Radiation Safety Program Guide
FOREWORD

Portland State University (PSU) is committed to providing an effective radiation safety program designed to ensure the safe handling of all sources of radiation. To accomplish this, the following specific policies are designed to maximize the benefits of the safe use of radiation sources and minimize the risk to faculty, staff, students, the environment, and the community especially by eliminating unnecessary exposures to radiation and reducing incidental and occupational exposures to levels that are As Low As Reasonably Achievable (ALARA). This program guide serves as a key piece of the PSU license to use radionuclides and radiation-producing machines and should be considered binding for all users and/or operators at PSU.

To administer the use of radiation sources, PSU has been granted a “Broad Scope B” category radioactive material license by the State of Oregon Health Authority, Radiation Protection Services division (ORPS). This license provides the authority and defines the university-level requirements for managing radionuclides and radiation-producing machines. Additionally, responsibility is assigned to the PSU Radiation Safety Committee (RSC) and Radiation Safety Officer (RSO) for assuring compliance with state and federal radiation safety regulations. The authority granted in the program guide specifically defines responsibilities for internal regulation and provides safety rules for users of radionuclides and radiation-producing machines. Authorization for all sources of radiation is afforded to individuals through licenses granted by the RSC and the RSO.

Technical assessments, evaluations, and interpretations shall be consistent with Oregon Administrative Rules (OAR), Chapter 333 (Div. 100-120) and the recommendations of advisory bodies such as:

1. The National Council on Radiation Protection and Measurements (NCRP)
2. The Nuclear Regulatory Commission (NRC)
3. The Environmental Protection Agency (EPA)
4. Federal Department of Transportation (DOT)
5. The International Commission on Radiological Protection (ICRP)
6. The National Academy of Sciences Committee on the Biological Effects of Ionizing Radiation (BEIR)
7. The American National Standards Institute (ANSI)

PSU will obtain and maintain all licenses, site use permits, registration certificates, and certificates of insurance, which are necessary or useful for the conduct of the radiation safety program and administered for the RSC by the RSO. Copies of these documents are accessible by contacting the RSO. If there is any conflicting information between this document and any PSU-generated document, the information in this guide will take precedence.

Any radiation user may communicate directly, in confidence and without prejudice, with the PSU RSO, ORPS, or the NRC on any matter concerning radiation protection.

Scott L. Jaqua
Radiation Safety Officer

Michael Bartlett
Associate Professor
Radiation Safety Committee Chair
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1 RADIATION SAFETY COMMITTEE (RSC)

1.1 The purpose of the RSC at PSU shall be to promote the best practices in the use of ionizing radiation sources, regardless of physical or chemical form, in experimental, instructional, and research programs. The RSC will work directly and indirectly through the Radiation Safety Officer (RSO), with individual faculty members, and/or department chairpersons to ensure the execution of safety procedures.

1.2 The RSC responsibilities include:

1.2.1 Serve as a decision making body, designating and granting authority over the radiation safety program to and through an RSO.

1.2.2 Review and authorize requests submitted by individuals wishing to use radioactive material or radiation-producing machines in a teaching and/or research program. Approval of such a request will be based on and limited to the conditions specified in the individual's license application(s), which must include laboratory safety measures and training history of the prospective licensee.

1.2.3 Review and approve amendments to radioactive material licenses based on recommendations from the RSO.

1.2.4 Review quarterly radiation exposure records and all incidents involving radioactive material.

1.2.5 Review the radiation safety program annually.

1.2.6 Review and approve, with advice and consent from the RSO, policies, procedures, and radiation safety program changes to ensure that ionizing radiation on the PSU campus is used in accordance with the requirements of the regulatory bodies.

1.2.7 Suspend or revoke the license of any radioactive material user or x-ray producing machine user on the basis of safety concerns and/or RSO recommendation.

1.3 Committee members and the chairperson are appointed by and report to the University president or his/her designee on recommendation from the Vice Provost for Research and Sponsored Projects (VPRSP).

1.3.1 The RSC will report directly to the VPRSP.
1.3.2 Voting members shall consist of a chairperson, the RSO, and in so far as possible, at least one representative from each department in which licensed radioactive material and/or x-ray producing machines are used. This may include, but is not limited to Biology, Chemistry, Physics, Geology, and Student Health and Counseling (SHAC). The RSC may include graduate student(s) upon vote by RSC, but this individual(s) will be an ex-officio member(s).

1.3.3 Committee meetings will be held quarterly, at the discretion of the chairperson, or by verbal or written petition of any member. Interim business will be conducted by the chairperson and the RSO. In the event that a vote is required, the RSO will coordinate communication of the need, counting the votes, and documenting the results for review at the next meeting.

1.3.4 Meetings may be conducted by an alternative method (email, teleconference, or online) provided that no committee member raises an objection.

1.3.5 A quorum will be defined as attendance by greater than 50% of the voting committee members. An item will be approved if a simple majority is achieved.
RADIATION SAFETY OFFICER (RSO)

2.1 The RSO is appointed by the University president or his/her designee on the recommendation of the Vice President for Research Strategic Partnership (VPRSP). The training and experience of the RSO must be in accordance with state and federal requirements.

2.2 The RSO is the authorized representative of the RSC in implementing radiation protection and control at PSU and is administratively responsible to the RSC. The RSO is the liaison official in all contacts with the State of Oregon Health Authority, Radiation Protection Services division (ORPS). In the RSO’s absence, the RSC shall designate a replacement.

2.3 The RSO is responsible for:

2.3.1 Implementing the radiation safety program.

2.3.2 Investigating any deviation from approved radiation safety practice and implementing corrective actions as necessary, including stop work/research orders as deemed appropriate for situation. Reporting any of these situations to the RSC and the VPRSP. Refer to Radiation Safety Operating Procedure (RSOP) 101.1.

2.3.3 Assisting the RSC with its duties.

2.3.4 Coordinating introductory, periodic, and supplemental radiation safety training for all users of radiation sources. Refer to Table 8.1.

2.3.5 Registration, re-registration, decommissioning, and safety checks of all radiation-producing machines and periodic resubmission of PSU’s radioactive material license. Refer to Section 16 and RSOP 1601.1.

2.3.6 Ensuring that ALARA practices are followed.

2.3.7 Implementing written policy and procedures for the following program elements as performed by laboratory personnel and the RSO, where applicable:

- Radioactive material acquisition, including receipt and delivery.
- Storing radioactive material.
- Maintaining radioactive material inventory records.
- Safe use of radioactive material.
- Required actions for loss of radioactive material.
- Performing periodic radiation/contamination surveys.
• Calibration of radiation survey instruments.
• Disposing of radioactive material.
• Ensuring personnel who work in or frequent areas where radioactive material or radiation-producing machines are used or stored are trained as appropriate.

2.3.8 Maintaining copies of all records and reports required by the OAR’s and this program guide.

2.3.9 Administration of the dosimetry and bioassay program.
• Reporting quarterly summaries of dosimetry results to the RSC.
• Providing written annual summary reports to all dosimetry users.

2.3.10 Attending RSC meetings and coordinating meeting agendas and minutes, which must include:
• The date of the meeting
• Members present and absent
• Summary of deliberations, discussions, and conclusions.
• Recommended actions.
• All reviews required by the ALARA program.

2.3.11 Following RSC approval, distributing radiation safety program revisions to appropriate users.

2.3.12 Following RSC approval, preparing for and coordinating with licensees including:
• Establishing appropriate radiation work areas and conditions.
• Providing policies, procedures, and recommendations associated with radioactive material use or radiation-producing machine use.
• Coordinating laboratory decommissioning and final radiation survey(s).

2.3.13 Periodic radioactive material user inspections. Refer to Section 9 and RSOP 901.1.

2.3.14 Performing periodic radiation and contamination surveys in accordance with state and federal regulations.

2.3.15 Enforcing the policies and procedures established by the RSC.

2.3.16 Serving as liaison to ORPS on all matters related to the PSU license.

2.3.17 All other activities required by state and federal regulations.
3 RADIOACTIVE MATERIAL LICENSEE

3.1 A Radioactive Material Licensee (Licensee) is an individual who has obtained a radioactive material license from the RSC at PSU. This individual is authorized by the RSC to acquire and use specific radioactive sources (radionuclides and radiation-producing machines) as well as supervise their use by others. Principal Investigators (PI)’s with sealed sources in their laboratory are not considered Licensees. Refer to Section 6.5 for other exemptions.

3.2 A Licensee is responsible for all work with radionuclides and radiation producing machines in the work areas listed on his/her license. The Licensee shall:

3.2.1 Ensure compliance with all PSU radiation safety regulations.

3.2.2 Demonstrate training and experience with the type and quantity of material that they propose to use prior to licensure.

3.2.3 Attend periodic refresher radiation safety training in accordance with Section 8.

3.2.4 Ensure that all laboratory personnel have received appropriate training for radionuclides and radiation-producing machines, including special training for visitors, minors (14-18 years old), and administrative staff members. Refer to Table 8.1.

3.2.5 Provide laboratory-specific training to each laboratory member following attendance at radiation safety training. Documentation of laboratory-specific training is kept in the laboratory.

3.2.6 Ensure that there are proper security measures to prevent unauthorized access, use, or loss of radioactive material and radiation-producing machines. The main emphasis is on maintaining radiation doses ALARA. Refer to Section 16 and RSOP 1601.1.

3.2.7 Ensure that acquisition, use, disposal, and documentation of radionuclides is in accordance with PSU policy. Refer to Section 11 and RSOP 1101.1.

3.2.8 Ensure that the RSO is notified of any new radiation-producing machine prior to its first use. Refer to Section 16 and RSOP 1601.1.

3.2.9 Ensure that an operations manual is available for users of any radiation-producing machine or equipment necessary for radioactive material use in a laboratory.

3.2.10 Inform the RSO of any significant modification of radiation-producing machine(s) including, change in arrangement, components, disassembly, reassembly, any maintenance or alignment.

3.2.11 Ensure that all radiation-producing machine safety features and interlocking devices remain in place while primary beam is energized. Inform RSO of any need to disable safety features.

3.2.12 Ensure that exposure monitoring is performed consistent with laboratory radioactive material license and in accordance with RSO recommendations. Refer to Section 7.
3.2.13 Ensure that radioactive material disposal is performed consistent with laboratory radioactive material license and in accordance with RSO recommendations. Refer to Section 15 and RSOP 1501.1, RSOP 1501.2, and RSOP 1501.3.

3.2.14 Ensure laboratory radiation surveys are performed consistent with this program guide and RSO recommendations. Refer to Section 10 and RSOP 1001.1.

3.2.15 Ensure all radiation detection instrument calibration is performed in accordance with this program guide and RSO recommendations. Refer to Section 12.

3.2.13 Ensure that radioactive material and work areas have proper postings and labels. Refer to Section 11 and RSOP 1101.1.

3.2.14 Notify the RSO when assistance is needed to handle an unusual occurrence with radioactive material or radiation-producing machines.

3.2.15 Notify the RSO and complete license amendments prior to making changes in the laboratory radiation program, including location changes, modifications radionuclide authorizations, chemical, and/or physical forms. Refer to Section 6 and RSOP 601.1 and RSOP 601.2.

3.2.16 Notify the RSO in a timely manner to terminate or cancel the laboratory license. Refer to Section 6.

3.2.17 Ensure that the use of radionuclides or radiation-producing machines with animals, infectious agents, or hazardous materials is in accordance with RSC instructions and PSU policy.
4 AUTHORIZED USERS OF RADIATION SOURCES

4.1 Individuals who work for a Licensee and have met the training requirements for their work, whether radionuclide or radiation-producing machine, are considered Authorized Users. Refer to Section 8 and Table 8.1 for these requirements.

4.2 Authorized Users are responsible for following the policies in this manual, applicable procedures, and laboratory-specific instructions, and state mandated Notices to Employees and Notices to Workers when working with radiation sources.
EXCLUSIONS

Personnel who are prohibited from working with radioactive material, radiation-producing machines, or any other source of radiation are:

- Employment agency temporary workers
- Children under the age of 14
- Unsupervised youths between the ages of 14 and 18 years, whether they are students or PSU employees.
6 RADIOACTIVE MATERIAL LICENSE

6.1 Possession or use of any radionuclides and/or any radiation-producing machine(s), except for the exemptions listed in Section 6.5, at any PSU location must be in accordance with a written Radioactive Material License or authorization issued by the PSU RSC.

6.2 The radioactive material license and/or subsequent amendments become valid when signed by the RSO or his/her designee.

6.3 License amendments are required for changes to any current license. Refer to RSOP 601.2.

6.4 A license status change will occur when:

6.4.1 Any Licensee that is found to be willfully or negligently, violating university, state or federal regulations may have his/her license suspended by the RSC and/or the RSO. Use of radioactive material or radiation-producing equipment will be prohibited until formal action is taken by the RSC to cancel, modify and reissue, or reinstate the license.

6.4.2 The Licensee requests cancellation or leaves PSU.

6.5 Some radioactive sources, based on specific uses, do not require a license. These exemptions are:

6.5.1 Electron microscopes, electron beam welders, and other similar devices exempt from state registration in accordance with state regulations.

6.5.2 Chemical compounds, not including those containing uranium or thorium.

6.5.3 Readily available commercial items containing radioactive material e.g. gas lantern mantles, smoke detectors, small static eliminators, thoriated welding rods, and other commercial devices using radionuclides for illumination, etc., as long as radioactive material will not be separated or used for experimental purposes.

6.5.4 Naturally occurring radioactive material in unprocessed form i.e., ore samples, rock samples etc., in modest quantities.

6.6 Use of radionuclides and radiation-producing machines in the classroom, whether exempted or not, requires written consent from the RSC. This process is similar to applying for a radiation safety license, except the application is less involved and this authorization is only on a per-term, specific classroom basis. Refer to RSOP 601.1.
7 RADIATION MONITORING

Exposures shall not exceed the limits in Table 7.1 under normal conditions.

7.1 Individual External Exposure Monitoring

7.1.1 Dosimeters must be worn only by the individual to whom they were issued.

7.1.2 Dosimeters will be obtained, worn, and cancelled by contacting the RSO.

7.1.3 Any person requesting a dosimeter will be issued one.

7.1.4 Whole body dosimeters will be issued:
   • When whole body dose could exceed 25 mrem/quarter

7.1.5 Extremity dosimeters will be issued:
   • When extremity dose could exceed 250 mrem/quarter
   • To users who handle P-32 or other beta emitters with maximum energies greater than 600 keV.
   • To users working with or in the vicinity of any open/un-enclosed radiation-producing machine.

7.1.6 The RSO will issue dosimetry on a case-by-case basis for all other situations upon request.

7.2 Pregnant Workers

7.2.1 Workers who have declared their pregnancy in writing will be issued an extra dosimeter for abdominal (fetal) monitoring. Fetal monitoring dosimeters will be issued based on the radionuclide being used, the workers’ position, and the RSO’s discretion.

7.2.2 Under the provisions of Oregon rules, pregnant workers may request reassignment if their appropriate health care provider deems it necessary.

7.3 Individual Internal Dose Estimation – Bioassays

All workers who handle volatile forms of radioiodine must participate in the bioassay program unless other arrangements have been made. Personnel using 20 mCi or more per month of tritium must also participate in the bioassay program. Workers handling bound forms may participate on a voluntary basis.

7.4 Visitors

Visiting radiation workers will be issued dosimeters under the guidelines of Section 7.1.

7.5 Records of Exposure
7.5.1 The RSO will make dosimetry reports available for review by all workers. Annual summaries based on a calendar year will be sent to each monitored employee.

7.5.2 Any user may obtain a summary of his/her radiation exposure records and bioassay results upon termination of employment or at any other time by written request to the RSO.

7.5.3 The RSO will provide estimated exposures to the dosimeter company for individuals with lost or damaged dosimeters.

7.6 Environmental Monitoring

7.6.1 The RSO will exchange work area dosimeters at selected locations to measure ambient radiation levels.

7.6.2 Portable air monitors will be provided by the RSO for situations where it may be necessary to check for airborne contamination.

7.6.3 The Licensee must contact the RSO for hood monitoring before starting an iodination program if the activity used per iodination exceeds 10 mCi.

7.6.4 Other monitoring of environmental releases may be done where calculations show that allowable concentrations in air or water could be realistically exceeded.
Table 7.1  Occupational Radiation Dose Equivalent Guidelines
(Sum of internal and external sources)

<table>
<thead>
<tr>
<th>Category</th>
<th>Federal/State Annual Limit</th>
<th>PSU Annual Limit</th>
<th>PSU Quarterly ALARA Limit</th>
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<tbody>
<tr>
<td></td>
<td>mSv</td>
<td>mrem</td>
<td>mSv</td>
</tr>
<tr>
<td>Whole Body$^1$</td>
<td>50</td>
<td>5000</td>
<td>11</td>
</tr>
<tr>
<td>Skin &amp; Extremities$^2$</td>
<td>500</td>
<td>50000</td>
<td>110</td>
</tr>
<tr>
<td>Declared Pregnant Worker$^3$</td>
<td>5</td>
<td>500</td>
<td>1.1</td>
</tr>
<tr>
<td>Youthful Worker$^4$</td>
<td>10% of the above Federal/State, PSU and ALARA adult limits.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$Whole body is defined as the head, trunk, and arms above elbow, legs above knee. Deep dose equivalent at tissue depth of 1 cm.
$^2$Extremities include elbows and knees, arms below the elbow, and legs below the knee. Shallow dose to depth of 0.007 cm.
$^3$Dose is for exposure over the entire pregnancy
$^4$Youthful worker is defined as minors over 14 and under 18 years of age. Child labor laws prohibit youths under 14 years from working in areas where radiation hazards exist.
$^5$OAR 333-120-0100 & 10CFR20.1201
8 TRAINING

8.1 The radiation safety training program ensures that all personnel receive proper instruction, which is at least commensurate with the degree of potential hazards to be encountered, see Table 8.1 for training categories and descriptions.

8.1.1 Training records for radionuclide users and one-time radiation-producing machine radiation safety training will be maintained by the RSO.

8.1.2 Training records for laboratory-specific training and specialized instruction for radiation-producing machines and other equipment will be maintained by the laboratory.

8.2 Workers who use radiation producing machines and radionuclides must have appropriate training prior to initial use. See Table 8.1 for training categories and descriptions. Exceptions must be approved by the RSC. New users are allowed a 60-day grace period for initial training provided:

- PSU Radiation Safety Program Guide is read prior to radioactive material use
- Interim instruction on radionuclide use and/or radiation-producing machine operation is provided by senior laboratory person
- New user is supervised by senior laboratory person until training is completed.

8.3 New radionuclide Licensees must receive PSU radiation safety training prior to licensure. New radiation-producing machine users must provide documentation of prior experience and training or attend the PSU radiation-producing machine training prior to licensure. Exceptions must be approved by the RSC.

8.4 Existing radionuclide use licensees and authorized users must receive refresher training at intervals not exceeding two years. There is a grace period of 90 days for PSU trained personnel. Radiation-producing machine training is a one-time only training.

8.5 Radiation safety training attendees must pass a written exam to receive credit for radiation safety training. Passing scores and authorization will be at the discretion of the RSO. The requirement for a written exam does not apply to administrative training or radiation-producing machine training.

8.6 Following any person attending radiation safety training, licensees are expected to train laboratory personnel on the specific safety and operational details of laboratory procedures and experiments. This laboratory specific training must be documented and retained in the laboratory.

8.7 Custodial employees must complete radiation awareness training annually and within 60 days of hire.
**Table 8.1 Radiation Safety Training Categories and Descriptions**

<table>
<thead>
<tr>
<th>Training Type</th>
<th>Who</th>
<th>When</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introductory</td>
<td>New radionuclide user or licensee to PSU and have never received radiation safety training</td>
<td>Prior to initial use*</td>
</tr>
<tr>
<td>Refresher – in-class</td>
<td>Radionuclide user or licensee with prior training at other organizations or Introductory training at PSU previously</td>
<td>Within 60 days of initial use*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 2 years**</td>
</tr>
<tr>
<td>Refresher – online</td>
<td>Radionuclide user or licensee with prior training at PSU</td>
<td>Within 60 days of initial use</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 2 years**</td>
</tr>
<tr>
<td>Administrative</td>
<td>Radionuclide licensee who does not use radioactive material and is eligible for refresher training</td>
<td>Every 2 years***</td>
</tr>
<tr>
<td>Radiation-producing machine</td>
<td>New radiation-producing machine users and licensees</td>
<td>Prior to initial use*</td>
</tr>
<tr>
<td>Custodial</td>
<td>Ancillary PSU staff accessing laboratories while performing janitorial services.</td>
<td>Within 60 days after hire</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Every 3 years</td>
</tr>
</tbody>
</table>

* Interim instruction required by authorized user before working with radionuclides (not applicable for licensee. New users are allowed a 60-day grace period for initial training
** 90-day grace period
*** Must request training material from RSO and complete before 90-day grace period is over.
9 INSPECTIONS

9.1 The inspection program applies to all radionuclide licensees and radiation-producing machine licensees. Refer to Section 6 and RSOP 901.1

9.2 Licensees’ radiation safety programs will be inspected prior to initial licensure, within a year after issuing a license, and annually thereafter, not to exceed 15 months after the previous inspection. Delays or missed inspections will be documented by the RSO in the licensee’s file.

9.3 Inspections will not be performed if radioactive material has not been ordered or used since the previous inspection. Inspections of radiation-producing machines will not be performed if the machine is dismantled or inoperable, see Section 16. These instances will be documented by the RSO in the licensee’s file.

9.4 Reports of inspection findings will be sent to the Licensee, who must describe corrective actions when necessary. Refer to RSOP 101.1.

9.5 Reinspections will occur to ensure that corrective actions recommended during the inspection have been implemented. Multiple unannounced reinspections will occur when warranted by the RSO.

9.6 The Licensee or any lab member of a licensee is expected to cooperate fully during compliance inspections by the NRC, ORPS, and/or the PSU RSO.
10 **SURVEYS**

Periodic surveys are required by state and federal regulations and to maintain a safe environment at PSU. It is the Licensee’s responsibility to ensure that these surveys are completed in a timely manner. Refer to RSOP 1001.1.

10.1 Documented contamination surveys must be performed monthly when radioactive material is used.

10.2 The following specific rules apply for these surveys:

- Laboratories in which only P-32 is used need only perform properly documented meter surveys.
- Laboratories in which only H-3 is used need only perform properly documented wipe tests.
- All other laboratories must perform both meter surveys and wipe tests each month.

10.3 Records of contamination surveys must include:

- Date of the survey
- Name of the surveyor
- Map with locations of wipes taken (if required)
- Survey meter make, model, serial number, and calibration date
- The background observed on the survey meter
- The results of the wipe test, meter survey, or both (i.e. no contamination found, all readings < background).

10.4 The RSO performs all required radiation surveys that are not required by laboratory personnel under normal circumstances (i.e. radiation-producing machine surveys following configuration changes or exposure investigation).

- If exposure rate information is desired, contact the RSO.
- If installation, maintenance, or an alteration of a radiation-producing machine is planned, contact the RSO.
11.1 Handling Radioactive Material

11.1.1 Radioactive material must be handled to keep personnel dose and contamination levels ALARA, considering the nature of the activities being performed. Refer to RSOP 1101.1.

Radioactive material handling is defined as:

- Using radioactive material in experiments
- Transporting, measuring, disposing, or moving radioactive solid or liquid

Radioactive material handling is NOT:
- Performing a radiation or contamination survey, unless contamination is found while doing so.

11.1.2 Appropriate protective equipment must be worn when handling radioactive material, except sealed sources. Protective equipment includes gloves, laboratory coats, and protective eyewear. Additional personal protective equipment should be used when necessary.

11.1.3 Whenever an individual handles liquid radionuclides, a survey of the area must be performed with an appropriate, operating, and calibrated survey instrument.

11.1.4 Radioactive material work surfaces must be covered to prevent contamination.

11.1.5 Radioactive sources may be used in classrooms for demonstration only. Refer to Section 6.6. Upon course completion, the instructor must provide to the RSO a list of all students exposed to the source(s) and an approximate length of time exposed.

11.1.6 Sealed source use in a laboratory does not require contamination surveys, but is considered radioactive material use for training purposes.

11.1.7 Volatile forms of radioactive material must be opened and used, in an operating fume hood.

11.1.8 All radioactive liquid containers require secondary containers to prevent spills. Radioactive material transported on campus must be securely contained, adequately shielded, and properly labeled. Radioactive material must not be left unattended. Refer to RSOP 1501.1.

11.1.9 Performing a radiation survey and/or disposing of radioactive material (liquid or solid) is considered radioactive material use and requires training and contamination survey(s).

11.1.10 Radioactive material may not be transported on any university or public conveyance.

11.1.11 Food and/or beverages are prohibited from being stored in any freezer or refrigerator where radionuclides are stored.

11.2 Acquisition, Receipt, and Transfer of custody of radionuclides
11.2.1 Acquisition of any radioactive material, either from off-campus or from another laboratory on campus, must be in accordance with a valid PSU radiation license, except for unregulated items listed in Section 6.5.

11.2.2 Incoming radionuclide packages must be delivered to the RSO receiving area. The RSO, or his/her designee, will accept custody, survey as required, and transfer the package(s) to the intended user. Refer to RSOP 1101.1

11.2.3 If a package bypasses the RSO and is delivered directly to the intended user, the RSO must be notified as soon as possible.

11.2.4 Radioactive material shipments off campus must be performed by the RSO. All outgoing packages containing radionuclides must have appropriate documentation and packaging in accordance with state and federal regulations.

11.2.5 Transfer of radioactive material between PSU locations requires appropriate documentation and proper transportation arrangements. Contact the RSO in advance.

11.3 Radionuclide inventory

11.3.1 All radioactive material must be accurately tracked in the laboratory including:
   • Receipt date
   • Amount received (activity)
   • Use date, quantity used (activity), and balance remaining. This should include the date and amount placed into storage for decay, drain disposed, or placed into a waste container.

11.3.2 Each Licensee must submit periodic radionuclide inventories to the RSO in accordance with PSU procedures. Refer to RSOP 1101.2.

11.3.3 The RSO will maintain semi-annual inventories in accordance with state regulations.

11.4 Postings and Labeling

11.4.1 Radiation signs must be posted to denote areas of radioactive material use, storage, and the presence or potential presence of radioactive material, x-ray machines, and/or equipment.

11.4.2 Each refrigerator and freezer where radioactive material is stored must have a “Caution Radioactive Material” sign and a “Store No Edibles,” or equivalent sign visibly displayed.

11.4.3 Radiation labels must be affixed to all items associated with the use of radioactive material. The radionuclide and an activity approximation must be included on the label.

11.4.4 Any radiation signs or labels must be removed or obliterated when no longer applicable.

11.4.5 Each Licensee must post a copy of “Oregon Notice to Employees” and “Notice to Radiation Workers” in a visible laboratory location.

Rev: 10/12/2015
11.5 Radiation-producing machine provisions

11.5.1 Only authorized users are permitted to make adjustments to radiation-producing machines while primary beam is energized. Shielding should be verified prior to each use. Refer to RSOP 1601.1.

11.5.2 Maintenance on radiation-producing machines must be performed by a graduate student or above.

11.5.3 A radiation survey by the RSO is required following any change in arrangement, alignment, or components external to cabinet or shielding. Any disassembly, reassembly, maintenance, or when personnel exposures appear abnormal requires RSO inspection and radiation survey.

11.5.4 The RSO maintains a list of radiation-producing machine licensees and authorized radiation-producing machine users. Specific authorizations are kept by the PI/ Licensee/ Department for each machine.

11.5.5 Shielding and installed safety features should be maintained at default levels and specifications in accordance with manufacturer instructions unless specifically approved by the RSO.

11.5.6 Radiation-producing machines may be used in classrooms for demonstration only, see Section 6.6. Upon course completion, the instructor must provide to the RSO a list of all students present while the exposed to the source(s) and an approximate length of time exposed.
INSTRUMENT CALIBRATIONS

12.2 Each radiation survey meter must be calibrated at least annually, and after repairs which may have affected the calibration.

12.2.1 Documentation of calibration is maintained by the RSO and is available upon request.

12.3 Instruments that are used to interpret laboratory wipe surveys or bioassays (liquid scintillation counters and gamma counters) must be calibrated annually.

12.3.1 Documentation of liquid scintillation counter calibrations is maintained by the RSO, PI, or department through whom the maintenance contract is paid. Daily calibration checks made in the normal course of operation may be used in lieu of the above, if the results are documented.
SECURITY

13.2 Laboratories or radiation work areas must be locked when unoccupied and radioactive material is present.

13.3 Any known or suspected loss of radioactive material must be reported immediately to the RSO. Refer to RSOP 1701.2

13.4 Stock vials of radioactive material must be locked when not in use.

13.5 Access to a restricted area shall be limited to individuals with appropriate training. Refer to Table 8.1.
14.2 Sealed sources must be leak tested every six months when in use or as required. A record of the test results must be maintained.

EXCEPTION: Sealed sources containing 100 µCi or less of beta and/or gamma emitting material or 10 µCi or less of alpha emitting material are exempt from the leak test requirements.

14.3 Any equipment or analytical device containing a sealed source of radioactive material (liquid scintillation counters or gas chromatographs) must have the radioactive source removed only by the RSO prior to collection by the surplus property department. This requirement must also be met if the device or equipment is not to be used for its intended purpose (i.e. Parts scavenging).

14.4 PSU sponsors of industrial radiographers and other contractors or individuals who intend to bring radiation sources to PSU must notify the RSO in advance, allowing time to make appropriate arrangements.
Radioactive waste shall be disposed of by drain, in accordance with Section 15.3 or picked up by the RSO in accordance with RSOP 1501.3.

Any radioactive material disposal and storage must be documented. Refer to RSOP 1101.1.

Aqueous waste may be disposed of down the drain, must be documented, and must be in accordance with RSOP 1501.2.

Radioactive liquid disposals must meet the following criteria:

- Only compounds allowed by local, state, and federal regulations.
- Only readily dispersible biological material, with approval of the RSO and/or the biological safety officer.
- Must be Soluble in water
- Solid material is not allowed

Disposals must be documented. The following are the PSU monthly drain disposal limits:

<table>
<thead>
<tr>
<th>Radionuclide</th>
<th>Allowable Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-3</td>
<td>1 mCi</td>
</tr>
<tr>
<td>C-14</td>
<td>1 mCi</td>
</tr>
<tr>
<td>All others</td>
<td>1 mCi</td>
</tr>
</tbody>
</table>

Radioactive material must not be disposed of with normal trash. Fines imposed by city or state agencies will be referred to the responsible laboratory/principal investigator.

The RSO picks up all radioactive waste regardless of half-life, but waste must be segregated by radionuclide/half-life. Refer to RSOP 1501.1.

All radioactive waste containers must be properly labeled and have a log sheet, recording the activity and radionuclide contained.

Chemically toxic and/or hazardous radioactive waste will be handled by the RSO only by prior arrangement and on a case-by-case basis.
15.10 Radioactive biological waste will not be picked up by the RSO unless the biological agent has been deactivated. In the event that these wastes are generated, an off-site disposal will be arranged through a commercial contractor on a case-by-case basis.
16.2 X-ray or gamma-producing machines must comply with specific registration and safety requirements specified in OAR 333 and be acquired, used, stored, transferred, and disposed of in accordance with these rules. Refer to RSOP 1601.1.

16.3 Acquisition of radiation-producing machines requires authorization by the RSC, which is specific for the equipment being acquired.

16.4 If applicable, radiation-producing machines shall be registered with the ORPS prior to being put into use. Registration will be arranged by the RSO.

16.5 Radiation-producing machines shall be inspected by the RSO after acquisition, relocation, or major modification and/or repair. The equipment shall not be put into use until found to comply with all applicable state and university regulations. Equipment owners are responsible for notifying the RSO of completion of any of the above activities and for arranging for the inspection.

16.6 Each approved operator and each person working with or near radiation-producing machines shall be given radiation safety training commensurate with the degree of hazard involved. Refer to Table 8.1. Documentation of the training shall be maintained by the equipment owner (PI) and copies sent to the RSO.

16.7 Radiation-producing machines shall be adequately secured against unauthorized use or relocation.

16.8 Shielding and survey records will be maintained by the RSO.

16.9 All safety precautions will be included in the operating procedure for the equipment, maintained by the licensee, and must be strictly followed.

16.10 Transfer to a non-PSU entity, including disposal, requires prior approval of the RSO signifying that the equipment meets applicable regulatory requirements for legal transfer and ensuring that the transaction will be properly reported per state regulations.

16.11 Internal transfer of equipment must be approved by the RSC.
16.12 Deactivation and storage of radiation-producing machines requires that the machines be properly labeled and secured by the RSO to prevent unauthorized operation. This equipment must continue to be registered with the state.

16.13 Applicable provisions of OAR 333, Chapter 108, “Radiation Safety Requirements for Analytical X-Ray Equipment” shall be strictly followed. A copy of the applicable regulations shall be available at or near the equipment.
17.2 In life threatening situations the first priority is preservation of human life; however it is
essential that personnel minimize radiation doses and contamination spread to the extent
reasonable under the circumstances.

17.3 Radiation Incidents and other abnormal situations involving radionuclides or radiation-emitting
machines shall be handled in order to:

- Minimize actual, potential, and perceived harm to persons, equipment, facilities, and the
  environment.
- Provide proper notification to authorities.
- Provide proper information to appropriate parties.

17.4 There are two types of spills with different responses for laboratory personnel at PSU. Refer to
RSOP 1701.1:

17.4.1 **Minor spill**: the contamination does not present an immediate health hazard or risk
of widespread contamination. Laboratory personnel who work in that laboratory
where the spill occurred may clean it up in accordance with approved procedures.

17.4.2 **Major spill**: there is an immediate health hazard or widespread contamination. This
type of spill requires RSO advice and/or assistance.

17.5 The RSO must be notified immediately if:

- Radioactive material is identified as lost or stolen
- A suspected or known excessive radiation exposure has occurred. Refer to Table 7.1.

17.6 In the event of personal injury, fire, flood, or other accident in any radiation restricted area, the
RSO shall be notified as soon as circumstances permit.

17.7 Upon being notified of a suspected or known radiation occurrence, a radiation incident, or
similar situation, the RSO will provide assistance in evaluating radiological aspects of the
situation.
Individual laboratory records will be maintained by the Licensee for the indicated period of time:

- License applications, evaluations, and authorizations: 3 years
- Radiation Safety Training certificates for radiation workers: 3 years
- Laboratory Survey Records: 2 years
- Radionuclide use
  - Inventories: 2 years
  - Receipt and use log sheets: 1 year after zeroed out
- Off campus shipping documents: 2 years
- Disposal records
  - Drain disposal documentation: 2 years
  - Disposal by incineration: While facility operates
  - Transfers: 1 year
  - Container waste log sheets: 2 years
- Instrument Calibration Records: 4 years
19.2 The Radiation Safety Operations Manual is written to assure the safe use of radiation sources within the laboratory and by radiation safety office staff. These procedures are prepared by the RSO with input and guidance from the RSC, professors, and other organizations. It is the responsibility of the RSO to ensure that these procedures are appropriate and timely with respect to new knowledge and changes in local policies, state rules and regulations, federal codes, and standards of practice established within the radiation safety community as a whole.

19.3 Procedures for use by laboratory personnel are subject to review and approval by the RSC.