should also be aware of additional specific training requirements that may apply to their licensed program. For example, OAC 3701:1-58 contains specific requirements for the training of individuals who will work under the supervision of medical authorized users.

**Response from Applicant:**

- 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.

**Or**

- 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.

## 7.9 ITEM 9: FACILITIES AND EQUIPMENT

**9. Facilities and Equipment** (attach documentation and diagram of locations of use and storage.)

**Regulations:** OAC 3701:1-38-11(E)(2); OAC 3701:1-38-11(E)(4); OAC 3701:1-38-22; OAC 3701:1-40-15(A)(2); OAC 3701:1-40-16(C); OAC 3701:1-40-17(I); OAC 3701:1-40-23; OAC 3701:1-40-24; and OAC 3701:1-40-25.

**Criteria:** Facilities and equipment must be adequate to protect health and minimize danger to life or property. They must minimize the possibility of contamination and keep exposures to workers and the public ALARA.

**Discussion:** Applicants for all broad scope licenses need to demonstrate that their facilities and equipment provide sufficient engineering controls and barriers to protect the health and safety of the public and its employees, keep exposures to radiation and radioactive materials ALARA and minimize the danger to life and property from the types and quantities of radioactive materials to be used. Facilities and equipment designed to control exposure can range from a vial that contains licensed material to buildings, fences or exclusion areas that are between the source and the maximally exposed member of the public. These facilities not only reduce the exposure from the source but may also limit access to the source. The licensee should list and describe these facilities for the following purposes:

- To show compliance with a regulation.
- To demonstrate the use of the material will be within the ALARA concept.
- To meet emergency response requirements.

Licensees should consider controlling exposures through available engineering options, as well as through limiting the releases of radioactive material in effluents to the environment. The licensee should describe all facilities and equipment essential to achieving these goals. The licensee will also need to describe the criteria that will be used by the RSC and/or RSO, as appropriate, to review and approve of proposed facilities. Facilities and equipment used for special applications where the impact upon workers or the public could be significant if radioactive material were released accidentally, need to be specifically described. These would include, for example, room irradiators, specialized iodination/tritiation facilities, alpha laboratories, radioactive waste processing facilities (including incinerators, compactors, liquid reclamation processors, etc.), radioactive waste storage facilities (including decay-in-storage locations), individual laboratories processing 3.7 gigabecquerels (GBq) (100 millicuries) or more of radioactive materials per experiment or process, nuclear pharmacies, specially designed therapy rooms and sealed source storage areas. Significant modifications affecting facilities and equipment should have prior RSO review and RSC approval before commencement of such modifications.

Also note that if radioactive materials will be used in or on animals, a description of the animal handling and housing facilities will need to be discussed. Appendix H of NMS-LIC-07, “Program-Specific Guidance About Academic, Research and Development, and Other Licenses of Limited Scope,” provides guidance on the information that should be addressed concerning the use of radioactive materials in animals.

In your discussion of the criteria used to evaluate your facilities and equipment, you should include a discussion on how a laboratory or facility classification scheme relates to toxicity and quantity of radioactive material and your facility and equipment requirements. For example, the International Atomic Energy Agency (IAEA), as well as other health physics and industrial hygiene professional organizations, has developed classification schemes used in assessing minimum needs (e.g., equipment and facilities, user training, personnel monitoring, surveys) that consider the hazard and quantity of radioactive materials to be used (IAEA Safety Standard, Safety Series No. 1, “Safe Handling of Radionuclides, 1973 Edition”). Applicants may consider the development of such a classification scheme because it can be correlated with all aspects of the radiation safety program. Each applicant’s scheme should be based upon the types and quantities of radioactive material anticipated to be used. The criteria used to develop the classification scheme should be provided to each RSC member for use when evaluating requests to use licensed materials.

Appendix F provides the radionuclide toxicity and laboratory classification information excerpted from IAEA, which is acceptable to department staff. This table is not all inclusive and is meant to be used as an example only. Based on chemical/physical form, need and quantities, your classification scheme may differ from that of the IAEA excerpt. Your application will need to describe the minimum facilities and equipment requirements for each laboratory classification.

Appendix G provides additional guidance regarding facilities and equipment used to handle radioactive materials in a laboratory setting.

**Response from Applicant:** Describe the criteria your RSC and/or RSO, as appropriate, will use to review and approve facilities and equipment (research laboratories, iodination facilities, waste storage facilities, survey and counting equipment, etc.). Your description will need to include your method of classifying laboratories based on type, toxicity and quantity of radioactive material being requested. Sample diagrams should be provided for each classification scheme that takes 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 descriptions of the ventilation systems including pertinent airflow rates, pressures, filtration equipment and monitoring systems. For special application facilities, such as those facilities described above, 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 radioactive material use. Also describe your procedures for control, review and approval of significant facilities or equipment modifications

## 7.10 ITEM 10: RADIATION SAFETY PROGRAM

<b>10. Radiation Protection Program</b> (Include personnel monitoring, instrumentation, and procedures.)
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### 7.10.1 Audit Program

**Regulations:** OAC 3701:1-40-23(C); OAC 3701:1-40-24(B); OAC 3701:1-40-25(C); OAC 3701:1-38-11; and OAC 3701:1-38-20.

**Criteria:** Applicants for Type A, Type B and Type C broad scope licenses are required by OAC 3701:1-40-23(C), 24(B) and 25(C), respectively, to establish administrative controls and provisions relating to management review necessary to ensure safe operations. OAC 3701:1-38-11(E)(3) requires the licensee to review the radiation program content and implementation periodically (at least annually). Licensees are required by OAC 3701:1-38-20 to maintain records of the radiation protection program, including: (1) the provisions of the program; and (2) audits and other reviews of the program contents and implementation.

#### **Discussion:**

#### **Management and Radiation Safety Committee Audits**

The application for a Type A, B or C broad scope license should discuss executive management oversight of the licensed program and the mechanisms they will use to ensure they are aware of applicable regulations, the provisions of the license and the compliance status of the institution's licensed program. This oversight may include independent audits of the program, frequent meetings with the RSC and/or RSO as appropriate and periodic tours of selected facility areas.

In a Type A broad scope program, the RSC assists executive management in performing this oversight function. Detailed written procedures should be developed and implemented for the operation of the RSC to ensure appropriate oversight is provided. The RSC should be fully aware of the operations and activities of the radiation safety office. The RSC should conduct periodic interactive management audits and evaluations of the radiation safety program's performance, including: non-conformance reports; corrective action; status reports and audits; incident investigation reports; ALARA program development and implementation; effluent releases; qualification and radiological safety training; and performance of the RSO. Results of the RSC's audit and program reviews should be reported to executive management to allow for timely and aggressive remedial actions sufficient in scope to ensure compliance with regulations and license conditions.

Appendix H contains a model audit program that is acceptable to the department for use in the review of most non-medical broad scope programs.

OAC 3701:1-38-11(E)(3) requires the licensee to review the radiation program content and implementation periodically (at least annually). Generally, these audits are conducted at least once every 12 months.

### **Internal Audits**

The application should describe the audit mechanism implemented by the RSO and their staff or other individual who is responsible for the day-to-day operation of the licensed program 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. The audit program should include routine unannounced inspections of each user's facility and practices to supplement and audit the routine monitoring performed by the user. Facility inspections should include:

- Review of user inventory and survey records.
- Evaluation of user and technician training through discussion and observation of work practices.
- Performance of independent surveys of user work areas.
- Evaluation of compliance with regulations, the conditions of the license, the RSC/RSO permit and safety manual requirements.
- Provision for performance-based instruction to users and technical-level staff.

The types and frequencies of monitoring performed by the RSO should be indicated. The intervals of surveys and audits should be frequent enough to ensure close communications and proper surveillance of individual radioactive material users. Applicants should consider developing survey and audit schedules based on activity and use (e.g., high-use facilities and users of volatile radioactive materials may be audited weekly or biweekly, intermediate use facilities may be audited monthly and low-level facilities may be audited quarterly).

If an audit identifies violations of department requirements, the licensee should evaluate the safety significance of each violation to set priorities and identify resources to correct these violations. Certain identified problems or potential violations may require notification or a report to the department. Appendix I of this document describes the more common reporting requirements. Licensees are encouraged to contact the department for guidance if there is any uncertainty regarding a reporting requirement. The department routinely reviews licensees' records to verify if appropriate corrective actions were implemented in a timely manner to prevent recurrence. It is in the best interest of the licensee to identify potential violations of regulatory requirements and take necessary steps to correct them. Items of noncompliance may not necessarily be deemed violations if prompt and effective corrective actions are implemented.

The department's emphasis in inspections is for applicants to perform actual observations of work in progress. As a part of their audit programs, applicants should consider

performing unannounced audits of radioactive material users to determine if, for example, safe use of radionuclide procedures and emergency procedures are available and are being followed.

### **Recordkeeping**

OAC 3701:1-38-20 requires that licensees maintain records of audits and other reviews of program content and implementation for three years from the date of the record. Records of audits should include: date of audit, name of person(s) who conducted the audit, persons contacted by the auditor(s), areas audited, audit findings, corrective actions and follow-up. These records must be maintained for inspection by the department.

### **Response from Applicant:**

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.

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 department for review during the licensing phase. The adequacy of this audit program will be reviewed during inspection.

Describe the audit mechanism implemented by the RSO or other responsible individual to determine user compliance with department regulations, the terms and conditions of the license, the requirements of the RSC- or RSO-approved permits (as appropriate) and good health physics practices.

### **7.10.2 Radiation Monitoring Instruments**

**Regulations:** OAC 3701:1-38-14; OAC 3701:1-38-20(C); OAC 3701:1-40-15(A)(2); OAC 3701:1-40-23; OAC 3701:1-40-24; OAC 3701:1-40-25; OAC 3701:1-58-23; and OAC 3701:1-58-24.

**Criteria:** Licensees must, pursuant to OAC 3701:1-38-14, possess and periodically calibrate radiation monitoring instruments that are necessary to protect health and minimize danger to life or property.

**Discussion:** Licensees must possess an adequate number of radiation detection and measurement instruments as necessary and ensure they are calibrated periodically for the radiation being measured. For purposes of this document, survey instruments are defined as any device used to measure the radiological conditions at a licensed facility. The choice of instrument needs to be appropriate for the type of radiation to be measured and for the type of measurement to be taken (count rate, dose rate, etc.).

The applicant should submit the criteria used in determining what radiation detection and monitoring equipment will be required for each type of use by authorized users and the availability of a sufficient quantity of these instruments to both the radiation safety office and authorized users (e.g., ion-chambers, G-Ms, air samplers, liquid scintillation counters).

The department requires survey instruments used to determine compliance with regulatory requirements be calibrated periodically by the instrument manufacturer or persons specifically authorized by the NRC or an Agreement State. Survey instruments should be calibrated at least annually (every 12 months), unless otherwise specified by regulation or license condition. Licensees seeking authorization to perform their own survey instrument calibrations will need to submit calibration procedures for review. The licensee may wish to review available industry standards for calibration of instruments such as ANSI N323A-1997, "Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments." Appendix J of this document provides useful information about instrument specifications and model calibration procedures that are acceptable to the department.

Some instruments may need to be checked only periodically for operability and response to radiation rather than receive full calibration. For example, Geiger-Mueller (G-M) type survey instruments used to identify contamination in laboratories may only need to be checked for ability to detect low-level contamination.

Applicants will need to submit their method for assuring instruments are checked and/or calibrated at proper frequencies.

**Response from Applicant:**

- 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.
- Discuss how the RSC and/or RSO, as appropriate, will assure instruments are properly calibrated at prescribed frequencies.
- Submit procedures for instrument calibration or state that instruments will be calibrated by a vendor who is licensed by the 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.

**NOTE:** If you wish to perform instrument calibration as a commercial service, you will need to either amend your existing broad scope license or apply for a new license authorizing commercial calibration service.

### 7.10.3 Material Receipt and Accountability

Regulations: OAC 3701:1-38-14(A)(1); OAC 3701:1-38-17; OAC 3701:1-38-18; OAC 3701:1-38-19; OAC 3701:1-38-20(K); OAC 3701:1-38-21; OAC 3701:1-40-16(C); OAC 3701:1-40-17(I); OAC 3701:1-40-19; OAC 3701:1-40-21; OAC 3701:1-40-23; OAC 3701:1-40-24; and OAC 3701:1-40-25.

**Criteria:** Licensees must, pursuant to Chapters 3701:1-38 and 40 of the OAC, develop, implement and maintain written procedures for all of the following:

- Purchasing and receipt of radioactive material.
- Safely receiving and opening packages.
- Control and accountability of licensed material.

The licensee must also maintain records of receipt, utilization, transfer and disposal of licensed material.

**Discussion:** Applicants for a broad scope license are required to establish appropriate administrative controls and provisions that are necessary to assure safe operations including procedures to assure the control of procurement and use of radioactive material. Administrative procedures must assure that only authorized individuals receive radioactive materials and those individuals receive only the types and quantities of radioactive material that they are authorized to receive.

Applicants for a broad scope license are strongly encouraged to develop an administrative procedure to control procurement and use of radioactive material that emphasizes centralized purchasing and receipt. The department has found centralized purchasing and receipt to be effective in controlling licensed materials entering the licensed institution through normal commercial channels, particularly for larger institutions. Procedures must also be established to control licensed materials obtained outside of the normal channels, e.g., through the loan or transfer of materials without purchase or through surplus. Appendix K of this document describes a model procedure for controlling procurement and use of radioactive material that is acceptable to the department.

Licensees are required to develop, implement and maintain written procedures for safely receiving and opening packages in accordance with OAC 3701:1-38-18. Appendix K of this document describes a model procedure for safely receiving and opening packages containing licensed materials that is acceptable to the department.

Applicants for a broad scope license are required to establish appropriate administrative controls and provisions relating to material control and accounting that are necessary to assure safe operations. Licensees use various methods to account for receipt, use, transfer, disposal and radioactive decay of unsealed licensed material (e.g., computer programs, manual ledgers, log books, etc.). These methods help to assure that licensee and individual authorized user possession limits are not exceeded. Licensees who possess

sealed sources are required to perform periodic inventories. The frequency of these inventories is normally established by license condition as every six months; however, regulation may specify a different inventory frequency (e.g., sealed sources used for medical therapy are required to be inventoried every three months).

Licensed material is considered to become part of the licensee’s inventory at the time that it is received by the licensee, be it during normal working hours or after hours when delivered by the carrier in accordance with procedures established by the licensee. If through some error, the licensee receives material it is unauthorized to possess or receives quantities of material that would result in the total inventory being in excess of license possession limits, the licensee should place the package in secure storage and arrange for the return of these materials in a timely manner. If return of the materials is not possible, the licensee should contact the department and request issuance of an expedited license amendment. The materials must not be used until the amendment is granted.

OAC 3701:1-38-17 requires licensees to secure radioactive materials from unauthorized removal or access while in storage and to control and maintain constant surveillance over licensed material that is not in storage. Applicants for broad scope licenses must establish policies and procedures to ensure compliance with security requirements.

Licensees must maintain records of receipt, use, transfer and disposal of all licensed material. Table 7.1 below lists each type of record and how long the record must be maintained.

**Table 7.1 Record Maintenance**

<b>Type of Record</b>	<b>How Long Record Must be Maintained</b>
Receipt	For as long as the material is possessed until three years after transfer or disposal
Transfer	For three years after transfer
Disposal	Until the director terminates the license
Important to Decommission*	Until the site is released for unrestricted use

\* Information about locations where licensed material is used or stored are among the records important to decommissioning and required by OAC 3701:1-40-17(I). See also the section on “Financial Assurance and Recordkeeping for Decommissioning.”

**Response from Applicant:**

Describe your administrative procedures to assure control of procurement, use and transfer of radioactive material.

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.

Describe your administrative controls and provisions relating to materials control, accounting and security.

#### **7.10.4 Occupational Dose**

**Regulations:** OAC 3701:1-38-12; OAC 3701:1-38-14; OAC 3701:1-38-16; OAC 3701:1-38-20; and OAC 3701:1-38-12 Appendices A and C.

**Criteria:** The use of individual monitoring devices for external dose is required, pursuant to OAC 3701:1-38-14(B)(1), for:

- Adults who are likely to receive an annual dose in excess of any of the following (each evaluated separately):
  - 0.005 Sv (0.5 rem) deep-dose equivalent.
  - 0.015 Sv (1.5 rems) eye-dose equivalent.
  - 0.05 Sv (5 rems) shallow-dose equivalent to the skin.
  - 0.05 Sv (5 rems) shallow-dose equivalent to any extremity.
- Minors who are likely to receive an annual dose in excess of any of the following (each evaluated separately):
  - 1.0 mSv (0.1 rem) deep-dose equivalent.
  - 1.5 mSv (0.15 rem) eye-dose equivalent.
  - 0.005 Sv (0.5 rem) shallow-dose equivalent to the skin.
  - 0.005 Sv (0.5 rem) shallow-dose equivalent to any extremity.
- Declared pregnant women who are likely to receive an annual dose from occupational exposures in excess of 1.0 mSv (0.1 rem) deep-dose equivalent, although the dose limit applies to the entire gestation period.
- Individuals entering a high or very high radiation area.

Internal exposure monitoring is required, pursuant to OAC 3701:1-38-14(B)(2), for:

- Adults likely to receive in one year an intake in excess of 10% of the applicable Annual Limit of Intake (ALI) for ingestion and inhalation.
- Minors and declared pregnant women likely to receive in 1 year a committed effective dose equivalent in excess of 1.0 mSv (0.1 rem).

**Discussion:** If an adult is likely to receive in 1 year a dose greater than 10 percent of any applicable limit, monitoring is required. The licensee should perform an evaluation of the dose the individual is likely to receive prior to allowing the individual to receive the dose. This evaluation need not be made for every individual; evaluations can be made for employees with similar job functions or work areas.

If this prospective evaluation shows the individual is not likely to exceed 10 percent of any applicable limit, there are no record keeping or reporting requirements in regard to the individual's exposure. For individuals who received exposure at other facilities in the

current year, the previous dose need not be considered in this prospective evaluation. Only dose that could be received at the facility performing the evaluation need be considered when determining the need for monitoring, and therefore, recordkeeping and reporting requirements. If it is determined that monitoring is not required and a subsequent evaluation shows the 10 percent threshold has or will be exceeded, the dose received when monitoring was not provided should be estimated, recorded, and reported. These estimates can be based on any combination of work location radiation monitoring or survey results, monitoring results of individuals in similar work situations or other estimates to produce a “best estimate” of the actual dose received.

If monitoring is not required to demonstrate compliance with all limits but is required relative to one or more specific limits, the licensee should enter “NR” for “Not Required” in the blocks on the dose history forms to indicate the areas for which monitoring was not required (e.g., extremity or skin doses). Where monitoring was provided but not measurable, the licensee should enter “ND” for “Not Detectable.”

If the prospective evaluation shows the individual is likely to exceed 10 percent of an applicable limit, then monitoring and reporting of the results of monitoring performed regardless of the actual dose received is required. If air sampling or bioassay is required, discussion of air sampling or bioassay should provide enough detail that department staff are assured appropriate steps will be taken to manage and monitor such exposure.

**Response from Applicant:** Submit a description of the method used to demonstrate compliance with the referenced regulations or submit a statement that an evaluation disclosed that individuals do not require monitoring.

### 7.10.5 Public Dose

**Regulations:** OAC 3701:1-38-01; OAC 3701:1-38-13; OAC 3701:1-38-17; and OAC 3701:1-38-20.

**Criteria:** Licensees must ensure licensed material will be used, transported, stored and disposed in such a way that the total effective dose equivalent (TEDE) to members of the public will not exceed more than 1 mSv (100 mrem) in one year and the dose in any unrestricted area will not exceed 0.02 mSv (2 mrem) in any one hour.

**Discussion:** Public dose is defined in OAC 3701:1-38-01 as “the dose received by a member of the public from exposure to radiation and/or radioactive material released by a licensee, or to any other source of radiation under the control of a licensee or registrant.” Public dose excludes doses received from background radiation, from any medical administration the individual has received, from exposure to individuals administered radioactive material and released in accordance with OAC 3701:1-58-30, from voluntary participation in medical research programs and from the licensee’s disposal of radioactive material into sanitary sewerage in accordance with OAC 3701:1-38-19. Whether the dose to an individual is an occupational dose or a public dose depends on the individual’s

assigned duties. It does not depend on whether the individual is in a restricted area, a controlled area or an unrestricted area when the dose is received.

There are both external exposure components and internal exposure components of public dose. The licensee should review all possible internal and external exposure pathways and decide which are applicable to its operations.

Licensees should design a monitoring program to ensure compliance with OAC 3701:1-38-13(E). The extent and frequency of monitoring will depend upon the nature of the licensee's operations, potential releases, exposures and pathways to cause public dose or environmental contamination. For additional guidance regarding monitoring of effluents, refer to section titled "Radiation Safety Program - Surveys."

OAC 3701:1-38-20 requires that licensees maintain survey and monitoring records that demonstrate compliance with the dose limits for members of the public until the director terminates the license.

**Response from Applicant:** 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.

#### **7.10.6 Safe Use of Radionuclides and Emergency Procedures**

**Regulations:** OAC 3701:1-38-10(A)(1)(c); OAC 3701:1-38-11; OAC 3701:1-38-17; OAC 3701:1-38-21; OAC 3701:1-38-23(E); OAC 3701:1-40-14(G); OAC 3701:1-40-16(C); OAC 3701:1-40-20; OAC 3701:1-40-14 Appendix; OAC 3701:1-40-23; OAC 3701:1-40-24; and OAC 3701:1-40-25.

**Criteria:** Licensees are required, pursuant to the rules stated above, to:

- Keep radiation doses to workers and members of the public ALARA.
- Ensure security of licensed material.
- Make required notifications to the department of events.

**Discussion:** Licensees are responsible for developing and implementing procedures to ensure the security and safe use of all licensed material from the time it arrives at their facility until it is used, transferred and/or disposed. The written procedures should provide reasonable assurance that only appropriately trained personnel will handle and

use licensed material without undue hazard to themselves, other workers or members of the public.

All licensed materials that are stored in controlled or unrestricted areas must be secured from unauthorized access or removal, so individuals who may not be knowledgeable about radioactive materials cannot be exposed to or contaminated by the material, and individuals cannot take the material. When any licensed materials are in use inside controlled or unrestricted areas, they must be under constant surveillance so the radiation worker can prevent others from becoming contaminated by or exposed to the material, or prevent persons from removing the material from the area.

Acceptable methods for securing material will vary from one facility to another. Some alternatives used by licensees include:

- Storage and use of licensed materials only in restricted areas.
- Limiting access to an entire facility or building or portion of the building only to radiation workers.
- Providing storage areas that can be locked to prevent access to the material.
- Implementing procedures that require a radiation worker to be within “line of sight” of the materials whenever licensed materials are in use.

You should develop procedures that clearly state acceptable methods to secure licensed material at your facility. Particular attention may be required at facilities that may have unusual needs due to the activities performed such as hot cells, animal care facilities and waste processing facilities. Your security procedures may be in a separate document or included in the “General Safety Procedures.”

Applicants should develop radioisotope-specific procedures based on the respective hazards associated with the radioisotopes. General safety guidelines are described in Appendix M of this document. Licensees are encouraged to use these guidelines in developing procedures for the safe use of radioisotopes.

Licensees need to identify all areas that require posting in accordance with 3701:1-38-18(A), unless they meet the exemptions listed in 3701:1-38-18(B) Also, containers of licensed material (including radioactive waste) must be labeled in accordance with 3701:1-38-18(C), unless they meet the exemptions in 3701:1-38-18(E).

Applicants need to establish written procedures to handle emergencies ranging from a minor spill to a major accident that may require intervention by outside emergency response personnel. These procedures should include provisions for immediate response, after-hours notification, handling of each type of emergency, equipment and the appropriate roles of users and the radiation safety staff. Except for minor spills or releases of radioactivity that can be controlled and cleaned up by the user, individual users should have a clear understanding of their limitations in an emergency, with step-by-step

instructions and clear direction of whom to contact. Model Emergency Procedures that are acceptable to the department are described in Appendix M of this document.

Emergency spill kits should be strategically placed in well marked locations for use by all users and the radiation safety staff. All equipment should be periodically inspected for proper operation and replenished as necessary. The licensee should also consider establishing an Emergency Response Team composed of individuals experienced in various emergency response functions (e.g., radiological, medical, emergency management, security and fire protection).

OAC 3701:1-38-21, OAC 3701:1-38-23(E) and OAC 3701:1-40-20 require certain incidents and emergencies be reported to the department. Appendix I of this document provides examples of some events that require notification and/or reports. Note that Appendix I is not all inclusive, as there are other notification and/or reporting requirements that may apply to your specific program.

If you plan to possess quantities of material in excess of the applicable amounts listed in OAC 3701:1-40-14 Appendix, then you may also be required to submit an “Emergency Response Plan for Responding to a Release.” See Section 7.5.1 for specific information related to this requirement.

**Response from Applicant:** Submit your procedures for safe use of radionuclides and emergencies. Your submission should include procedures for maintaining security of licensed radioactive materials. 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.’”

#### 7.10.7 Surveys

**Regulations:** 3701:1-38-14; OAC 3701:1-38-20(C); OAC 3701:1-40-23; OAC 3701:1-40-24; OAC 3701:1-40-25; OAC 3701:1-48-09(C)(2); OAC 3701:1-48-23; 10 CFR 35.59(d); OAC 3701:1-52-28(H); OAC 3701:1-49-07(A).

**Criteria:** Licensees are required, pursuant to the regulations listed above, to make surveys of potential radiological hazards in their workplaces. The department requires testing to determine whether there is any radioactive leakage from sealed sources. Records of surveys and leak test results must be maintained.

**Discussion:** Survey is defined as an evaluation of the radiological conditions and potential hazards incident to the production, use, transfer, release, disposal or presence of radioactive material or other sources of radiation. These evaluations may be measurements (e.g., radiation levels measured with a survey instrument or results of wipe tests for contamination), calculation or a combination of measurements and calculations. The licensees must interpret and evaluate such measurements and calculations to take appropriate action. The selection and proper use of appropriate instruments is one of the most important factors in ensuring surveys accurately assess the radiological conditions.

Surveys are also used to plan work in areas where licensed material or radiation exists and to evaluate doses to workers and individual members of the public. In certain cases, environmental monitoring may be required to demonstrate compliance with OAC 3701:1-38.

Surveys are required when it is necessary for the licensee to comply with the regulations or to evaluate a radiological hazard. Many different types of surveys may need to be performed due to the particular use of licensed materials. The most important are as follows:

- Surveys for radioactive contamination that could be present on surfaces of floors, walls, laboratory furniture and equipment.
- Measurements of radioactive material concentrations in air for areas where radioactive materials are handled or processed in unsealed form and where operations could expose workers to the inhalation of radioactive material or where licensed material is or could be released to unrestricted areas.
- Measurements of radioactive material concentrations in water that is released to the environment or to the sanitary sewer.
- Bioassays to determine the kinds, quantities or concentration and in some cases, the location of radioactive material in the human body. A bioassay can be made by direct measurement, in vivo counting or by analysis and evaluation of material excreted or removed from the human body.
- Surveys of external radiation exposure levels in both restricted and unrestricted areas.

The frequency of routine surveys depends on the nature, quantity and use of radioactive materials, as well as the specific protective facilities, equipment and procedures that are designed to protect the worker from external and internal exposure. Also, the frequency of the survey depends on the type of survey such as those listed above.

OAC 3701:1-38 does not specify limits for surface contamination. Each applicant should propose and justify what removable surface contamination limits will be allowable before decontamination will be performed in each work area.

Appendix N of this document describes survey procedures that are acceptable to the department.

### **Leak Test**

When issued, a license will require performance of leak tests of sealed/plated foil sources at six-month intervals or as otherwise specified in an SSD Registration Certificate. 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 (Bq) (0.005 microcuries) of radioactivity.

Leak tests are not required if:

- Sources contain only hydrogen-3 (tritium).
- Sources contain only radioactive material with a half-life of less than 30 days.
- Sources contain only a radioactive gas.
- Sources contain 3.7 megabecquerels (MBq) (100 microcuries) or less of beta-emitting or gamma-emitting material or 370 kilobecquerels (kBq) (10 microcuries) or less of alpha-emitting material.
- Sources are stored and are not being used (must be leak tested before use or transfer).

For more information regarding leak tests, see Appendix O of this document.

**Response from Applicant:**

- Surveys
  - 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.’”
- Leak Testing
  - Submit your leak test procedures. 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.’”

**7.10.8 Transportation**

**Regulations:** OAC 3701:1-38-11; OAC 3701:1-40-19; OAC 3701:1-40-21; OAC 3701:1-40-23; OAC 3701:1-40-24; OAC 3701:1-40-25; OAC 3701:1-48-13; OAC 3701:1-50-05; OAC 3701:1-50-07; OAC 3701:1-50-08; OAC 3701:1-50-09; OAC 3701:1-50-17; and 49 CFR Parts 171-178.

**Criteria:** Broad scope licensees who will transport or ship licensed material including radioactive waste must develop, implement and maintain safety programs for transport of radioactive material to ensure compliance with department, NRC and U.S. Department of Transportation (DOT) regulations.

**Discussion:** Knowing how OAC 3701:1-50-05 and 49 CFR interrelate is very important to broad scope programs. Therefore, it is imperative that your radiation safety staff be thoroughly familiar with OAC 3701:1-50-05 and 49 CFR in order to comply and to take full advantage of the flexibility inherent in DOT requirements.

Licensed material including radioactive waste must be packaged and transported in accordance with department, NRC and DOT requirements if the transportation involves the use of public highways. In addition, broad scope licensees need to develop and maintain their own radiation safety procedures for transporting licensed material within their own facilities if such transportation does not involve the use of public highways.

Licensees also need to consider the safety of all individuals who may handle or may come in contact with the packages containing licensed material. Therefore, the primary considerations in packaging licensed material should be to ensure package integrity is not compromised during transport and the radiation levels (including removable contamination levels) at the package surfaces not only meet the regulatory requirements of OAC 3701:1-50-17 but are ALARA.

Licensees shipping radioactive waste for disposal must prepare appropriate documentation as specified in OAC 3701:1-38-19, Appendix A.

**Response from applicant:** The applicant must provide procedures used to ensure compliance with, and document the following transportation requirements:

- Contamination and dose rate limits.
- Shipping papers.
- Marking.
- Labeling.
- Placarding.
- Emergency response information.
- Training.

The applicant also needs to indicate what security measures have been documented and implemented as needed. Only indicate the origin of the transportation security requirements (e.g., 49 CFR 172 Subpart I, director's orders for increased controls or other NRC orders). DO NOT SUBMIT THE ACTUAL SECURITY PLANS.

## 7.11 ITEM 11: WASTE MANAGEMENT

<b>11. Waste Disposal / Waste Management</b> (List methods to be used by name or reference.)
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**Regulations:** OAC 3701:1-38-14; OAC 3701:1-38-19(A); OAC 3701:1-38-19(C); OAC 3701:1-38-19(D); OAC 3701:1-38-19(F); OAC 3701:1-38-19(G); OAC 3701:1-38-19(H); OAC 3701:1-38-19(I); OAC 3701:1-38-20; and OAC 3701:1-40-21.

**Criteria:** Licensed materials must be disposed of in accordance with department requirements, and appropriate records must be maintained.

**Discussion:** The applicant should discuss the methods for management and disposal of radioactive waste. The program should include procedures for handling of waste, safe and secure storage, waste characterization, waste minimization and disposal of radioactive waste. Appropriate training should be provided to waste handlers. Licensees may not receive radioactive waste from other licensees for processing, storage or disposal unless specifically authorized by the director.

The following methods of waste disposal may be considered and should be addressed in the application as appropriate:

### **Transfer to an Authorized Recipient**

Waste may be transferred to a recipient (usually a waste disposal service company or the original supplier) who is properly licensed to receive such waste in accordance with OAC 3701:1-38-19(A). Each shipment must comply with all applicable department and DOT requirements.

Licensees should implement procedures to reduce the volume of radioactive waste for final disposal in an authorized low-level radioactive waste (LLW) disposal facility. These procedures include volume reduction by segregating, consolidating, compacting, or allowing certain waste to decay-in-storage (DIS). Waste compaction or other treatments can reduce the volume of radioactive waste, but such processes may pose additional radiological hazards (e.g., airborne radioactivity) to workers, members of the public and the environment. Safety procedures to address these concerns should be implemented.

### **Decay-In-Storage (DIS)**

The department has concluded materials with half-lives of less than or equal to 120 days are appropriate for DIS. Such waste may be disposed of as ordinary trash if radiation surveys (performed in a low-background area and without any interposed shielding) of the waste at the end of the holding period indicate radiation levels are indistinguishable from background. All radiation labels must be defaced or removed from containers and packages prior to disposal as ordinary trash. If the decayed waste is compacted, all labels that are visible in the compacted mass must also be defaced or removed.

The department does not consider storage as a substitute for final disposal of radioactive wastes. Other than storage for radioactive decay, LLW should be stored only when disposal capacity is unavailable and for no longer than is necessary.

A model procedure for DIS is contained in Appendix Q of this guidance document.

### **Release into Air and Water**

Release of radioactive material into air and water must conform to the requirements described in OAC 3701:1-38-13(E)(2). The applicant should discuss the monitoring and control mechanisms in place to ensure compliance with the requirements. Applicants are

reminded of the “constraint” on air emissions of radioactive material required by OAC 3701:1-38-11(E)(4), which effectively reduces the limits specified in OAC 3701:1-38-13(E)(2) for release of gaseous effluents.

Licensees considering disposal by release to the sanitary sewerage system must comply with the requirements of OAC 3701:1-38-19(D). OAC 3701:1-38-19(D) authorizes disposal of licensed material by release into a public sanitary sewerage system if certain conditions are met. Licensees are responsible for demonstrating licensed materials discharged into the public sewerage system are readily soluble in water or are biological materials that are readily dispersible in water. Licensees should carefully consider the possibility of reconcentration of radioisotopes that are released into the sewer.

Applicants should provide procedures that will ensure all releases of radioactive waste into the sanitary sewerage meet the criteria stated in OAC 3701:1-38-19(D) and do not exceed the monthly and annual limits specified in regulations. Licensees are required to maintain accurate records of all releases of licensed material into the sanitary sewerage. A model procedure for disposal of radioactive waste via sanitary sewer and maintenance of records is described in Appendix Q of this guidance document.

If your facility maintains a private sewerage treatment system, a septic system or leach fields, the regulations of OAC 3701:1-38-19(D) are not applicable for releases to these systems (see OAC 3701:1-38-01 definition of “sanitary sewerage”). You may make releases of liquids to private sewerage systems, septic systems or leach fields as effluents released to unrestricted areas pursuant to OAC 3701:1-38-13(E)(2)(b)(i).

If liquid releases are made to a private sewerage treatment system, septic system or leach field, the sludge or other solids from these systems may become contaminated with radioactive material. Applicants should describe the monitoring planned for these systems in Item 7.10.7 of your application. Contaminated sludge will be required to be disposed of as radioactive waste using one of the methods described in this section. Applicants may obtain approval of alternative disposal methods through application to the department, as described in OAC 3701:1-38-19(C).

### **Incineration**

Applicants who wish to treat or dispose of licensed material by incineration must comply with the requirements of OAC 3701:1-38-19(F). A model procedure for incineration of waste is described in Appendix Q of this guidance document.

### **Waste Volume Reduction**

Waste volume reduction operations that could create a radiological hazard to licensee employees or the general public must be described in detail in the application. A model procedure for waste compaction is described in Appendix Q of this guidance document.

## **Disposal of Specific Waste as if it Were Not Radioactive**

The following radioactive wastes may be disposed of as non-radioactive waste:

- Liquid scintillation medium containing no more than 1.85 kBq (0.05 microcuries) of H-3 or C-14 per gram of the medium.
- Animal carcasses or animal tissue containing no more than 1.85 kBq (0.05 microcuries) of H-3 or C-14 per gram averaged over the weight of the entire animal.

Applicants should have procedures that will ensure the above limits are not exceeded and the disposal of animal tissue or a carcass containing licensed material is in a manner that will not permit their use as food for either humans or animals. Applicants must maintain accurate records of these disposals.

## **Burial**

Licensees who were previously authorized to bury radioactive materials pursuant to 10 CFR 20.304 prior to Jan. 28, 1981, should describe the locations, condition and current status of these former sites, i.e., controlled or uncontrolled, active monitoring of the site, and current condition of burial site.

## **Other Methods Specifically Approved by the Department**

Applicants may also request alternate methods for the disposal of radioactive waste generated at their facilities. Such requests must describe the waste containing licensed material including the physical and chemical properties that may be important to assess risks associated with the waste and the proposed manner and conditions of waste disposal. Additionally, the applicant must submit its analysis and evaluation of pertinent information on the nature of the environment, nature and location of other affected facilities and procedures to ensure that radiation doses are maintained ALARA and within regulatory limits.

The application should describe the ALARA considerations taken before disposal of radioactive materials. Discuss the potential for unmonitored or unanticipated release of radioactive materials to work areas and from release points, i.e., hoods and incinerator stacks. To be in compliance with the ALARA philosophy stated in OAC 3701:1-38-11, radioactive material waste stream concentrations should be a fraction (generally less than 10 percent) of the limits specified in Appendix C, Table II, OAC 3701:1-38-12. Furthermore, due to the variability of inventory control programs for monitoring disposal and releases of radioactive material in use, a program for physically measuring releases should be in place whenever releases exceed the specified ALARA action point.

**NOTE:** Because of the difficulties and costs associated with disposal of sealed sources, applicants should preplan the disposal. Applicants may want to consider contractual arrangements with the source supplier as part of a purchase agreement.

**Response from Applicant:** Provide procedures for waste collection, storage and the disposal by any of the authorized methods described in this section. Applicants should contact the department for guidance to obtain approval of any method(s) of waste disposal other than those discussed in this section.

Applicants do not need to provide information to the department if they plan to dispose of LLW via transfer to an authorized recipient or to dispose of liquid scintillation media or animals containing low levels of H-3 or C-14, as authorized by OAC 3701:1-38-19(G).

**7.12 ITEM 12: DOMESTIC/FOREIGN CORPORATION**

<p><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>  <small>If a Foreign corporation, show the Designated Agent</small></p>		
Name:	Address:	Phone: (    )

Applicants should indicate their corporate designation. Section 1701.01 of the Revised Code provides the following definitions:

- “Corporation” or “Domestic Corporation” means a corporation for profit formed under the laws of this state.
- “Foreign Corporation” means a corporation for profit formed under the laws of another state.

Applicants that meet the definition of “foreign corporation” should provide the name, address and phone number of their designated agent. A designated agent is required by Section 1703.041 of the ORC.

**7.13 ITEM 13: CERTIFICATION**

<p><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.</p>		
Printed name and title of applicant/official executing this application	Signature	Date

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 department will return all unsigned applications for proper signature.

**NOTES:**

- It is a criminal offense to make a willful false statement or representation on applications or correspondence.
- When the application references commitments, those items become part of the licensing conditions and regulatory requirements.

**7.14 ITEM 14: TAX ID NUMBER**

**14. Licensee Federal Tax ID number** (If no Tax ID number, then Social Security Number):

The department needs this number in order to process any adjustments to fees, which favor the licensee, such as refunds of overpayments. If the applicant is an individual and does not have a tax ID number, include the Social Security number.

**7.15 ITEM 15: REDUCED FEES CERTIFICATION**

**15. License Reduced Fees Certification** (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

Applicants should review and determine if the facility to be licensed for radioactive material meets the definitions for reduced license fees as delineated in paragraph (J) of rule 3701:1-38-02 of the OAC. Applicants shall sign the certification and attach all required supporting documentation if the applicant desires a reduction in fees as provided for in the OAC.

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

It is the licensee's obligation to keep the license current. If any of the information provided in the original application is to be modified or changed, the licensee must submit an application for a license amendment before the change takes place. Also, to continue the license after its expiration date, the licensee must submit an application for a license renewal at least 180 days before the expiration date (OAC 3701:1-40-18(A)).

Applications for license amendment, in addition to the following, must provide the appropriate fee. For renewal and amendment requests applicants must do the following:

- Be sure to use the most recent guidance in preparing an amendment or renewal request.
- Submit either the application form or a letter requesting amendment or renewal.
- Provide the license number.
- For renewals, provide a complete and up-to-date application if many outdated documents are referenced or there have been significant changes in regulatory requirements, the department's guidance, the licensee's organization, or radiation protection program. Alternatively, describe clearly the exact nature of the changes, additions, and deletions.

Licensees wishing to renew their licenses should submit a complete application according to NMS-LIC-11. Department staff's action will be similar to that described for amendments, but will include an extension of the license's expiration date.

## 9 TERMINATION OF ACTIVITIES

**Regulations:** OAC 3701:1-40-16(A); OAC 3701:1-40-17(I); OAC 3701:1-40-18(C); OAC 3701:1-40-18(G); OAC 3701:1-40-18(I); OAC 3701:1-40-18(K); OAC 3701:1-40-21(F); OAC 3701:1-38-22(A); OAC 3701:1-38-22(B); OAC 3701:1-38-22(D); OAC 3701:1-38-22(D)(4); and OAC 3701:1-38-22(G).

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

- Notify the bureau, as the director’s designee, in writing, within 60 days, of:
  - The expiration of its license.
  - A decision to permanently cease licensed activities at the entire site (regardless of contamination levels).
  - A decision to permanently cease licensed activities in any separate building or outdoor area if they contain residual radioactivity making them unsuitable for unrestricted activity in accordance with OAC 3701:1-40-18(C)(2) (regardless of contamination levels).
  - No principal activities have been conducted at the entire site under the license for a period of 24 months.
  - No principal activities have been conducted for a period of 24 months in any separate building or outdoor area if they contain residual radioactivity making them unsuitable for unrestricted activity in accordance with OAC 3701:1-40-18(C)(4) (regardless of contamination levels).
- Submit a decommissioning plan if required by OAC 3701:1-40-18(G).
- Conduct decommissioning as required by OAC 3701:1-40-18(I) and (K).
- Submit to the bureau, a completed “Certificate of Disposition of Materials” (or equivalent information) and a demonstration that the premises are suitable for release for unrestricted use (e.g., results of final survey).
- Before a license is terminated, send the records important to decommissioning (as required by OAC 3701:1-40-17(I)) to the bureau. If licensed activities are transferred or assigned in accordance with OAC 3701:1-40-16(A), transfer records important to decommissioning to the new licensee.

**Discussion:** As noted in several instances discussed in “Criteria,” before a licensee can decide whether it must notify the bureau, the licensee must determine whether residual radioactivity is present and if so, whether the levels make the building or outdoor area unsuitable for release according to bureau requirements. A licensee’s determination that a facility is not contaminated is subject to verification by inspection.

The permanent cessation of principal activities in an individual room or laboratory may require the licensee to notify the bureau if no other licensed activities are being

performed in the building. This also applies to buildings that were approved by the broad scope licensee as locations of use but not specifically named on the broad scope license.

**Table 9.1 Acceptable License Termination Screening Values of Common Radionuclides for Building Surface Contamination**

Radionuclide	Symbol	Acceptable Screening Levels*
hydrogen-3 (tritium)	<sup>3</sup> H	1.2 x 10 <sup>8</sup>
carbon-14	<sup>14</sup> C	3.7 x 10 <sup>6</sup>
sodium-22	<sup>22</sup> Na	9.5 x 10 <sup>3</sup>
sulfur-35	<sup>35</sup> S	1.3 x 10 <sup>7</sup>
chlorine-36	<sup>36</sup> Cl	5.0 x 10 <sup>5</sup>
manganese-54	<sup>54</sup> Mn	3.2 x 10 <sup>4</sup>
iron-55	<sup>55</sup> Fe	4.5 x 10 <sup>6</sup>
cobalt-60	<sup>60</sup> Co	7.1 x 10 <sup>3</sup>
nickel-63	<sup>63</sup> Ni	1.8 x 10 <sup>6</sup>
strontium-90	<sup>90</sup> Sr	8.7 x 10 <sup>6</sup>
technetium-99	<sup>99</sup> Tc	1.3 x 10 <sup>6</sup>
iodine-129	<sup>129</sup> I	3.5 x 10 <sup>4</sup>
cesium-137	<sup>137</sup> Cs	2.8 x 10 <sup>4</sup>
iridium-192	<sup>192</sup> Ir	7.4 x 10 <sup>4</sup>

\* Screening levels are based on the assumption that the fraction of removable surface contamination is equal to 0.1. For cases when the fraction of removable contamination is undetermined or higher than 0.1, users may assume, for screening purposes, that 100 percent of surface contamination is removable; and therefore the screening levels should be decreased by a factor of 10. Alternatively, users having site-specific data on the fraction of removable contamination (e.g., within 10 percent to 100 percent range) may calculate site-specific screening levels using D and D Version 1, based on site-specific resuspension factor. For unrestricted release (dpm/100 cm<sup>2</sup>) units are disintegrations per minute per 100 square centimeters (dpm/100 cm<sup>2</sup>). 1 dpm is equivalent to 0.0167 becquerel (Bq). The screening values represent surface concentrations of individual radionuclides that would be deemed in compliance with the 0.25 mSv/yr (25 mrem/yr) unrestricted release dose limit in OAC 3701:1-38-22(B). For radionuclides in a mixture, the “sum of fractions” rule applies; see OAC 3701:1-38-12, Appendix C, Note 4.

**Response from Applicant:** The applicant is not required to submit a response to the bureau during the initial application. However, when the license expires or at the time the licensee ceases operations, then any necessary decommissioning activities must be undertaken and the certificate of disposition of materials or equivalent information must be submitted, and other actions must be taken as summarized in criteria above.

**Reference:** The Certificate of Disposition of Materials may be obtained from the department (Decommissioning Section) upon request.

# 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</b> or <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	

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## 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 that the bureau 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"/>

Item	Suggested Response	Agree to use App.	Description Attached
	<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"/>
6.	<b>PURPOSE FOR WHICH LICENSED MATERIAL WILL BE USED</b>		
	Describe in general terms the use or purpose of each requested radioisotope.	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</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>○ Description of the duties and responsibilities of the RSC.</li> </ul>	N/A	<input type="checkbox"/>
	<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>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Criteria used by the RSC and RSO for approving new users and new uses.</li> </ul>	N/A	<input type="checkbox"/>

Item	Suggested Response	Agree to use App.	Description Attached
7.	<b>INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM (continued)</b>		
	<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>○ Review and approval of permitted program and procedural changes prior to implementation.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Implementation of program and procedural changes.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Audit of licensed operations to determine compliance.</li> </ul>	N/A	<input type="checkbox"/>
	<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>	N/A	<input type="checkbox"/>
	<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"/>

Item	Suggested Response	Agree to use App.	Description Attached
7.	<b>INDIVIDUALS RESPONSIBLE FOR RADIATION SAFETY PROGRAM (continued)</b>		
	<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>		
	<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"/>

Item	Suggested Response	Agree to use App.	Description Attached
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 bureau 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
10.	<b>RADIATION SAFETY PROGRAM (continued)</b>		
	<b>Audit Program (continued)</b>		
	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"/>

Item	Suggested Response	Agree to use App.	Description Attached
10.	<b>RADIATION SAFETY PROGRAM (continued)</b>		
	<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>		
	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"/>

Item	Suggested Response	Agree to use App.	Description Attached
10.	<b>RADIATION SAFETY PROGRAM (continued)</b>		
	<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>○ Contamination and dose rate limits.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Shipping papers.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Marking.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Labeling.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Placarding.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ Emergency response information.</li> </ul>	N/A	<input type="checkbox"/>
	<ul style="list-style-type: none"> <li>○ 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 bureau 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 Bureau of Radiation Protection 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 bureau 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 Ohio Department of Health, Bureau of Radiation Protection requirements.

# Appendix F

## Radionuclides Classified According to Relative Toxicity

Excerpted from (IAEA Safety Standard, Safety Series No. 1,  
“Safe Handling of Radionuclides, 1973 Edition”

**Radionuclides Classified According to Relative Toxicity -Excerpted from: (IAEA Safety Standard, Safety Series No. 1, “Safe Handling of Radionuclides, 1973 Edition”)**

This table is not all inclusive and is meant to be used as an example only. Based on chemical/physical form, need and quantities, your classification scheme may differ from that of the IAEA excerpt. (Additional classification can be located in Handbook of Health Physics and Radiological Health, Third Edition, Bernard Shleien editor, page 11-5.)

**Table F.1: Radionuclides Classified According to Relative Radiotoxicity**

***Group 1: Very High Radiotoxicity***

210Pb	226Ra	227Th	231Pa	233U	238Pu	243Am	244Cm	249Cf	
210Po	228Ra								

***Group 2: High Radiotoxicity***

22Na	56Co	95Zr	125Sb	131I	144Ce	181Hf	207Bi	228Ac	
36Cl	60Co	125I	192Ir						

***Group 3: Moderate Radiotoxicity***

7Be	48Sc	65Zn	91Sr	103Ru	125mTe	140La	153Gd	187W	198Au
14C	48V	69mZn	90Y	32P	35S	51Cr	24Na		

***Group 4: Low Radiotoxicity***

3H	58mCo	71Ge	87Rb	97Nb	103mRh	131mXe	125Cs	191mOs	232Th
15O	85Kr	99mTc							

**Table F.2: Limitations on Activities in Various Types of Working Place or Laboratory<sup>4</sup>**

Radiotoxicity of Radionuclides	Minimum Quantity	Type of Working Place or Laboratory Required		
		Type C	Type B	Type A
1. Very High	0.1 (3.7 kBq)	<10 µCi (<370 kBq)	10 µCi (370 kBq)	<10 µCi or more (>370 kBq)
2. High	1.0 (37.0 kBq)	<100 µCi (<3.7 MBq)	100 µCi (3.7 MBq)	100 µCi or more (>3.7 MBq)
3. Moderate	10 (370 kBq)	<100 µCi (<3.7 MBq)	100 µCi (3.7 MBq)	100 µCi or more (>3.7 MBq)
4. Low	100 (3.7 MBq)	<100 µCi (<3.7 MBq)	100 µCi (3.7 MBq)	100 µCi or more (>3.7 MBq)

<sup>4</sup> Laboratory Types correspond to the laboratory classification criteria of IAEA Safety Standard, Safety Series No. 1. Type C is a good quality chemical laboratory. Type B is a specially designed radioisotope laboratory. Type A is a specially designed laboratory for handling large activities of highly radioactive materials. In the case of a conventional modern chemical laboratory with adequate ventilation and non-porous work surfaces it may be possible to increase the upper limits of activity for Type C laboratories toward the limits for Type B for toxicity groups 3 and 4.

## Appendix G

### 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 H

## 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 department's regulations but also the licensee's commitments in its applications and other correspondence with the department. 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 followup 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

OAC 3701:1-38-15 Control of access to high/very high radiation areas.

OAC 3701:1-38-17 Security of stored material.

OAC 3701:1-38-17(B) Control of material not in storage.

Applicable license conditions.

2. Engineering Controls

OAC 3701:1-38-11 Radiation protection programs.

OAC 3701:1-38-16(A) Use of process or other engineering controls.

Applicable license conditions.

D. Equipment and Instrumentation

1. Survey Instruments

OAC 3701:1-38-14 General

OAC 3701:1-38-16(A) Use of Process or Other Engineering Controls.

OAC 3701:1-38-20(C) Calibration Records

Applicable license conditions

2. Safety Component Defects

	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

	OAC 3701:1-38-01	Definitions (restricted area and unrestricted area).
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	OAC 3701:1-38-17	Security of stored material.
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	OAC 3701:1-38-17(B)	Control of material not in storage.
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3. Receipt and Transfer of Licensed Material

	OAC 3701:1-38-13(E)	Compliance with dose limits for individual members of the public.
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	OAC 3701:1-38-18	Procedures for receiving and opening packages.
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	OAC 3701:1-38-14	Surveys.
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	OAC 3701:1-38-20(C)	Records of surveys.
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	OAC 3701:1-40-19	Transfer of byproduct material.
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	OAC 3701:1-40-21(A)	Records of receipt and transfer.
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F. Area Radiation Surveys And Contamination Control

1. Area Surveys

	OAC 3701:1-38-13(E)	Compliance with dose limits for individual members of the public.
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	OAC 3701:1-38-14	General
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	OAC 3701:1-38-20(C)	Records of surveys.
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	OAC 3701:1-38-20(J)	Records of dose to individual members of the public.
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		Applicable license conditions.
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2. Leak Tests and Inventories

		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.

**External**

<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.

**Internal**

<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**

<input type="checkbox"/>	OAC 3701:1-38-19(F)	Treatment or disposal by incineration.
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**Control of air effluents and ashes**

<input type="checkbox"/>	OAC 3701:1-38-12(A)	Occupational dose limits for adults.
<input type="checkbox"/>	OAC 3701:1-38-13(A)	Dose limits for individual members of the public.
<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"/>	Applicable license conditions	

### 3. Waste Management

#### General

<input type="checkbox"/>	OAC 3701:1-38-19(A)	General requirements
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#### Waste compacted

<input type="checkbox"/>	Applicable license conditions.	
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#### Waste storage areas

<input type="checkbox"/>	OAC 3701:1-38-17	Security of stored material.
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<input type="checkbox"/>	OAC 3701:1-38-18(A)	Posting requirements.
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<input type="checkbox"/>	OAC 3701:1-38-18(C)	Labeling containers.
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<input type="checkbox"/>	Applicable license conditions.	
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#### Packaging, Control, and Tracking

<input type="checkbox"/>	OAC 3701:1-38-19 App. A	Requirements for Low-Level Waste Transfer for Disposal at Land Disposal Facilities and manifests.
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<input type="checkbox"/>	OAC 3701:1-38-19(H)	Transfer for disposal and manifests.
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#### Transfer

<input type="checkbox"/>	OAC 3701:1-38-19 App. A	Requirements for Low-Level Waste Transfer for Disposal at Land Disposal Facilities and Manifests.
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<input type="checkbox"/>	OAC 3701:1-38-19(A)	General requirements
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<input type="checkbox"/>	OAC 3701:1-38-19(H)	Transfer for disposal and manifests.
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#### Records

<input type="checkbox"/>	OAC 3701:1-38-20(C)	Records of surveys
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<input type="checkbox"/>	OAC 3701:1-38-20(K)	Records of waste disposal
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### J. Decommissioning

<input type="checkbox"/>	OAC 3701:1-40-17	Financial assurance and recordkeeping for Decommissioning.
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<input type="checkbox"/>	OAC 3701:1-40-18	Expiration and termination of licenses and decommissioning of sites and separate buildings or outdoor areas.
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## 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.
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	49 CFR 173.24	General requirements for packaging and packages.
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	49 CFR 173.448	General transportation requirements.
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	49 CFR 173.435	Table of A1 and A2 values for radionuclides.
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#### Transport Quantities

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

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

	49 CFR 173.421	Excepted packages for limited quantities of Class 7 (radioactive) materials.
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	49 CFR 173.422	Additional requirements for excepted packages containing Class 7 (radioactive) materials
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#### Type A quantities

	49 CFR 173.412	Additional design requirements for Type A packages.
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	49 CFR 173.415	Authorized Type A packages
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	49 CFR 178.350	Specification 7A; general packaging, Type A.
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**Type B quantities**

	49 CFR 173.416	Authorized Type B packages
	49 CFR 173.467	Package testing

**LSA material and SCO**

	49 CFR 173.403	Definitions.
	49 CFR 173.427	Transport requirements for low specific activity (LSA) Class 7 (radioactive) materials and surface contaminated objects (SCO).

3. HAZMAT Communication Requirements

	49 CFR 172.200-205	Shipping Papers
	49 CFR 172.300-338	Marking
	49 CFR 172.400-450	Labeling
	49 CFR 172.500-560	Placarding
	49 CFR 172.600-604	Emergency response information.

4. HAZMAT Training

	49 CFR 172.702	Applicability and responsibility for training and testing.
	49 CFR 172.704	Training requirements.

5. Transportation by Public Highway

	49 CFR 171.15	Immediate notice of certain hazardous materials incidents.
	49 CFR 171.16	Detailed hazardous materials incident reports.
	49 CFR 177.800	Purpose and scope of this part and responsibility for compliance and training.
	49 CFR 177.816	Driver training.
	49 CFR 177.842	Class 7 (radioactive) material

L. Notifications And Reports

	OAC 3701:1-38-10(C)	Notifications and reports to individuals.
	OAC 3701:1-38-21	Reports of theft or loss of licensed material.
	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 I

Reporting Requirements

**Table I.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 J

# Instrument Specifications and Model Survey Instrument and Air Sampler Calibration Program

## INSTRUMENT SPECIFICATIONS AND MODEL SURVEY INSTRUMENT AND AIR SAMPLER CALIBRATION PROGRAM

### Radiation Monitoring Instrument Specifications

The specifications in Table J.1 will help applicants and licensees choose the proper radiation detection equipment for monitoring the radiological conditions at their facility.

**Table J.1 Typical Survey Instruments<sup>5</sup> (instruments used to measure radiological conditions at licensed facilities).**

<b>Portable Instruments Used for Contamination and Ambient Radiation Surveys</b>			
Detectors	Radiation	Energy Range	Efficiency
Exposure Rate Meters	Gamma, X-ray	μR-R	N/A
Count Rate Meters			
GM	Alpha	All energies (dependent on window thickness)	Moderate
	Beta	All energies (dependent on window thickness)	Moderate
	Gamma	All energies	< 1%
NaI Scintillator	Gamma	All energies (dependent on crystal thickness)	Moderate
Plastic Scintillator	Beta	C-14 or higher (dependent on window thickness)	Moderate
<b>Stationary Instruments Used to Measure Wipe, Bioassay, and Effluent Samples</b>			
Detectors	Radiation	Energy Range	Efficiency
LSC*	Alpha	All energies	High
	Beta	All energies	High
	Gamma		Moderate
Gamma Counter (NaI)*	Gamma	All energies	High
Gas Proportional	Alpha	All energies	High
	Beta	All energies	Moderate
	Gamma	All energies	< 1%

<sup>5</sup> Table from The Health Physics & Radiological Health Handbook, Revised Edition, edited by Bernard Shleien, 1992 (except for \* items).

## **MODEL INSTRUMENT CALIBRATION PROGRAM**

### **Training**

Before allowing an individual to perform survey instrument calibrations, the RSO will ensure that he or she has sufficient training and experience to perform independent survey instrument calibrations.

Classroom training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- Principles and practices of radiation protection.
- Radioactivity measurements, monitoring techniques, and using instruments.
- Mathematics and calculations basic to using and measuring radioactivity.
- Biological effects of radiation.

Appropriate on-the-job-training consists of the following:

- Observing authorized personnel performing survey instrument calibration.
- Conducting survey meter calibrations under the supervision and in the physical presence of an individual authorized to perform calibrations.

### **FACILITIES AND EQUIPMENT FOR CALIBRATION OF DOSE RATE OR EXPOSURE RATE INSTRUMENTS**

- To reduce doses received by individuals not calibrating instruments, calibrations will be conducted in an isolated area of the facility or at times when no one else is present.
- Individuals conducting calibrations will wear assigned dosimetry.
- Individuals conducting calibrations will use a calibrated and operable survey instrument to ensure that unexpected changes in exposure rates are identified and corrected.

### **Model Procedure for Calibrating Survey Instruments**

A radioactive sealed source(s) used for calibrating survey instruments will:

- Approximate a point source.
- Approximate the same energy and type of radiation as the environment in which the calibrated device will be employed.
- For dose rate and exposure rate instruments, the source should be strong enough to give an exposure rate of at least about  $7.7 \times 10^{-6}$  coulombs/kilogram/hour (30 mR/hr)

at 100 cm [e.g., 3.1 gigabecquerels (85 mCi) of cesium-137 or  $7.8 \times 10^2$  megabecquerels (21 mCi) of cobalt-60.

The three kinds of scales frequently used on dose or dose rate survey meters are calibrated as follows:

- Linear readout instruments with a single calibration control for all scales shall be adjusted at the point recommended by the manufacturer or at a point within the normal range of use. Instruments with calibration controls for each scale shall be adjusted on each scale. After adjustment the response of the instrument shall be checked at approximately 20 percent and 80 percent of full scale. The instrument's readings shall be within  $\pm 15$  percent of the conventionally true values for the lower point and  $\pm 10$  percent for the upper point.
- Logarithmic readout instruments which commonly have a single readout scale spanning several decades normally have two or more adjustments. The instrument shall be adjusted for each scale according to site specifications or the manufacturer's specifications. After adjustment calibration shall be checked at a minimum of one point on each decade. Instrument readings shall have a maximum deviation from the conventionally true value of no more than 10 percent of the full decade value.
- Meters with a digital display device shall be calibrated the same as meters with a linear scale.
- Readings above  $2.58 \times 10^{-4}$  coulomb/kilogram/hour (1 R/hr) need not be calibrated but such scales should be checked for operation and response to radiation.
- The inverse square and radioactive decay law should be used to correct changes in exposure rate due to changes in distance or source decay.

### **Surface Contamination Measurement Instruments<sup>6</sup>**

- Survey meters' efficiency must be determined by using radiation sources with similar energies and types of radiation that the survey instrument will be used to measure.
- If each scale has a calibration potentiometer, the reading shall be adjusted to read the conventionally true value at approximately 80 percent of full scale, and the reading at approximately 20 percent of full scale shall be observed. If only one calibration potentiometer is available the reading shall be adjusted at mid-scale on one of the scales and readings on the other scales shall be observed. Readings shall be within  $\pm 20$  percent of the conventionally true value.

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<sup>6</sup> ANSI N323A-1997, "Radiation Protection Instrumentation Test and Calibration."

## **MODEL PROCEDURES FOR CALIBRATING, LIQUID SCINTILLATION COUNTERS, GAMMA COUNTERS, GAS FLOW PROPORTIONAL COUNTERS, AND MULTICHANNEL ANALYZERS**

A radioactive sealed source used for calibrating instruments will do the following:

- Approximate the geometry of the samples to be analyzed
- Approximate the same energy and type of radiation as the samples that the calibrated device will be used to measure.

### **Calibration**

- Calibration must produce readings within  $\pm 20$  percent of the actual values over the range of the instrument.
- Calibration of liquid scintillation counters will include quench correction.

### **Calibration Records**

- Calibration records for all survey instruments should indicate the procedure used and the data obtained. The description of the calibration should include:
  - The owner or user of the instrument.
  - A description of the instrument, including the manufacturer's name, model number, serial number, and type of detector.
  - A description of the calibration source, including the exposure rate at a specified distance or activity on a specified date.
  - For each calibration point, the calculated exposure rate or count rate, the indicated exposure rate or count rate, the deduced correction factor (the calculated exposure rate or count rate divided by the indicated exposure rate or count rate), and the scale selected on the instrument.
  - For instruments with external detectors, the angle between the radiation flux field and the detector (i.e., parallel or perpendicular).
  - For instruments with internal detectors, the angle between radiation flux field and a specified surface of the instrument.
  - For detectors with removable shielding, an indication whether the shielding was in place or removed during the calibration procedure.
  - The exposure rate or count rate from a check source if used.
  - The name of the person who performed the calibration and the date it was performed.

The following information will be attached to the instrument as a calibration sticker or tag:

- For exposure rate meters, the source isotope used to calibrate the instrument (with correction factors) for each scale.
- The efficiency of the instrument, for each isotope the instrument will be used to measure (if efficiency is not calculated before each use).
- For each scale or decade not calibrated; an indication that the scale or decade was checked only for function but not calibrated.
- The date of calibration and the next calibration due date.
- The apparent exposure rate or count rate from the check source, if used.

### **Air Sampler Calibration**

In order to assess accurately the air concentration of radioactive materials in a given location the volume of air sampled and the quantity of contaminant in the sample must be determined. Accurate determination of the volume of air sampled requires standard, reproducible and periodic calibration of the air metering devices that are used with air sampling instruments.

### **Frequency of Calibration**

- A licensee committed to a routine or emergency air sampling program should perform an acceptable calibration of all airflow or volume metering devices at least annually.
- Special calibrations should be performed at any time there is reason to believe that the operating characteristics of a metering device have been changed, by repair or alteration or whenever system performance is observed to have changed significantly.
- Routine instrument maintenance should be performed as recommended by the manufacturer.
- Primary or secondary standard instruments used to calibrate air sampling instruments should be inspected frequently for consistency of performance.

### **Error Limit for Measurement of Air Sample Volume**

Most methods of calibrating airflow or air volume metering devices require direct comparison to a primary or secondary standard instrument to determine a calibration curve or a correction factor. An example of a primary standard is a spirometer that measures total air volume directly with high precision by liquid displacement. An example of a secondary standard is a wet-test meter that has been calibrated against a primary standard.

The following are significant errors associated with determining the total air volume sampled:

- $E_C$ : The error in determining the calibration factor. (An acceptable estimate is the percentage error associated with the standard instrument used in the calibration.)<sup>7</sup>
- $E_S$ : Intrinsic error in reading the meter scale. (An acceptable estimate is the percentage equivalent of one-half of the smallest scale division, compared to the scale reading.)
- $E_t$ : The percentage error in measurement of sampling time that should be kept within 1%.
- $E_V$ : The most probable value of the cumulative percentage error in the determination of the total air volume sampled.  $E_V$  can be calculated from the following equation, provided there are no additional significant sources of errors:

$$E_V = [E_S^2 + E_C^2 + E_t^2]^{1/2}$$

The most probable value of the cumulative error  $E_V$ , in the determination of total volume, should be less than 20 percent.

A sample calculation of the most probable value of the cumulative error in total volume measured is as follows: If accuracies of the scale reading, the calibration factor, and sample time are  $\pm 4$ , 2, and 1 percent, respectively, and there are no other significant sources of error, the cumulative error would be:

$$E_V = [4^2 + 2^2 + 1^2]^{1/2} = 4.5\% \text{ approx. } 5\%$$

If there are significant differences in pressure and temperature between the calibration site and the sampling site, appropriate corrections should be made using the ideal gas laws provided below:

$$V_S = V_1 \left( \frac{P_1}{760} \right) \left( \frac{273}{T_1} \right)$$

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<sup>7</sup> The calibration factor should be based on two kinds of determinations. First, correction factors should be determined at several flow rates distributed over the full-scale range. Each flow rate correction factors should be determined while adjusting flow rates upscale and again while adjusting flow rates downscale, and the two sets of data should be compared. Second, subsequent calibrations should compare the new correction factors to those determined during the previous calibration. If observed differences are significant compared to the over volume error limit of 20 percent, an additional error term should be included in the calculation above.

- $V_s$  = volume at standard pressure and temperature (760 mm Hg and 273°K)  
 $V_1$  = volume measured at conditions  $P_1$  and  $T_1$   
 $T_1$  = temperature of  $V_1$  in K  
 $P_1$  = pressure of  $V_1$  in mm Hg

### **Documentation of Calibration of Air Metering Devices**

The licensee should maintain records of all routine and special calibrations of airflow or volume metering devices, including the primary or secondary standard used, method employed and estimates of accuracy of the calibrated metering devices. All instruments should be clearly labeled as to the date and results of the most recent calibration and should include the appropriate correction factors to be used.

### **REFERENCES:**

1. Draft Regulatory Guide FC 413-4, "Guide for the Preparation of Applications for Licenses for the Use of Radioactive Materials in Calibrating Radiation Survey and Monitoring Instruments," June 1985.
2. Regulatory Guide 8.25, Revision 1, "Air Sampling in the Workplace," June 1992.
3. NUREG-1400, "Air Sampling in the Workplace," September 1993.

### **Additional References:**

4. The Health Physics & Radiological Health Handbook, 3rd Ed. Edited by Bernard Shleien, Lester A. Slaback, Jr., and Brian Kent Birky, 1998.
5. ANSI N323A-1997, "Radiation Protection Instrumentation Test and Calibration, Portable Survey Instruments." Copies may be obtained from the American National Standards Institute, 1430 Broadway, New York, NY 10018 or ordered electronically at the following address: <<http://www.ansi.org>>.
6. "Air Sampling Instruments," American Conference of Governmental Industrial Hygienists, 7th Edition, 1989.
7. DOE G 441.1-7, "Portable Monitoring Instrument Calibration Guide," U.S. Department of Energy, March 1999.
8. DOE G 441.1-8, "Air Monitoring Guide," U.S. Department of Energy," March 1999.
9. NRC Report 112 "Calibration of Survey Instruments Used in Radiation Protection for the Assessment of Ionizing Radiation Fields and Radioactive Surface Contamination" (Dec 1991)

# Appendix K

## Material Receipt and Accountability

**MATERIAL RECEIPT AND ACCOUNTABILITY SAMPLE MODEL  
PROCEDURE FOR ORDERING AND RECEIVING RADIOACTIVE  
MATERIAL**

- The RSO should approve or place all orders for radioactive material to ensure the requested material, quantities, manufacturer and model are authorized by the license to ensure the license possession limits are not exceeded.
- During normal working hours carriers should be instructed to deliver radioactive packages directly to the Radiation Safety Office (or designated receiving area).
- During off-duty hours security or other designated trained personnel should accept delivery of radioactive packages in accordance with the procedure outlined in the sample memorandum below:

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**Sample Memorandum**

*Memorandum for Security Personnel*

From: RSO, President, Vice President, etc.

Subject: Procedures for Receipt of Packages Containing Radioactive Material

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

Any packages containing radioactive material that arrive between (state times, e.g., 4:30 p.m. and 7:00 a.m. or on Saturdays or Sundays) shall be signed for by the security guard (or other designated trained individual) on duty and taken immediately to the designated receiving area. Security personnel (or other designated trained individual) should unlock the door, place the package in the designated secured storage area and re-lock the door.

Radiation Safety Officer (RSO): \_\_\_\_\_

Office Phone: \_\_\_\_\_

Home Phone: \_\_\_\_\_

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## Sample Instructions to Personnel Involved in Material Receipt

### *Shipping and Receiving Personnel*

During normal working hours immediately upon receipt of any package of licensed material; each package must be visually inspected for any signs of shipping damage such as crushed or punctured containers, or signs of dampness. Any obvious damage must be reported to the RSO immediately. Do not touch any package suspected of leaking. Request the person delivering the package to remain until monitored by the RSO.

Outside of normal working hours (e.g., nights, weekends and holidays), deliveries will usually be handled by security personnel (or other trained individuals) as described in the above procedures. Since certain packages of licensed material will have detectable external radiation they should be sent immediately to a designated storage area where they will be checked for contamination and external radiation level as soon as practical. They should not be allowed to remain in the receiving area any longer than necessary because they may be a source of exposure for receiving personnel.

If the instructions are not clear or if there are questions regarding receiving packages containing radioactive material please contact:

Name: \_\_\_\_\_

Phone: \_\_\_\_\_

For additional information on worker training, see the section entitled "Training for Individuals Working In or Frequenting Restricted Areas."

### **Materials Possessed Under a General License, or Received from a General Licensee**

Individuals at your facility may receive and use material pursuant to a general license as authorized in OAC 3701:1-46. Generally licensed materials are distributed by manufacturers authorized by the director to distribute materials directly to the persons who will use them under a general license. Some common items include nickel-63 sources in electron capture detectors in certain gas chromatographs, tritium gas contained in self-luminous EXIT signs, calibration sources in liquid scintillation counters and uranyl acetate used for staining electron microscope samples. You should develop a policy for how your institution will require responsible use and tracking of this material.

Generally licensed material may also be received when a general licensee transfers a generally licensed item to a specific licensee that is authorized to possess the material. However, when received by the specific licensee (your facility), the item must now be considered as specifically licensed and should be tracked with other specifically licensed material.

## **Sample Model Procedure for Safely Opening Packages Containing Licensed Materials**

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

- Wear gloves to prevent hand contamination.
- Visually inspect the package for any sign of damage (e.g. crushed, punctured). If damage is noted, stop and notify the RSO.
- Check DOT White I, Yellow II, or Yellow III label or packing slip for activity of contents so shipment does not exceed license possession limits.
- Monitor the external surfaces of a labeled package according to specifications in Package and Vehicle Contamination Limits (Appendix P).
- Open the outer package (following supplier's directions if provided) and remove packing slip. Open inner package to verify contents (compare requisition, packing slip and label on the bottle or other container). Check integrity of the final source container (e.g., inspecting for breakage of seals or vials, loss of liquid, discoloration of packaging material or high count rate on smear). Check again that the shipment does not exceed license possession limits. If you find anything other than expected, stop and notify the RSO.
- Survey the packing material and packages for contamination before discarding. If contamination is found, treat as radioactive waste. If no contamination is found, obliterate the radiation labels prior to discarding in the regular trash.
- Maintain records of receipt, package survey and wipe test results.
- Notify the final carrier and the bureau by telephone, email or fax when removable radioactive surface contamination exceeds the limits of OAC 3701:1-50-17(I); or external radiation levels exceed the limits of OAC 3701:1-50-17.

## **Sample Transfer Policy Statements**

### **Internal Transfers**

Licensed materials that may be transferred from one department or laboratory or AU's control to another should have prior approval from the RSO. A written transfer procedure should be developed by the RSO to ensure that transfers are done in accordance with the conditions of the license. All transfers shall be done in a way that minimizes the probability of spillage or breakage. Double containers including suitable shielding should be used for such transfers.

### **External Transfers**

Licensed material shall not be transferred or shipped from one institution to another without the approval of the RSO. Such transfers/shipments must be packaged and labeled

in accordance with DOT, ODH, NRC, or U.S. Postal Service Regulations, whichever is applicable.

### **Gifts**

On occasion, licensees may be offered or have donated licensed materials by other individuals as gifts (e.g., a retiring medical practitioner donating his cesium needles to the university medical center). All such gifts of radioactive materials must be transferred to the licensee and handled in accordance with department requirements and the conditions of the license. In any case, the RSO should approve the gift prior to the transfer.

## Appendix L

# Methodology for Determining Public Dose

**METHODOLOGY FOR DETERMINING PUBLIC DOSE**

This appendix describes methods for determining radiation doses to members of the public. Licensees must ensure that:

- The radiation dose received by individual members of the public does not exceed 1 millisievert (mSv) [100 millirem (mrem)] in one calendar year resulting from the licensee’s possession and/or use of licensed materials.
- The radiation dose in unrestricted areas does not exceed 0.02 mSv (2 mrem) in any one hour.
- Air emissions of radioactive materials do not result in doses greater than 0.1 mSv (10 mrem) TEDE.

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

**Doses to members of the Public**

INCLUDES doses from:	DOES NOT INCLUDE doses from:
<ul style="list-style-type: none"> <li>• Radiation and/or radioactive material released by a licensee</li> <li>• Sources of radiation under the control of a licensee</li> <li>• Air effluents from sources of licensed radioactive materials</li> <li>• Licensed material in transportation or storage at the licensee’s facility</li> </ul>	<ul style="list-style-type: none"> <li>• Sanitary sewerage discharges from licensees</li> <li>• Natural background radiation</li> <li>• Medical administration of radioactive material</li> <li>• Voluntary participation in medical research</li> </ul>

Typical unrestricted areas may include offices, shops, laboratories (where licensed material is not used or stored), areas outside buildings, property and storage areas. The licensee does not control access to these areas for purposes of controlling exposure to radiation or radioactive materials, but the licensee may control access to these areas for other reasons such as security.

The licensee may show compliance with the annual dose limit for individual members of the public by:

- Demonstrating by measurement or calculation that the TEDE to the individual likely to receive the highest dose at the boundary of the unrestricted area does not exceed 1 mSv (100 mrem).
- Demonstrating that the annual average concentration of radioactive material released in gaseous and liquid effluents at the boundary of the unrestricted area does not exceed the values specified in Table 2 of Appendix B to Part 20; and if an individual were continuously present in an unrestricted area, the dose from external sources would not exceed 0.02 mSv (2 mrem) in an hour and 0.5 mSv (0.05 rem) in a year.

In order to perform a dose assessment, the licensee should identify all potential sources of external and internal radiation exposure to members of the public and all locations of use, transport and storage of radioactive material at the facility. The licensee must then take radiation measurements or perform calculations to demonstrate compliance.

### **Measurements**

The licensee may use measurements to demonstrate that the average annual releases are within regulatory limits, as well as to demonstrate that the TEDE to the individual likely to receive the highest dose at the boundary of the unrestricted area does not exceed 1 mSv (100 mrem). These measurements may include:

- Dose rate surveys for radiation exposures from external radiation sources.
- Measurements of radionuclides in air and water effluent.

The method used to measure dose will depend on the nature of the radiation source. If the source of radiation is constant, it may be adequate to measure the dose rate and integrate it over time. If the source of radiation differs or changes over time, it may be necessary to perform continuous measurements.

Radioactivity releases may be determined by effluent monitoring or by effluent sampling and analysis. Airborne effluents may be discharged when volatile materials are used, such as during iodinations, but the discharge itself is usually not continuous since volatile materials are often used periodically rather than continuously. Liquid effluents may be discharged continuously or may be stored and subsequently discharged on a batch basis. For each type of source and for each route of potential exposure, consider the location of measurement points, whether continuous or periodic monitoring is required, the frequency of sampling and measurement and any additional information. For discharges of airborne radionuclides, for example, it may be necessary to obtain information on the efficiency of filters and the air flow rate of the discharge system, as well as meteorological data and the distance to the nearest individual member of the public.

## Calculation Method

Using a calculation method, the licensee must determine the highest dose an individual is likely to receive at the boundary of the unrestricted area. The licensee must take into account the individual's exposure from external sources and the concentration of radionuclides in gaseous and liquid releases. In practice, the licensee may wish to make conservative assumptions to simplify the dose calculation.

The public dose limit applies to the individual who is likely to receive the highest dose from licensed operations. Therefore, the dose calculations must consider the location with the potential for the highest internal and external exposures. An extremely conservative calculation would assume that the individual was continuously present 24 hours a day, 365 days a year, or an occupancy factor of 1 (see Table L.1). If the result of the calculation using an occupancy factor of 1 demonstrates that the public dose limit is not exceeded, then there is no need for further evaluation.

If however, the licensee would rather choose a more realistic assumption of the individual's occupancy at the points of highest internal and external exposures, then the licensee may use the occupancy factors in Table L.1 or may calculate a specific occupancy factor by determining the likely fraction of time that the individual is present.

**Table L.1 Standard Occupancy Factors**

<b>Occupancy Factor</b>	<b>Description</b>
1	Work areas such as offices, laboratories, shops, and occupied space nearby buildings or outdoor areas
1/4	Corridors, lounges, elevators using operators, unattended parking lots
1/16	Waiting rooms, restrooms, stairways, unattended elevators, janitor's closets, outside areas used only for pedestrians or vehicular traffic

## Records

The licensee must maintain records to demonstrate compliance with the dose limit for individual members of the public, until the director terminates the license. In general, survey and monitoring records of ambient radiation and effluent radioactivity should be adequate.

## Appendix M

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

## **GENERAL TOPICS FOR SAFE USE OF RADIOISOTOPES**

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 that 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 Radiation Safety Officer (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 department.

## **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 department.

### **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 that 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 department.

### **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 that there are no other possibilities 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 department.

### **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 radioisotopes 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 department.

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 N

### Radiation Safety Survey Topics

## **RADIATION SAFETY SURVEY TOPICS**

This Appendix provides applicants and licensees with additional information on surveys, including training requirements, survey frequency, contamination limits, and bioassays.

### **Training**

Before allowing an individual to perform surveys, the RSO (or for Type C broad scopes, the individual designated as responsible for the day-to-day operation of the radiation safety program) will ensure that he or she has sufficient training and experience to perform surveys independently. Academic training may be in the form of lecture, videotape, or self-study and will cover the following subject areas:

- Principles and practices of radiation protection.
- Radioactivity measurements, monitoring techniques and using instruments.
- Mathematics and calculations basic using and measuring radioactivity.
- Biological effects of radiation.

Appropriate on-the-job-training consists of the following:

- Observing authorized personnel using survey equipment, collecting samples and analyzing samples.
- Using survey equipment, collecting samples, and analyzing samples under the supervision and in the physical presence of an individual authorized to perform surveys.

### **Facilities and Equipment**

- To ensure achieving the required sensitivity of measurements, survey samples will be analyzed in a low-background area.
- A gamma counter system with a single or multi-channel analyzer can be used to count samples containing gamma-emitters (e.g., cesium-137, cobalt-60).
- A liquid scintillation or gas-flow proportional counting system can be used to count samples containing alpha-emitters, beta-emitters and gamma-emitters (if efficiency is great enough to achieve the required sensitivity for measurements).

### **Ambient Radiation Level Surveys**

- Dose-rate surveys, at a minimum, should be performed in locations where workers are exposed to radiation levels that might result in radiation doses in excess of 10% of the occupational dose limits or where an individual is working in a dose rate of 0.025 mSv (2.5 mrem/hr) or more (50 mSv/year divided by 2,000 hr/year).

- OAC 3701:1-38-13 requires that the total effective dose equivalent to an individual member of the public from the licensed operation does not exceed 1 mSv (0.1 rem) in a year and the dose in any unrestricted area from external sources does not exceed 0.02 mSv (2 mrem) in any one hour.

### **Contamination Surveys**

Licensees' contamination surveys should be sufficient to identify areas of contamination that might result in doses to workers or to the public. Combined removable and fixed contamination should be surveyed using appropriate radiation detection equipment. Removable contamination can be detected and measured through a wipe test of the surface, which is counted in an appropriate counting instrument, such as a liquid scintillation counter, a sodium iodide or germanium gamma counter or a proportional alpha/beta counter.

Contamination surveys should be performed:

- To evaluate radioactive contamination that could be present on surfaces of floors, walls, laboratory furniture and equipment
- After any spill or contamination event
- When procedures or processes have changed
- To evaluate contamination of users and the immediate work area at the end of the day when licensed material is used
- In unrestricted areas at frequencies consistent with the types and quantities of materials in use but not less frequently than quarterly
- In areas adjacent to restricted areas and in all areas through which licensed materials are transferred and temporarily stored before shipment.

### **Contamination Survey Frequency**

Personnel should survey for contamination in locations where individuals are working with an unsealed form of radioactive material in an amount greater than or equal to 10% of the smallest annual limit on intake (ALI) (either the inhalation or ingestion ALI) listed for that Radionuclides in OAC 3701:1-38. These surveys should be done at a frequency appropriate to the types and quantities of radioactive materials in use, but at a minimum quarterly. If amounts are used that are greater than or equal to the smallest ALI listed for that Radionuclides in OAC 3701:1-38, detailed and documented surveys should be performed at least monthly.

Table N.1 contains suggested contamination survey frequency (See Tables N.2, N.3, and N.4 for alternate survey frequencies).
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**Table N.1 Suggested Frequency of Contamination Surveys**

Areas Where RAM Has Been Used	Frequency
Areas where > 7.4 MBq (200 µCi) is used at any one time	Weekly
Areas where < 7.4 MBq (200 µCi) is used at any one time	Monthly

**ALTERNATE SURVEY FREQUENCY****Classification of Laboratories****Table N.2 Survey Frequency Category**

Group	Low	Medium	High
1	< 370 kBq (10 µCi)	370 kBq (10 µCi) to 37 MBq (1 mCi)	> 37 MBq (1 mCi)
2	< 37 MBq (1 mCi)	37 MBq (1 mCi) to 3.7 GBq (100 mCi)	> 3.7 GBq (100 mCi)
3	< 3.7 GBq (100 mCi)	3.7 GBq (100 mCi) to 370 GBq (10 Ci)	> 370 GBq (10 Ci)
4	< 370 GBq (10 Ci)	370 GBq (10 Ci) to 37 TBq (1000 Ci)	> 37 TBq (1000 Ci)

Proportional fractions are to be used for more than one isotope.

**Table N.3 Survey Frequency Category Modifiers**

Modifying Factors	Factor
Simple storage	x 100
Very simple wet operations (e.g., preparation of aliquots of stock solutions)	x 10
Normal chemical operations (e.g., analysis, simple chemical preparations)	x 1
Complex wet operations (e.g., multiple operations, or operations with complex glass apparatus)	x 0.1
Simple dry operations (e.g., manipulation of powders) and work with volatile radioactive compounds	x 0.1
Exposure of non-occupational persons	x 0.1
Dry and dusty operations (e.g., grinding)	x 0.01

The object is to determine how often to survey the laboratory. To do this, multiply the activity range under LOW, MEDIUM and HIGH survey frequency by the appropriate Modifying Factor to construct a new set of mCi ranges for LOW, MEDIUM and HIGH survey frequency.

Survey Frequency:

- Low - Not less than once a month
- Medium - Not less than once per week
- High - Not less than once per normal working day.

**Table N.4 Isotope Groups**

Group 1	Pb <sup>210</sup>	Po <sup>210</sup>	Ra <sup>223</sup>	Ra <sup>228</sup>	Ac <sup>227</sup>	Th <sup>227</sup>	Th <sup>230</sup>	Pa <sup>231</sup>	U <sup>230</sup>	U <sup>232</sup>	
	U <sup>233</sup>	U <sup>234</sup>	Np <sup>237</sup>	Pu <sup>238</sup>	Pu <sup>239</sup>	Pu <sup>240</sup>	Pu <sup>241</sup>	Pu <sup>242</sup>	Am <sup>241</sup>	Am <sup>243</sup>	
	Cm <sup>242</sup>	Cm <sup>243</sup>	Cm <sup>244</sup>	Cm <sup>245</sup>	Cm <sup>246</sup>	Cf <sup>249</sup>	Cf <sup>250</sup>	Cf <sup>252</sup>			
Group 2	Na <sup>22</sup>	Cl <sup>36</sup>	Ca <sup>45</sup>	Sc <sup>46</sup>	Mn <sup>54</sup>	Co <sup>56</sup>	Co <sup>60</sup>	Sr <sup>89</sup>	Sr <sup>90</sup>	Y <sup>91</sup>	
	Zr <sup>95</sup>	Ru <sup>106</sup>	Ag <sup>110m</sup>	Cd <sup>115m</sup>	In <sup>114M</sup>	Sb <sup>124</sup>	Sb <sup>125</sup>	Te <sup>127m</sup>	Te <sup>129m</sup>	I <sup>124</sup>	
	I <sup>125</sup>	I <sup>126</sup>	I <sup>131</sup>	I <sup>133</sup>	Cs <sup>134</sup>	Cs <sup>137</sup>	Ba <sup>140</sup>	Ce <sup>144</sup>	Eu <sup>152</sup>	Eu <sup>154</sup>	
	Tb <sup>160</sup>	Tm <sup>170</sup>	Hf <sup>181</sup>	Ta <sup>182</sup>	Ir <sup>192</sup>	Tl <sup>204</sup>	Bi <sup>207</sup>	Bi <sup>210</sup>	At <sup>211</sup>	Pb <sup>212</sup>	
	Ra <sup>224</sup>	Ac <sup>228</sup>	Pa <sup>230</sup>	Th <sup>234</sup>	U <sup>236</sup>	Bk <sup>249</sup>					
Group 3	Be <sup>7</sup>	C <sup>14</sup>	F <sup>18</sup>	Na <sup>24</sup>	Cl <sup>38</sup>	Si <sup>31</sup>	P <sup>32</sup>	P <sup>33</sup>	S <sup>35</sup>	Ar <sup>41</sup>	
	K <sup>42</sup>	K <sup>43</sup>	Ca <sup>47</sup>	Sc <sup>47</sup>	Sc <sup>48</sup>	V <sup>48</sup>	Cr <sup>51</sup>	Mn <sup>52</sup>	Mn <sup>56</sup>	Fe <sup>52</sup>	
	Fe <sup>55</sup>	Fe <sup>59</sup>	Co <sup>57</sup>	Co <sup>58</sup>	Ni <sup>63</sup>	Ni <sup>65</sup>	Cu <sup>64</sup>	Zn <sup>65</sup>	Zn <sup>69m</sup>	Ga <sup>72</sup>	
	As <sup>73</sup>	As <sup>74</sup>	As <sup>76</sup>	Se <sup>75</sup>	Br <sup>82</sup>	Kr <sup>85m</sup>	Rb <sup>86</sup>	Sr <sup>85</sup>	Sr <sup>91</sup>	Y <sup>90</sup>	
	Y <sup>92</sup>	Y <sup>93</sup>	Zr <sup>97</sup>	Nb <sup>93m</sup>	Nb <sup>95</sup>	Mo <sup>99</sup>	Tc <sup>96</sup>	Tc <sup>97</sup>	Tc <sup>99</sup>	Ru <sup>97</sup>	
	Ru <sup>103</sup>	Ru <sup>105</sup>	Rh <sup>105</sup>	Pd <sup>103</sup>	Pd <sup>109</sup>	Ag <sup>105</sup>	Ag <sup>111</sup>	Cd <sup>109</sup>	Cd <sup>115</sup>	In <sup>115m</sup>	
	Sn <sup>113</sup>	Sn <sup>125</sup>	Sb <sup>122</sup>	Te <sup>125m</sup>	Te <sup>127</sup>	Te <sup>129</sup>	Te <sup>131m</sup>	Te <sup>132</sup>	I <sup>130</sup>	I <sup>132</sup>	
	I <sup>134</sup>	I <sup>135</sup>	Xe <sup>135</sup>	Cs <sup>131</sup>	Cs <sup>136</sup>	Ba <sup>131</sup>	La <sup>140</sup>	Ce <sup>141</sup>	Ce <sup>143</sup>	Pr <sup>142</sup>	
	Pr <sup>143</sup>	Nd <sup>147</sup>	Nd <sup>149</sup>	Pm <sup>147</sup>	Pm <sup>149</sup>	Sm <sup>151</sup>	Sm <sup>153</sup>	Eu <sup>152</sup>	Eu <sup>155</sup>	Gd <sup>153</sup>	
	Gd <sup>159</sup>	Dy <sup>165</sup>	Dy <sup>166</sup>	Ho <sup>166</sup>	Er <sup>169</sup>	Er <sup>171</sup> (9.2hr)		Tm <sup>171</sup>	Yb <sup>175</sup>	Lu <sup>177</sup>	
	W <sup>181</sup>	W <sup>185</sup>	W <sup>187</sup>	Re <sup>183</sup>	Re <sup>186</sup>	Re <sup>188</sup>	Os <sup>185</sup>	Os <sup>191</sup>	Os <sup>193</sup>	Ir <sup>190</sup>	
	Ir <sup>194</sup>	Pt <sup>191</sup>	Pt <sup>193</sup>	Pt <sup>197</sup>	Au <sup>196</sup>	Au <sup>198</sup>	Au <sup>199</sup>	Hg <sup>197</sup>	Hg <sup>197m</sup>	Hg <sup>203</sup>	
	Tl <sup>200</sup>	Tl <sup>202</sup>	Pb <sup>203</sup>	Bi <sup>206</sup>	Bi <sup>212</sup>	Rn <sup>220</sup>	Rn <sup>222</sup>	Th <sup>231</sup>	Pa <sup>233</sup>	Np <sup>239</sup>	
	Group 4	H <sup>3</sup>	O <sup>15</sup>	Ar <sup>37</sup>	Co <sup>58m</sup>	Ni <sup>59</sup>	Zn <sup>69</sup>	Ge <sup>71</sup>	Kr <sup>85</sup>	Sr <sup>85m</sup>	Rb <sup>87</sup>
		Y <sup>91m</sup>	Zr <sup>93</sup>	Nb <sup>97</sup>	Tc <sup>96m</sup>	Tc <sup>99m</sup>	Rh <sup>103m</sup>	In <sup>113m</sup>	I <sup>129</sup>	Xe <sup>131m</sup>	Xe <sup>133</sup>
Xs <sup>134m</sup>		Cs <sup>135</sup>	Sm <sup>147</sup>	Re <sup>187</sup>	Os <sup>191m</sup>	Pt <sup>193m</sup>	Pt <sup>197m</sup>	Th <sup>232</sup>	Th <sup>Nat</sup>	U <sup>235</sup>	
U <sup>238</sup>		U <sup>Nat</sup>									

## Contamination in Unrestricted Areas

Contamination found in unrestricted areas should be immediately decontaminated to background levels. When it is not possible to get to background levels, the licensee must ensure that the amounts do not exceed the contamination levels listed in Table N.5.

**Table N.5 Acceptable Surface Contamination Levels**

<b>Nuclide<sup>1</sup></b>	<b>Average<sup>2,3</sup></b>	<b>Maximum<sup>2,4</sup></b>	<b>Removable<sup>2,5</sup></b>
I-125, I-129	1.7 Bq/100 cm <sup>2</sup> (100 dpm/100 cm <sup>2</sup> )	5.0 Bq/100 cm <sup>2</sup> (300 dpm/100 cm <sup>2</sup> )	0.3 Bq/100 cm <sup>2</sup> (20 dpm/100 cm <sup>2</sup> )
I-126, I-131, I-133, Sr-90	16.7 Bq/100 cm <sup>2</sup> (1,000 dpm/100 cm <sup>2</sup> )	50.0 Bq/100 cm <sup>2</sup> (3,000 dpm/100 cm <sup>2</sup> )	3.3 Bq/100 cm <sup>2</sup> (200 dpm/100 cm <sup>2</sup> )
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above.	83.3 Bq/100 cm <sup>2</sup> (5,000 dpm/100 cm <sup>2</sup> )	250 Bq/100 cm <sup>2</sup> (15,000 dpm /100 cm <sup>2</sup> )	16.7 Bq/100 cm <sup>2</sup> (1,000 dpm/100 cm <sup>2</sup> )

- 1 Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.
- 2 As used in this table, dpm (disintegration per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.
- 3 Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.
- 4 The maximum contamination level applies to an area of not more than 100 cm<sup>2</sup>.
- 5 The amount of removable radioactive material per 100 cm<sup>2</sup> of surface area should be determined by wiping that area with filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

When equipment or facilities that are potentially contaminated are to be released for unrestricted use, the above table provides the maximum acceptable residual levels. To the extent practicable, it is appropriate to decontaminate to below these levels. Surface contamination surveys should be conducted for both removable and fixed contamination before these facilities or equipment are released from restricted to unrestricted use to ensure that they meet these limits.

A standardized method for smear testing of a relatively uniform area should be used to aid in comparing contamination at different times and places. A smear taken from an area of about 100 cm<sup>2</sup> is acceptable to indicate levels of removable contamination.

## **Survey Record Requirements**

Each survey record should include the following:

- A diagram of the area surveyed.
- A list of items and equipment surveyed.
- Specific locations on the survey diagram where wipe test was taken.
- Ambient radiation levels with appropriate units.
- Contamination levels with appropriate units.
- Make and model number of instruments used.
- Background levels.
- Name of the person making the evaluation and recording the results and date.

Licensees should record contamination levels observed and procedures followed for incidents involving contamination of individuals. The record should include names of individuals involved, description of work activities, calculated dose, probable causes (including root causes), steps taken to reduce future incidents of contamination, times and dates and the surveyor's signature.

## **Air Monitoring in the Workplace**

Air monitoring can be used to do the following:

- Determine whether the confinement of radioactive materials is effective.
- Measure airborne radioactive material concentrations in the workplace.
- Estimate worker intakes of radioactive material.
- Determine posting requirements.
- Determine what protective equipment and measures are appropriate.
- Warn of significantly elevated levels of airborne radioactive materials.

If bioassay measurements are used to determine worker doses of record, air sampling may be used to determine time of intake and to determine which workers should have bioassay measurements. The use of engineering controls and a good air sampling program can eliminate the need for bioassays.

## **Airborne Effluent Release Monitoring**

When practicable, airborne radioactive effluents should be released from monitored release points (e.g., monitored stacks, discharges, vents) to provide accurate measurements to estimate public exposure. Licensees should verify the performance of

effluent monitoring systems by regular calibration (at least annually) to ensure their reliability.

For release points where monitoring is not practicable, the licensee should estimate the magnitude of the unmonitored effluents. These unmonitored releases will occur anytime unsealed material is handled outside a fume hood or other device that will control the releases. The licensee should include these estimates when demonstrating compliance with dose limits and ALARA goals. Unmonitored releases may be estimated based on the quantity of material used in these areas, the number of procedures performed or other appropriate methods. The unmonitored effluents should not exceed 30% of the total estimated effluent releases or 10% of the permissible air effluent concentrations found on column 1 of Table 2 in OAC 3701:1-38-12, Appendix C, whichever is greater.

### **Liquid Effluent Release Monitoring**

The licensee should evaluate the concentrations of radioactive material in water that is released to the environment and to the sanitary sewer. The licensee must show that these releases meet the limits in OAC 3701:1-38-13 and OAC 3701:1-38-19(D), respectively.

## **BIOASSAY MONITORING**

### **Frequency of Required Bioassay Measurements**

Determining the appropriate frequency of routine bioassay measurements depends upon the exposure potential and the physical and chemical characteristics of the radioactive material and the route of entry to the body. Consider the following elements:

- Potential exposure of the individual.
- Retention and excretion characteristics of the radionuclides.
- Sensitivity of the measurement technique.
- Acceptable uncertainty in the estimate of intake and committed dose equivalent.

Bioassay measurements used for demonstrating compliance with the occupational dose limits should be conducted often enough to identify and quantify potential exposures and resultant intakes that, during any year, are likely to collectively exceed 0.1 times the ALI. The 10% ALI criterion is consistent with OAC 3701:1-38-14(B), which requires licensees to monitor intakes and assess occupational doses for exposed individuals who are likely to exceed 10% of the applicable limit (i.e., intakes likely to exceed 0.1 ALI for adults).

Separate categories of bioassay measurements, routine measurements and special measurements further determine the frequency and scope of measurements.

## **Routine Measurements**

Routine measurements include baseline measurements, periodic measurements, and termination measurements. These measurements should be conducted to confirm that appropriate controls exist and to assess dose. The method of bioassay selected (for example, whole body counting, urinalysis, etc.) and the samples collected will vary according to the radionuclides and the compound to which it is attached. Sample collection procedures should be developed to ensure that appropriate types, sizes and numbers of samples are collected that will provide appropriate physiological information for the dose assessment.

An individual's baseline measurement of radioactive material within the body should be conducted before beginning work that involves exposure to radiation or radioactive materials for which monitoring is required.

In addition to the baseline measurements, periodic bioassay measurements should be performed. The frequency of periodic measurements should be based on the likelihood of significant exposure of the individual. In determining the worker's likely exposure, consider such information as the worker's access, work practices, measured levels of airborne radioactive material and exposure time. Periodic measurements should be made when the cumulative exposure to airborne radioactivity since the most recent bioassay measurement is  $> 0.02$  ALI (40 DAC hours). Noble gases and airborne particulates with a radioactive half-life of less than 2 hours should be excluded from the evaluation because external exposure generally controls these radionuclides.

At a minimum, periodic measurements should be conducted annually. Periodic measurements provide additional information on any long-term accumulation and retention of radioactive material in the body, especially for exposures to concentrations of airborne radioactive material below monitoring thresholds.

When an individual is no longer subject to the bioassay program because of change in employment status, termination bioassay measurement should be made, when practicable, to ensure that any unknown intakes are quantified.

## **Special Monitoring**

Because of uncertainty in the time of intakes and the absence of other data related to the exposure (e.g., physical and chemical forms, exposure duration), correlating positive results to actual intakes for routine measurements can sometimes be difficult. Abnormal and inadvertent intakes from situations such as a failed respiratory protective device, inadequate engineering controls, inadvertent ingestion, contamination of a wound or skin absorption should be evaluated on a case-by-case basis. When determining whether potential intakes should be evaluated, consider the following circumstances:

- The presence of unusually high levels of facial and/or nasal contamination.
- Entry into airborne radioactivity areas without appropriate exposure controls.
- Operational events with a reasonable likelihood that a worker was exposed to unknown quantities of airborne radioactive material (e.g., loss of system or container integrity).
- Known or suspected incidents of a worker ingesting radioactive material.
- Incidents that result in contamination of wounds or other skin absorption.
- Evidence of damage to or failure of a respiratory protective device.

**References:**

1. Regulatory Guide 4.20, "Constraints on Release of Airborne Radioactive Materials to the Environment for Licensees Other Than Power Reactors," dated December 1996.
2. Regulatory Guide 8.9, Revision 1, "Acceptable Concepts, Models, Equations, and Assumptions for a Bioassay Program," dated July 1993.
3. NCRP Report 123 "Screening Models for Releases of Radionuclides to Atmosphere, Surface Water, and Ground (Jan 1996)

# Appendix O

## Model Leak Test Procedures

## Model Leak Test Procedures

This appendix provides applicants and licensees with model leak test procedures and sample calculations for determining activity on a wipe test sample.

### Frequency for Conducting Leak Tests of Sealed Sources

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

### Procedure for Performing Leak Testing and Analysis

- For each source to be tested, list identifying information such as manufacturer, model number, serial number, radionuclide, and activity.
- If available, use a survey meter to monitor exposure.
- Prepare a separate wipe sample (e.g., cotton swab or filter paper) for each source.
- Number each wipe to correlate with identifying information for each source.
- Wipe the most accessible area (but not directly from the surface of a source) where contamination would accumulate if the sealed source were leaking.
- Select an instrument that is sensitive enough to detect 185 becquerels (0.005 microcurie) of the radionuclide and ensure that its calibration is current.
- Using the selected instrument, count and record background count rate.
- Calculate efficiency of the detector. A sample calculation is shown in the next box.
- Count the sample.

For Example:

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

cpm = counts per minute  
std = standard  
bkg = background  
Bq = Becquerel

- Count each wipe sample; determine net count rate.
- For each sample, calculate and record estimated activity in becquerels (or microcuries).

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

- Sign and date the list of sources, data and calculations. Retain records for 3 years (OAC 3701:1-38-20(C)).
- If the wipe test activity is 185 Bq (0.005 mCi) or greater, notify the RSO, so that the source can be withdrawn from use and disposed of properly.
- Notify the department.

# Appendix P

## 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

Appendix C to Part 172 --Dimensional Specifications for Recommended Placard Holder

### **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.

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§ 178.358-2 Materials of construction and other requirements.

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#### 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 Jan 2006, is not a substitute for DOT regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at [www.gpoaccess.gov](http://www.gpoaccess.gov).

<b>Package and Vehicle Radiation Level Limits (49 CFR 173.441)<sup>1</sup></b>				
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> <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><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 Excepted", if the package is excepted 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 foreign-made packaging [§172.203(d)(8)] (see §173.473)</li> </ul> <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>	<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 may be inserted in addition to activity units [§172.203(d)(3)]</li> <li>▪ Emergency response information may be entered on the shipping papers, or may be a separate document carried with the shipping papers [§ 172.602(b)]</li> </ul>

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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 only true 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, 2 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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**Hazard Communications for Class 7 (Radioactive) Materials  
Marking (49 CFR Part 172, Subpart D)**

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 1000 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 <ul style="list-style-type: none"> <li>- UN 2911 [§173.422(a)]</li> </ul> </li> <li>▪ Manufactured Articles containing natural uranium or thorium <ul style="list-style-type: none"> <li>- UN 2909 [§173.422(a)]</li> <li>- “Radioactive” [§173.421(a)(4)]</li> </ul> </li> <li>▪ Empty Packaging <ul style="list-style-type: none"> <li>- UN 2908 [§173.422(a)]</li> </ul> </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 number [§§172.301(c) and 172.302(c)]</li> <li>▪ 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)]</li> </ul>	<p>Both the name and address of consignor and consignee are recommended</p>

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)

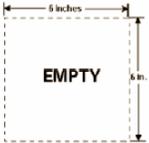
### Placement of Radioactive Labels

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
WHITE-I	YELLOW-II	YELLOW-III	FISSILE	EMPTY
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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**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)

*Note: This reference guide, last updated Jan 2006, is not a substitute for DOT regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at [www.gpoaccess.gov](http://www.gpoaccess.gov).*

**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 which 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
- Phone number to 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 Jun 13, 2003]
- NRC Orders to Manufacturers and Distributors [69FR3397 on Jan 23, 2004]
- NRC Transportation Orders [70FR44948 on Aug 4, 2005]
- Ohio Department of Health 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 Jan 2006, is not a substitute for DOT regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at [www.gpoaccess.gov](http://www.gpoaccess.gov).*

<b>Hazard Communications for Class 7 (Radioactive) Materials Training (49 CFR 172 Subpart H)</b>
<p>Responsibility for training and testing [§172.702]</p> <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>
<p>Hazmat employee training must include the following [§172.704(a)]:</p> <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>
<p>Recordkeeping</p> <ul style="list-style-type: none"><li>▪ Keep training records three years [§172.704(d)]</li></ul>

*Note: This reference guide, last updated Jan 2006, is not a substitute for DOT regulations on the transportation of radioactive materials. Current DOT regulations may be located through the internet at [www.gpoaccess.gov](http://www.gpoaccess.gov).*

## Appendix Q

### Model Waste Management Procedures

## **MODEL WASTE MANAGEMENT PROCEDURES**

### **General Guidelines**

1. All radioactivity labels must be defaced or removed from containers and packages prior to disposal into ordinary “non-radioactive” waste streams. If waste is compacted, all labels that are visible in the compacted mass must be defaced or removed.
2. Remind workers that non-radioactive waste such as leftover reagents, boxes and packaging material should not be mixed with radioactive waste.
3. Occasionally monitor all procedures to ensure that radioactive waste is not created unnecessarily. Review all new procedures to ensure that waste is handled in a manner consistent with established procedures.
4. In all cases, consider the entire impact of various available disposal routes. Consider occupational and public exposure to radiation along with other hazards associated with the material and routes of disposal (e.g., toxicity, carcinogenicity, pathogenicity, and flammability) and costs.
5. Waste management program should include waste handling procedures for the users within their laboratories or assigned areas, and for waste handlers who may collect waste from areas of use to bring to the storage area for eventual disposal.
6. Housekeeping staff should be provided adequate training to avoid the possibility of unauthorized disposal or exposure of these individuals to radioactive materials or to radiation.

### **Model Procedure for Disposal by Decay-in-Storage (DIS)**

Applicants should assure that adequate space and facilities are available for the storage of waste for DIS. Licensees can minimize the need for storage space if the waste is segregated according to physical half-life.

1. Only short-lived waste (physical half-life of less than or equal to 120 days) may be disposed of by DIS.
2. Short-lived waste should be segregated from long-lived waste.
3. Waste should be stored in suitable well-marked containers, and the containers should provide adequate shielding.
4. Liquid and solid wastes must be stored separately.
5. When the container is full it should be sealed. The sealed container should be identified with a label affixed or attached to it.
6. The identification label should include the date when the container was sealed, the longest-lived radioisotope in the container, total activity, date when ten half-lives of the longest-lived radioisotope will have transpired and the initials of the individual

who sealed the container. The container may be transferred to the DIS area. When large quantities are held for DIS, sufficient quantities may be present even after 10 half-lives that persons performing surveys should be aware of the potential for measurable radiation.

7. The contents of the container should be allowed to decay for at least ten half-lives of the longest-lived radioisotope in the container.
8. Prior to disposal as ordinary trash, each container should be monitored as follows:
  - a. Check the radiation detection survey meter for proper operation.
  - b. Survey the contents of each container in a low background area.
  - c. Remove any shielding from around the container.
  - d. Monitor all surfaces of the container.
  - e. Discard the contents as ordinary trash only if the surveys of the contents indicate no residual radioactivity, i.e. surface readings are indistinguishable from background.
  - f. If the surveys indicate residual radioactivity, return the container to DIS area and contact the RSO for further instructions.
9. If the surveys indicate no residual radioactivity, record the date when the container was sealed, the disposal date, type of waste (used or unused material, gloves, etc.), survey instrument used, and the initials of the individual performing surveys and disposing of the waste.

All radiation labels must be defaced or removed from containers and packages prior to disposal as ordinary trash. Syringes/needles placed into sealed waste containers for decay do not need the labels removed, provided that the following is done: waste barrels are sealed prior to delivery to the waste disposal firm and delivered directly from the licensee's facility; labels are removed from the waste barrels/containers; and that the waste is incinerated, not placed in a landfill; and the waste disposal firm is cautioned not to open the container prior to incineration.

### **Model Procedure for Disposal of Liquids into Sanitary Sewerage**

1. Confirm that the sewer system is a public system, not a private sanitary sewer, septic system or leach field.
2. Confirm that the liquid waste being discharged is soluble (or is biological material that is readily dispersible) in water.
3. Calculate the amount of each radioisotope that can be discharged by using the information from prior, similar discharges and the information in OAC 3701:1-38-12, Appendix C.
4. Make sure that the amount of each radioisotope does not exceed the monthly and annual discharge limits specified in OAC 3701:1-38-19(D)(4) and OAC 3701:1-38-12, Appendix C, Table 3 (records for individual users/laboratories).

5. If more than one radioisotope is released, the sum of the ratios of the average monthly discharge of a radioisotope to the corresponding limit in OAC 3701:1-38-12, Appendix C, Table 3 must not exceed unity.
6. Total quantity of licensed material released into the sanitary sewerage system in a year does not exceed 185 GBq (5 Ci) of H-3 (tritium), 37 GBq (1 Ci) of C-14, and 37 Gbq (1 Ci) of all other radioisotopes combined.
7. Record the date, radioisotope(s), estimated activity of each radioisotope, location where the material is discharged and the initials of the individual discharging the waste.
8. Liquid waste should be discharged only via designated sinks or toilets.
9. Discharge liquid waste slowly to minimize splashing with water running to be sure that the material moves out of the sink and into the sewer system.
10. Survey the sink and surrounding work surfaces to confirm that no residual material or contamination remained in the sink or on work surfaces. Decontaminate as appropriate.
11. Decontaminate all areas or surfaces if found to be contaminated.
12. For all releases to the sanitary sewer from the licensed facility, maintain records of each radioisotope and its quantity and concentration that is released into the sewer system that demonstrate compliance with the regulatory limits for total quantity released and concentrations released by the licensed facility.

### **Model Procedure for Incineration**

These guidelines apply to noncommercial waste disposal, i.e., incineration of a licensee's own waste. You do not need specific approval in order to incinerate certain categories of radioactive waste. For example, OAC 3701:1-38-19(G) provides that tritium and carbon-14 in low level concentrations in liquid scintillation media and animal tissue may be disposed of without regard to radioactivity. After you review your program and confirm that you have waste that requires specific approval for incineration, please provide the following information.

1. Describe the training and experience of the person who will be responsible for the on-site and day-to-day supervision of incinerator operations.
2. Describe the waste that is proposed to be incinerated, to include: the chemical and/or physical form of the waste containing licensed material and a description of how the waste is segregated, packaged and labeled for transfer from the generation site to the incinerator; the name of the radioisotope; concentration of radioactivity averaged over the weight of the material to be incinerated (microcuries per gram of waste medium) for each isotope to be incinerated; and the total radioactivity of each isotope per burn and the total number of burns per year. Describe procedures for ensuring that these frequencies and activities will not be exceeded.

3. Describe the procedures for packaging, handling, securing and monitoring of waste to prevent contamination and/or unnecessary exposure to personnel or property during the waste life cycle.
4. Describe your method for measuring or estimating the concentration of radioactive material remaining in the ash residue. Describe your procedures for collection, handling and disposal of the ash residue.
5. Describe the recordkeeping procedures for the waste incineration program. Records must be adequate to document all receipts, incinerations, environmental releases of effluents and any disposals of ash generated in the incineration process. These records must be maintained in the same units as applicable regulations.
6. Describe the characteristics of the incinerator and site location, including: height of the stack, rated air flow (cubic feet per hour or similar units), proximity of the stack or other discharge to occupied areas (e.g., residences, school, hospital) and distance to the nearest air intake ducts of adjacent buildings. Describe any scrubbers, filters or air cleaning equipment that is present.
7. State how the concentration of radionuclides released, either as airborne effluent or as any liquid effluent from scrubbers, condensers, or associated systems, will be measured or otherwise determined. Describe any stack monitoring that is planned.
8. Provide a copy of the written safety analysis that demonstrates the applicant will be able to incinerate the types and quantities of radioactivity specified in the application without exceeding the environmental release limits specified in OAC 3701:1-38.
9. Provide a written commitment that the applicant has coordinated with appropriate State and local authorities and such permits and other authorizations as may be necessary have been obtained.
10. Provide a copy of the radiation safety procedures for monitoring personnel involved in incineration operations and for monitoring all effluent generated by the incineration process. The procedures must ensure that regulatory limits for environmental releases of radioactivity will not be exceeded. The applicant must describe how any ash generated exceeding regulatory limits will be disposed of.

### **Model Procedure for Compaction**

The following information should be provided from licensees who propose to compact waste.

1. Describe the compactor to demonstrate that it is adequately designed and manufactured to safely compact the type and quantity of waste generated during licensed operations (e.g., manufacturer's specifications, annotated sketches, photographs, etc.).
2. Describe the type, quantities and concentrations of waste to be compacted.
3. Provide an analysis of the potential for airborne release of radioactive material during compaction activities.

4. State the location of the compactor(s) within the waste processing area(s), as well as a description of the ventilation and filtering systems used in conjunction with the compactors. Include a description of the procedures for monitoring filter blockage and exchange.
5. Discuss the methods used to monitor worker breathing zones and/or exhaust systems.
6. Discuss the types and frequencies of surveys that will be performed for contamination control in the compactor area.
7. Discuss the instruction provided to compactor operators, including instructions for protective clothing; checks for proper functioning of equipment; method of handling uncompacted waste; and examining containers for defects.

Reference - see also NCRP Report 143 "Management Techniques for Laboratories and Other Small Institutional Generators to Minimize Off-site Disposal of Low-Level Radioactive Waste (April 2003)