

Oregon State University Radiation Safety Manual

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1. Radiation Safety Program

1.1. University Policy Concerning Ionizing Radiation

1.1.1. The President of Oregon State University, recognizing the usefulness of ionizing radiation in the teaching and research missions of the University, directs that possession and use of radioisotopes and machines emitting ionizing radiation be optimized at OSU facilities and by OSU personnel. This shall be accomplished while ensuring that:

1.1.1.1. applicable laws and regulations of federal, state, and local agencies are not violated;

1.1.1.2. no risk from ionizing radiation shall be incurred except where justified by benefits from the activity;

1.1.1.3. radiation exposure shall be maintained As Low As Reasonably Achievable, all aspects considered.

1.1.2. The President has delegated to the Vice President for Finance and Administration the responsibility for maintaining a radiation safety program adequate to ensure compliance with this policy.

1.2. Scope of the Radiation Safety Program

The University Radiation Safety Program applies to all locations under University control wherein radioisotopes or radiation-producing machines are used or stored, regardless of ownership or the location. It applies to all persons working at or frequenting these locations, regardless of their relationship with the University. It applies to all radioisotopes and radiation-producing machines at these locations, regardless of ownership of the radioisotopes or machines. It applies to a limited extent to University personnel and equipment at non-University-controlled locations.

1.3. Scope of the Radiation Safety Manual

1.3.1. The University Radiation Safety Manual sets forth, either directly or by reference, the policies, regulations, standards and administrative procedures applying to the radiation safety program. Implementing procedures are issued separately either as Radiation Safety Office Procedures (RSOPs), Lab Procedures (LPs), or other documents.

1.3.2. The manual and all changes thereto will be issued by the Radiation Safety Committee after approval by the Vice President for Finance and Administration. Copies of the manual and of applicable state and federal regulations are available in the Radiation Safety Office.

2. Licenses and Regulations

2.1. Policy

Oregon State University will obtain and maintain all licenses that are necessary or useful for the conduct of the radiation safety program. The University will, insofar as possible, obtain and maintain copies of applicable federal, state, and local laws and regulations pertaining to the Radiation Safety Program.

2.2. State Licenses and Regulations

- 2.2.1. Radiation-producing machines and radioisotopes (other than fissionable material in quantity) which are used or stored at locations under State of Oregon jurisdiction are subject to provisions of Oregon Rules for the Control of Radiation (ORCR), found in Chapter 333, Oregon Administrative Rules (OAR). At OSU, such radioisotopes are governed by provisions of radioactive materials license ORE-90005, issued to Oregon State University by Radiation Protection Services, Center for Health Protection, Oregon Health Authority, State of Oregon. This license specifies the permitted radioisotopes, chemical forms, quantities, locations, and activities.
- 2.2.2. Radioactive material transport, storage and disposal must comply with rules issued by the Oregon Department of Energy, Department of Environmental Quality, and U.S. Department of Transportation.
- 2.2.3. Copies of ORCR, other applicable parts of OAR, and license ORE-90005 are in the Radiation Safety Office.
- 2.2.4. License ORE-90005 and State regulations are administered for the Radiation Safety Committee by Radiation Safety.

2.3. Federal Licenses and Regulations

- 2.3.1. The nuclear reactor and fissionable materials in significant quantities are subject to federal regulations given in various titles of the Code of Federal Regulations (CFR), particularly 10 CFR (Nuclear Regulatory Commission regulations) and 49 CFR (Transportation regulations). The reactor is governed by reactor operating license, R-106, issued to OSU by the U.S. Nuclear Regulatory Commission. The license specifies the permitted physical and operating parameters.
- 2.3.2. Copies of the license and the pertinent CFR parts are in the OSU Radiation Center and the Radiation Safety Office.
- 2.3.3. License R-106 is administered by the Radiation Center management. Other regulations are administered by Radiation Safety for the Radiation Safety Committee.
- 2.3.4. Use of fissionable in significant quantities other than in the reactor is performed under Special Nuclear Materials license 2013. The license is administered by Radiation Safety for the Radiation Safety Committee.

2.4. Reciprocity Agreements

Use of radioisotopes or radiation machines at locations not listed in these licenses can be arranged prior to any studies via a Reciprocity Agreements between the State of

Oregon and the other jurisdiction involved. The Reciprocity Agreement is arranged by Radiation Safety. However, any fees are the responsibility of the using group.

2.5. Human Use

OSU licenses do not permit deliberate application of radioisotopes or of ionizing radiation to humans, except for applications supervised by licensed medical practitioners and performed for diagnosis of medical problems (see OAR 33-100-020(5)). Experimental human uses require license amendments and other provisions that must be obtained via the Radiation Safety Committee, the State of Oregon and approved in addition by the OSU Institutional Review Board for the Protection of Human Subjects.

3. Radiation Safety Program Responsibilities

3.1. Policy

The responsibilities of the various participants in the radiation safety program at Oregon State University are listed in Section 3 of the OSU Radiation Safety Manual. The responsibilities for the parties are listed below:

3.2. President and Vice President for Finance and Administration

The President and, by delegation, the Vice President for Finance and Administration are responsible for providing a radiation safety program for Oregon State University. To this end, the Vice President for Finance and Administration is responsible for appointing and overseeing a University Radiation Safety Committee. The office of the Vice President for Finance and Administration is responsible for maintaining and overseeing the Office of Enterprise Risk Services.

3.3. Radiation Safety Committee

The Radiation Safety Committee, appointed by the Vice President for Finance and Administration, is responsible for recommending University policy with respect to radiation safety, establishing standards and regulations needed to implement this policy, reviewing operations and procedures of Radiation Safety, and acting as the statutory review committee for use of radiation and radioactive materials required by State and Federal radioactive materials licenses. More specific statements of Committee responsibilities are given in the Committee Bylaws (see section 9 of the OSU Radiation Safety Manual).

3.4. Chief Risk Officer

The Chief Risk Officer is responsible for appointing and overseeing the position of Assistant Director, Environmental Health and Safety.

3.5. Assistant Director, Environmental Health and Safety

The Assistant Director, Environmental Health and Safety is responsible for appointing the University Radiation Safety Officer, and maintaining and overseeing the administration of the Radiation Safety Office.

3.6. Radiation Safety Officer and Radiation Safety

3.6.1. The University Radiation Safety Officer, who is appointed by and reports administratively to the Assistant Director, Environmental Health and Safety, is responsible for managing the day-to-day affairs of Radiation Safety and providing secretariat for the Radiation Safety Committee.

3.6.2. The Radiation Safety Officer or his/her authorized representative has the authority to stop all operations with radioactive materials or radiation producing devices where a potential hazard or violation of federal, state or University rules and regulations may exist. Resumption of operations may take place only upon authorization from the Radiation Safety Officer or designee.

3.6.3. Responsibilities of Radiation Safety include:

3.6.3.1. operating efficient programs for radioactive waste disposal, package receipt surveys and delivery, preparation of radioactive materials for shipment, personnel dosimetry, workplace surveillance, records management, and basic personnel training;

- 3.6.3.2. administering the University's radioactive materials licenses and maintaining liaison with federal, state, and local regulatory agencies;
- 3.6.3.3. providing advice to OSU personnel and others concerning radiation safety matters;
- 3.6.3.4. managing radiation incidents and occurrences and supervising decontamination and other corrective tasks.

3.7. Program Director (Authorized User)

- 3.7.1. The Program Director has primary responsibility for all safety aspects of work under the program. This includes:
 - 3.7.1.1. being familiar with applicable parts of federal, state, and local laws and regulations;
 - 3.7.1.2. ensuring the personnel working under the program have received proper training;
 - 3.7.1.3. ensuring that all tasks involving radioisotopes or radiation machines are properly planned with respect to safety and that personnel involved understand what is to be done;
 - 3.7.1.4. ensuring that needed surveys, inspections and inventories are performed and documented properly and timely;
 - 3.7.1.5. ensuring that facilities and equipment needed for safety purposes are present and are properly maintained, including proper posting and labeling;
 - 3.7.1.6. ensuring that activities, materials, facilities, and personnel used during program work are properly authorized;
 - 3.7.1.7. ensuring proper security and marking of radioactive materials;
 - 3.7.1.8. ensuring proper notification of Radiation Safety and completion of proper corrective procedures in event of a spill, overexposure, etc.;
 - 3.7.1.9. ensuring proper notification and clearing of facilities and records upon termination of program work;
 - 3.7.1.10. ensuring that the Radiation Use Authorization is kept up to date.

3.8. Others involved with Radiation

- 3.8.1. All others working with or around radioisotopes and/or radiation machines are responsible for complying with safety and operating regulations and procedures pertaining to their activities. This includes such persons as:
 - 3.8.1.1. lab workers
 - 3.8.1.2. police and security workers
 - 3.8.1.3. janitorial personnel
 - 3.8.1.4. package delivery personnel
- 3.8.2. Responsibilities of the various participants in the OSU radiation safety program shall be made clear to all. Each participant is responsible for understanding and carrying out the required responsibilities and interacting with other participants.

3.9. Financial Responsibility

- 3.9.1. Program Directors are responsible for costs associated with their use of radioactive materials as set forth in the schedule of charges published by Radiation Safety (e.g. x-ray machine registration, survey instrument calibration fees.)
- 3.9.2. Departments will be responsible for any charges for which a Program Director is unable to pay.

4. Authorization to Possess and Use Radioisotopes or Radiation-emitting Machines

4.1. Policy

- 4.1.1. Possession or use of any radioisotope or radiation-emitting machine at any OSU-associated location must adhere to a written Radiation Use Authorization (RUA) issued by the OSU Radiation Safety Committee (RSC). There are no exceptions for small quantity or low emission rate. However, there are exceptions for specific materials and machines.
- 4.1.2. Exceptions for which written a RUA is not required include:
 - 4.1.2.1. naturally occurring radioactive materials in unprocessed form, i.e. ore or rock samples. These materials may not be extracted or otherwise processed.
 - 4.1.2.2. readily available commercial items containing small amounts of radioactive materials, i.e. gas lantern mantles, smoke detectors, small static elimination brushes for photo lab use, thoriated welding rods, exit signs and other commercial devices using radioisotopes for illumination. These radioactive materials must not be separated or used for experimental purposes.
 - 4.1.2.3. dental porcelain containing radioactive material.
 - 4.1.2.4. optics having thorium in anti-reflection coatings.
 - 4.1.2.5. radioisotopes in humans when administered (at non-OSU jurisdictions) by healing arts professionals for diagnosis or treatment.
 - 4.1.2.6. electron microscopes, electron beam welders, and other similar devices exempt from state registration in accordance with OAR 333-101.
- 4.1.3. Use of radiation at facilities under exclusive federal jurisdiction, even though on OSU property, requires authorization from that agency's radiation safety organization and notification to the OSU RSC.

4.2. Procedure to Obtain Authorization

Authorization requires the following steps:

- 4.2.1. The Applicant shall submit a written request to the RSC via Radiation Safety (RS). The request must provide sufficient information to enable safety analysis and prescription of adequate precautions. Instructions to prepare a RUA may be obtained from RS.
- 4.2.2. RS personnel will review the request, review the proposed facilities, obtain additional information if necessary, and submit a proposed Radiation Use Authorization to the RSC.
- 4.2.3. The RSC shall review the request, the safety review, and the proposed Authorization. It may obtain additional information and approve, modify, or deny the proposed Authorization.
- 4.2.4. Disapproval requires written notification to the Applicant stating the reasons for disapproval and giving possible alternatives.

4.2.5. An Authorization becomes valid when signed by the RSC and RS to signify approval and by the applicant to signify acceptance.

4.3. Authorization Scope

The Authorization shall specify every location, source of radiation, and a description of authorized activities. For RUAs authorizing use of radioactive material, it shall list isotopes, maximum use levels, and maximum possession levels. It shall list the expiration date and any special precautions required, and shall include any additional information desired by the RSC.

4.4. Authorization Availability

An up-to-date copy of the signed RUA must be posted in each workplace listed in the RUA. Copies for this purpose may be obtained from RS.

4.5. Amendment

Amendment of an Authorization requires the steps listed in Section 4.2. Amendment is needed for changes in locations, radioactive materials or radiation machines, maximum quantities, activities, chemical forms, or for Program Director or Lab Contact. Amendment is not needed for addition or deletion of other personnel.

4.6. Suspension

4.6.1. Radiation Safety will suspend the RUA of a Program Director willfully or negligently violating university, state or federal regulations. Radioisotopes or radiation machines will be impounded until formal action is taken by the RSC to terminate, modify and reissue, or reinstate the RUA.

4.6.2. Suspensions and actions pertaining thereto require written notification to the Program Director.

4.7. Termination

4.7.1. A Radiation Use Authorization will be terminated upon:

- 4.7.1.1. expiration without renewal,
- 4.7.1.2. completion of the work authorized,
- 4.7.1.3. departure from OSU of the Program Director, or
- 4.7.1.4. determination by the Radiation Safety Committee that termination is in the best interests of the University.

4.7.2. Termination requires:

- 4.7.2.1. disposal of all radioactive material and radiation machines to waste, to the Property Administration Office or to another Program Director authorized to possess the items,
- 4.7.2.2. survey by RSO personnel of all facilities to ensure removal of radiation signs and labels, to ensure no remaining radioactive contamination, to verify all final inventory and survey records,
- 4.7.2.3. return of all radiation dosimeters and payment of charges for waste disposal,
- 4.7.2.4. transfer of all laboratory survey, inventory, training and occurrence records to Radiation Safety for long-term storage, and

4.7.2.5. notification of the Program Director's Department that the RUA has been terminated.

5. Radiation Dose Limits

5.1. Policy

Work with sources of ionizing radiation will be conducted so that doses received by individuals do not exceed the applicable limit and doses are maintained as low as reasonably achievable (ALARA).

5.2. Definitions

- 5.2.1. Annual limit on intake (ALI) - the derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by the reference man that would result in a committed effective dose equivalent of 0.05 Sv (5 rem) or a committed dose equivalent of 0.5 Sv (50 rem) to any individual organ or tissue.
- 5.2.2. Dose equivalent - the product of the absorbed dose in tissue and the quality factor (a value that reflects the biological impact of a particular type of ionizing radiation). Measured in rem or Sievert (Sv).
- 5.2.3. Occupational dose - the dose received by an individual in a restricted area or while performing assigned duties that involve exposure to sources of radiation.
- 5.2.4. Member of the public - an individual who is not in a restricted area and who is not performing assigned duties that involve exposure to sources of radiation.
- 5.2.5. Committed dose equivalent (CDE) - the dose equivalent to organs or tissues of reference that will be received from an intake of radioactive material by an individual during the 50-year period following intake.
- 5.2.6. Committed effective dose equivalent (CEDE) - the sum of the products of the weighting factors applicable to each of the body organs or tissues that are irradiated and the committed dose equivalent (CDE) to each of these organs or tissues. This is a measure of the overall risk associated with internal deposition of radioactive material.
- 5.2.7. Eye dose equivalent (LDE) - the dose equivalent to the lens of the eye at a tissue depth of 0.3 cm (300 mg/cm²).
- 5.2.8. Shallow dose equivalent (SDE) - the dose equivalent at a tissue depth of .007 cm (7 mg/cm²) averaged over 1 cm²; applies to external whole body or extremity exposure.
- 5.2.9. Deep dose equivalent (DDE) - the dose equivalent at a tissue depth of 1 cm; applies to external exposure.
- 5.2.10. Total Effective Dose Equivalent (TEDE) - the sum of the deep dose equivalent (DDE) for external exposures and the committed effective dose equivalent (CEDE) for internal exposures.
- 5.2.11. Total Organ Dose Equivalent, Maximum Organ (TODE) - the sum of the deep dose equivalent (DDE) and the committed dose equivalent (CDE) to the organ receiving the highest dose.

5.3. Occupational Dose Limits for Adults

- 5.3.1. An annual limit of 5 rem (0.05 Sv) total effective dose equivalent (TEDE).

- 5.3.2. An annual limit of 50 rem (0.50 Sv) to an individual organ or tissue other than the lens of the eye, as determined by the deep-dose equivalent and the committed dose equivalent.
- 5.3.3. An annual limit of 15 rem (0.15 Sv) to the lens of the eye.
- 5.3.4. An annual limit of 50 rem (0.50 Sv) to the skin.
- 5.3.5. An annual limit of 50 rem (0.50 Sv) to each of the extremities.
- 5.3.6. The above limits must be reduced by the amount of occupational dose received while employed by someone other than Oregon State University during the current year.

5.4. Occupational Dose Limits for Minors (under age 18)

The occupational dose limits for minors are 10 percent of the above occupational dose limits for adults.

5.5. Dose to an Embryo or Fetus

- 5.5.1. A limit of 0.5 rem (5 mSv) during the entire pregnancy due to occupational exposure of a declared pregnant woman. The dose equivalent to an embryo/fetus must be taken as the sum of:
 - 5.5.1.1. The deep-dose equivalent to the declared pregnant woman; and
 - 5.5.1.2. The dose equivalent to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.
- 5.5.2. If the dose equivalent to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with subsection (3)(a) of this rule if the additional dose equivalent to the embryo/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy.
- 5.5.3. An effort will be made to avoid substantial variation above a uniform monthly dose rate to a declared pregnant woman. The Radiation Safety Officer will investigate any report of a dose in excess of 0.050 rem (0.5 mSv) to a declared pregnant worker within 7 working days of receiving knowledge of the dose.
- 5.5.4. A woman is not a declared pregnant woman unless she says so in writing without being coerced. Unless a woman declares her pregnancy, she is to be treated as any other radiation worker.

5.6. Dose Limits for Individual Members of the Public

- 5.6.1. An annual limit of 0.1 rem (1 mSv) total effective dose equivalent (TEDE)
- 5.6.2. An hourly limit from external sources of 0.002 rem (0.02 mSv) in unrestricted areas.

5.7. As Low As Reasonably Achievable (ALARA)

In addition to maintaining radiation doses below the limits set forth above, work with sources of ionizing radiation shall be planned and conducted to keep doses as low as reasonably achievable.

6. Regulations Concerning Radioisotopes

6.1. Policy

Radioisotopes must be acquired, used, stored, and disposed of in ways which will ensure compliance with federal, state, and local laws and maintain doses to workers as low as reasonably achievable.

6.2. Definitions

6.2.1. Approval number - number issued by Radiation Safety (RS) used to identify a shipment of radioactive material for receipt, inventory, and waste disposal records.

6.2.2. DOT - U.S. Department of Transportation

6.3. Personnel Training

No person may work with radioisotopes at any OSU-jurisdiction location unless safety training has been given and documentation is on file in the RS office. See section 9 for details.

6.4. Acquisition - Transfer

6.4.1. Acquisition of any radioactive material, regardless of whether by purchase, gift, loan, transfer, or other means must be in accordance with a valid RUA, except for items listed in Section 4.1.2, and must have prior approval from RS via phone or written request to ensure that acquisition will not violate provisions of the RUA.

6.4.1.1. Approval number is assigned by Radiation Safety upon receipt of an isotope.

6.4.1.2. Approval number will be shown on each package inspection survey form, and on any other transfer document.

6.4.1.3. Approval number must be shown on all inventory and disposal documents (waste tags, etc.).

6.4.2. Each package containing radioisotopes, whether incoming or outgoing, must be inspected by RS or as directed by RS, to determine compliance with DOT packaging, labeling, and inspection regulations.

6.4.2.1. "Ship To" address for all incoming packages containing radioisotopes destined for the Corvallis Campus is:

Program Director's name and Department
c/o OSU Radiation Safety
100 Oak Creek Building
Corvallis, OR 97331-7404

6.4.2.2. "Ship To" address for incoming packages destined for non-Corvallis locations shall be determined by RS on a case-by-case basis.

6.4.2.3. Packages will be delivered to RS, or as requested by RS, who will inspect and deliver to the intended user or will arrange to have the package inspected and delivered.

- 6.4.2.4. Should a package inadvertently be delivered direct to the intended user, RS must be notified immediately to arrange the required inspection and to assign an approval number.
 - 6.4.2.5. For outgoing packages, the shipping group must contact RS to arrange for inspection, labeling, preparation of shipping document, etc., and to arrange transportation to RS and from RS to the transporter.
 - 6.4.3. Transfers between on-Campus and off-Campus OSU groups require the procedures in 6.4 above. Transfers between on-Campus groups require RS approval of transfer, packaging and containment. Original approval number will be retained on transferred item(s).
 - 6.4.4. Nuclear gauges containing sealed sources of radioactive material transported for routine use are exempt from some of the package receipt requirements listed in 6.4.2.3 - 6.4.2.5 above. RS will inspect packaging of nuclear gauges upon initial receipt, label the gauge, and prepare the shipping papers and instructions for routine transport.
- 6.5. Posting - Labeling
- 6.5.1. Each entryway to every location where radioisotopes are used or stored must be posted with a "Caution - Radioactive Material" (CRAM) sign or equivalent other sign.
 - 6.5.2. Each hood wherein radioisotopes are used or stored must be posted with a CRAM sign.
 - 6.5.3. Each refrigerator or freezer wherein radioisotopes are used or stored must be posted with a CRAM sign containing the statement "Store No Edibles." No edibles are permitted in posted freezers or refrigerators except when clearly labeled for experimental use only, with human consumption forbidden.
 - 6.5.4. Each room wherein radioisotopes are used or stored must have posted a copy of Oregon "Notice to Employees" form or NRC Form 3, as appropriate, and an up-to-date copy of each applicable RUA.
 - 6.5.5. Any container holding radioactive material must be labeled to show radioisotope, activity, and initial date, or must be kept in a container, which is so labeled. This includes containers holding radioactive wastes, test tubes, vials, etc.
 - 6.5.6. Any contaminated tools, articles or equipment must be labeled with CRAM tape.
 - 6.5.7. Each transport container must be labeled in accordance with DOT regulations.
 - 6.5.8. Any sign or label posted per above regulations must be removed when no longer applicable, and must be replaced when no longer legible or when otherwise no longer suitable for its intended purpose. Deface any labels that do not apply.
- 6.6. Access and Custody
- 6.6.1. Any location where radioisotopes are used or stored shall have entry doors closed, and preferably locked, whenever using personnel are not present.

- 6.6.2. Access for such locations must be controlled sufficiently to prevent theft or loss of radioactive material.
- 6.6.3. Stock vials and sealed sources must be secured with a locking mechanism (in addition to the lock on the room) to prevent theft or loss when not in use. Access to these stock vials and sealed sources must be restricted to authorized radiation workers.
- 6.6.4. Each portable device containing licensed radioactive materials must be secured using a minimum of two independent physical controls that form two separate tangible barriers to prevent unauthorized removal or use, whenever the portable device is not under the direct control and constant surveillance of the licensee. Any known or suspected loss, including theft, of radioactive material must be reported immediately to RS.
- 6.6.5. Eating, drinking, smoking, or applying cosmetics is not permitted in any area where unsealed radioactive materials are stored or used.
- 6.6.6. Change of custody other than within the using group requires approval of RS.
- 6.6.7. Radioactive material shall not be stored or used in any area not authorized for radioactive material.

6.7. Inventory

- 6.7.1. Inventory of all radioactive materials in possession must be maintained reasonably up-to-date by the using group, and must be available for inspection at any reasonable time. Inventory must include approval number for each item, initial receipt date, reasonable log of uses and disposals, date and method of final disposition. Inventory form must contain a running total or permit rapid, easy totaling by radioisotope.
- 6.7.2. Radiation Safety inventory records will be updated and sent to the laboratory for review on a semi-annual basis. Semi-annual inventory verification reports must be returned to Radiation Safety in a timely manner.
- 6.7.3. Inventory records must be preserved for later inspection and review. All such records must be given to RS should the using group disband or terminate radioisotope use.

6.8. Personnel Dosimeters

- 6.8.1. Personnel dosimeters will be prescribed and provided by RS and listed in the RUA.
 - 6.8.1.1. Personnel body dosimeters will be prescribed when annual deep body dose equivalent is likely to exceed 500 mrem or when annual shallow dose equivalent is likely to exceed 5000 mrem. Hand dosimeters will usually be prescribed where hand doses could exceed 50 mrem in any month.
 - 6.8.1.2. Dosimeters usually will not be prescribed where use involves only isotopes which emit only alpha radiation and/or only beta radiation having maximum energy no greater than 0.26 MeV (e.g. ^3H , ^{14}C , ^{35}S , ^{45}Ca , ^{63}Ni).
 - 6.8.1.3. RS will prescribe on a case-by-case basis for all other situations.

- 6.8.2. Personnel dosimeters must be exchanged on schedule.
 - 6.8.2.1. Persons beginning work at OSU for which dosimeters are prescribed will be on a quarterly routine exchange frequency.
 - 6.8.2.2. Persons showing significant potential for body dose of 50 mrem or more per month or hand doses of 200 mrem or more per month will be placed on a monthly exchange frequency. Others will remain on a quarterly exchange frequency.
 - 6.8.2.3. Program Directors are responsible for ensuring that their personnel exchange dosimeters at the required times and that exchanged dosimeters are returned to RS without delay.
 - 6.8.2.4. RS may modify the exchange frequency on a case-by-case basis.

6.9. Internal Dosimetry

- 6.9.1. Routine bioassay is required before and 2-24 hours after handling unsealed ^3H in any chemical form in quantity of 50 mCi or more in any week.
- 6.9.2. Routine bioassay is required before and 6-72 hours after handling unsealed radioactive iodine in any chemical form in quantities of 0.1 mCi or more.
- 6.9.3. For other radioisotopes, routine bioassay is required for personnel likely to receive greater than 10% of the applicable Annual Limit on Intake (ALI).
- 6.9.4. Other routine or special bioassays will be prescribed by RS on a case-by-case basis and listed in the RUA.

6.10. Surveys - Monitoring - Records

- 6.10.1. Routine surveys of facilities and equipment must be made at least once each week wherein radioisotopes are handled.
 - 6.10.1.1. Each survey must include contamination swipes, and must include direct measurements via survey meters when appropriate.
 - 6.10.1.2. Each survey must be documented and kept on file. State-approved units must be used, i.e. dose rates in mrem/hr and contamination rates in microcuries per 100 cm² or disintegrations per minute (dpm) per 100 cm². RS must be notified when surface contamination at or above 500 dpm/100 cm² beta-gamma, or 10 dpm/100 cm² alpha in an accessible area is found; corrective actions taken must be documented. Survey reports must be given to RS whenever the using group disbands or otherwise stops using radioisotopes.
- 6.10.2. In addition, each person handling unsealed radioisotopes or visiting an area where such was handled should survey the work area and self by using an appropriate survey meter immediately upon completion of work using radioisotopes. Notify RS immediately if contamination is found outside of the immediate work area, on skin or personal clothing.
- 6.10.3. RS will perform surveys at least once every year to independently determine radiation levels and contamination levels, verify posting and labeling and ensure adequate radiation safety precautions in the lab. Report of finding will be sent to the using group, who will be responsible for any corrective actions needed.

6.10.4. Special surveys may be required by RS whenever conditions warrant. Surveys must be documented, with reports kept on file, in the same manner as routine surveys.

6.11. Survey Meters

6.11.1. An operable appropriate radiation survey meter must be present whenever handling radioisotopes other than ^3H in aggregate quantities exceeding ten microcuries.

6.11.2. Each radiation survey meter must undergo routine calibration and maintenance at least once each year, and, when repaired, must be recalibrated before being placed back into service.

6.11.3. Calibration and Maintenance

Routine calibration and maintenance shall include visual inspection and exposure to radiation levels or calibrated pulse signals appropriate for each operable scale. Responses must be within manufacturer's specifications. Records of calibration must be kept by or for the using group (Instrument calibration is provided for a fee by the OSU Radiation Center).

6.12. Handling - Storage Requirements

6.12.1. Radioisotopes must be handled in such ways as to keep personnel doses and contamination incidents as low as reasonably achievable considering the nature of the activities to be performed.

6.12.1.1. Minimum protective apparel for handling unsealed radioisotopes is lab coat and impervious gloves (vinyl, rubber, etc.). Additional protective apparel required will be noted in the RUA.

6.12.1.2. Working with unsealed radioisotopes is not permitted by persons having an open wound.

6.12.1.3. Remote handling devices (tongs, forceps, pliers, etc.) must be used whenever contact dose rates exceed 100 mrem/hr, and should be used with lower dose rates. Additional remote handling needs will be listed in the RUA.

6.12.1.4. Care must be used in handling and storing used beakers, test tubes, pipette tips, and other contaminated items to prevent bumping, dropping, or otherwise inadvertently spreading contamination.

6.12.1.5. Containers holding non-trivial quantities of radioiodines or other volatiles must be opened in an operating fume hood. Waste and other materials containing such radiochemicals must be double bagged in plastic and sealed before disposal or storage.

6.12.1.6. Radioactive materials transported through hallways must be securely contained. Radioactive liquids require secondary containment via tray, bucket, bag, etc., sufficient to hold the liquid in case of breakage.

6.12.1.7. In case of spill or accident involving radioactive materials, contact Radiation Safety.

- 6.12.2. Radioisotope storage must provide adequate safety.
 - 6.12.2.1. Liquids, including wastes, must be stored in secondary containers able to prevent contamination spread should the primary container break.
 - 6.12.2.2. Radioisotope storage locations must provide adequate protection against bumping, falling, overheating, and other mechanical hazards.
 - 6.12.2.3. Shielding should be used when necessary and appropriate.
- 6.12.3. Sealed radiation sources must be leak-tested and inventoried per State requirements.
 - 6.12.3.1. Each sealed source that is designed to emit alpha particles and contains 10 microcuries or greater must be leak-tested at intervals not to exceed three months.
 - 6.12.3.2. Each sealed source that is not designed to emit alpha particles and contains 100 microcuries or greater must be tested for leakage or contamination at intervals not to exceed six months.
 - 6.12.3.3. Copy of each leak test report must be kept on file at RS. Results must be in units of Becquerels (Bq) or microcuries.
 - 6.12.3.4. Positive results must be reported to RS immediately, and corrective actions taken as directed by RS.
 - 6.12.3.5. Sources placed in storage by RS are exempt from the leak test requirement. Sources in storage must be leak tested prior to use.

6.13. Waste Disposal

- 6.13.1. Radioactive waste may not be stored for decay in individual laboratories.
- 6.13.2. Drain disposal of radioactive waste is prohibited, except when authorized per 6.13.4.4.
- 6.13.3. Waste must be packaged per instructions from RS.
 - 6.13.3.1. Dry wastes must be placed in containers supplied by RS and marked "Dry Radioactive Waste Only."
 - 6.13.3.2. Liquid radioactive wastes must be placed in containers approved by RS. Liquid radioactive waste containers must be kept in secondary containers able to contain the liquid in case of breakage.
 - 6.13.3.3. Liquid scintillation vials containing counting fluid must be placed in containers supplied by RS and marked "Scintillation Vials Only." Note that liquid scintillation counting fluid may be disposed of alternatively by treating as liquid waste, i.e., emptying into containers approved by RS. Liquid scintillation counting fluid must be segregated from aqueous liquid.
 - 6.13.3.4. Biological wastes, i.e. animal carcasses or parts, blood, urine, feces, bedding, etc., shall be bagged, properly labeled to show radioisotopes, amounts, dates, and Program Director, and stored in a freezer until RS pickup.

- 6.13.3.5. Each container must have a proper waste tag attached that is kept up-to-date. Each container must also be marked as containing radioisotopes.
- 6.13.3.6. Waste must be segregated by half-life to the extent reasonable to permit efficient disposal by decay. Generally, this will involve two categories: radioisotopes with half-lives less than 90 days; and radioisotopes with half-lives greater than 90 days.
- 6.13.3.7. RS should be notified prior to generating any radioactive waste that contains other hazardous constituents or demonstrates hazardous characteristics (mixed waste). Mixed waste must be segregated from other radioactive waste.
- 6.13.4. Waste will be disposed of by RS
 - 6.13.4.1. RS will pick up and dispose of properly packaged radioactive waste upon request from the using group.
 - 6.13.4.2. RS will arrange disposal by sanitary sewer, compaction, incineration, land burial, or other means as appropriate.
 - 6.13.4.3. Cost of disposal will be borne by the generating group for mixed waste, sealed sources, improperly segregated or packaged waste and other non-routine wastes.
 - 6.13.4.4. Disposal via the sanitary sewer may be performed only by RS or upon specific approval of the RSC. Using groups must not pour radioactive waste down sinks, etc. For this purpose, liquid radioactive waste consists of the waste liquid plus the first rinse of the container, but not subsequent rinses or washes. Exceptions to either part of this rule will be listed on the RUA.
 - 6.13.4.5. RS will notify affected individuals of any waste for which legal, safe disposal means is not available, and may refuse to pick up such materials thereafter.

6.14. Animal Uses

- 6.14.1. Authorization to use radioactive materials in or on animals requires approval of the Institutional Animal Care and Use Committee in addition to authorization by RSC.
- 6.14.2. Quarters, caging, labeling requires approval as in 6.13.3.
- 6.14.3. Used cages, containers, food trays, etc. must be surveyed and found free of contamination before labeling is removed and before cages are released to Lab Animal Resources personnel.
- 6.14.4. Specific instructions to caretakers must be provided prior to feeding, handling, cleaning, etc. Instructions should be in writing, with a copy posted at the animal storage area.

6.15. Class Uses

- 6.15.1. Class uses require authorization in the same manner as does any other use.

6.15.2. Radiation safety training and documentation thereof for students must be ensured by the Program Director listed and must be approved by RSC as part of the RUA provisions.

6.15.3. Handling of radioisotopes by students must be closely supervised.

6.16. Human Uses

6.16.1. OSU's license and State regulations do not permit application of radioisotopes or radiation to humans unless by healing arts personnel for medical diagnosis or treatment.

6.16.2. License amendment to permit human use requires request to the RSC and request by RSC to State Radiation Protection Services, and will be handled on a case-by-case basis.

7. Regulations Concerning Radiation Machines

7.1. Policy

Radiation-emitting machines must comply with specific registration and safety requirements in Chapter 333, Oregon Administrative Rules (OAR), and be acquired, used, stored, transferred and disposed in accordance with accepted safety procedures.

7.2. Definitions

- 7.2.1. Analytical x-ray machine: Any radiation machine that produces x-rays for the purpose of analyzing substances via x-ray diffraction or fluorescence.
- 7.2.2. Cabinet radiography: Industrial radiography conducted in an enclosure or cabinet so shielded that every location on the exterior meets the dose limits for individual members of the public as specified in OAR 333-120-0180.
- 7.2.3. Cabinet x-ray system: Any radiation machine constructed so that the useful beam is entirely within a shielded enclosure from which humans are excluded during use and into which items are placed for radiography or irradiation, but excluding healing arts machines and analytical x-ray machines. The enclosure must be interlocked so that x-rays will not be produced unless all openings are securely closed.
- 7.2.4. Certifiable cabinet x-ray system - an existing uncertified x-ray system that has been modified to meet the certification requirements specified in 21 CFR 1020.40.
- 7.2.5. Certified cabinet x-ray system: An x-ray system that has been certified in accordance with 21 CFR 1010.2 as being manufactured and assembled pursuant to the provisions of 21 CFR 1020.40.
- 7.2.6. Failsafe: Design feature that results in termination of radiation emission in event of failure of the safety or warning device. Failsafe device requires a manual reset after device failure before emission of radiation can continue.
- 7.2.7. Healing Arts Radiation Machine: Any radiation machine used to apply radiation to humans or animals for diagnosis or treatment of disease or malady by a licensed or registered practitioner of a Healing Art (medicine, dentistry, veterinary medicine, etc.).
- 7.2.8. Other Radiation Machines - all other radiation machines that are not exempt from State of Oregon registration regulations. Generally, this includes:
 - 7.2.8.1. all particle accelerators, and
 - 7.2.8.2. those electron microscopes, electron beam welders or producing ionizing radiation only incidental to their furnaces, high voltage power supplies, and other devices operation and which emit radiation intensities exceeding 0.5 mrem/hr at 5 cm from any accessible surface, averaged over 10 cm² area.
- 7.2.9. Radiation Machine: Any device capable of producing ionizing radiation when the associated control devices are operated, but excluding devices which produce ionizing radiation only by the use of radioactive material.

7.3. Acquisition, Transfer, Disposal

- 7.3.1. Acquisition of a radiation machine, regardless of by purchase, gift, loan or other means, requires prior authorization by the Radiation Safety Committee that is specific for the machine to be acquired.
- 7.3.2. Acquisition documents (purchase requisition, etc.) should be approved by Radiation Safety (RS) to signify the acquisition complies with University regulations.
- 7.3.3. Transfer of possession to another Program Director within OSU requires following the procedure given in Section 4.
- 7.3.4. Transfer to a non-OSU entity or OSU surplus requires prior approval of RS signifying that the machine meets applicable regulatory requirements for legal transfer and insuring that the transaction will be properly reported per State regulations.
- 7.3.5. Disposal via disassembly or destruction requires prior approval of RS to ensure compliance with applicable regulations.
- 7.3.6. Deactivation and storage of a radiation machine requires that the machine be properly labeled and secured by RS to prevent operation without permission of that Office.

7.4. Use of Radiation Machines

7.4.1. General Regulations Applying to All Radiation Machines

- 7.4.1.1. Each radiation machine shall be registered with the Oregon Health Authority prior to being put into use. Registration will be arranged by RS.
- 7.4.1.2. Each radiation machine shall be inspected by RS after acquisition, relocation, modification, or repair. The machine shall not be put into use until found to comply with all applicable State and University regulations. The Program Director is responsible for notifying RS of completion of any of the above activities and arranging for the survey.
- 7.4.1.3. Each approved operator and each person working with or near a radiation machine shall be given radiation safety training commensurate with the degree of hazard involved. Training shall be given by or for RS; documentation shall be maintained by RS. Refresher training shall be as specified by the Radiation Safety Committee
- 7.4.1.4. Each radiation machine shall be adequately secured against unauthorized use or relocation. Normally, this requires keeping room doors locked whenever the machine is unattended plus providing a key-locking device for the main power supply, with adequate key control.
- 7.4.1.5. For each radiation machine, a machine log shall be maintained which contains:
 - 7.4.1.5.1. record of all maintenance activities,

- 7.4.1.5.2. record of all radiation surveys and other safety-related tests,
 - 7.4.1.5.3. record for each time radiation is produced showing:
 - a. when the machine was operated and for how long,
 - b. the operator and any other persons possibly exposed,
 - c. machine configuration and operating parameters,
 - d. any failures or improper functioning of the machine plus determination of cause and any corrective or preventive actions taken.
 - 7.4.1.6. Each machine shall have posted nearby:
 - 7.4.1.6.1. Written instructions for normal operation, and for beam alignment if applicable, emergency instructions,
 - 7.4.1.6.2. copy of the Radiation Use Authorization,
 - 7.4.1.6.3. copy of Oregon "Notice to Employees" form or its successor,
 - 7.4.1.6.4. State annual registration certificate.
 - 7.4.1.7. Modification or relocation of a machine or associated other devices not specifically permitted by the RUA requires an amendment to the RUA.
 - 7.4.1.8. Machine operation shall never be deliberately terminated by activating a safety interlock except for test purposes.
 - 7.4.1.9. Radiation machines shall never be operated unless all specified shielding and other safety devices are in place and functioning properly, except when operated by a qualified repair person.
 - 7.4.1.10. Each radiation machine control panel shall be clearly labeled to caution individuals that the machine produces ionizing radiation when operated.
 - 7.4.1.11. Each radiation machine shall have a light clearly visible by the operator at the control switch that indicates whether radiation is or is not being produced. The indicator shall be fail-safe.
 - 7.4.1.12. RS personnel shall inspect each radiation machine after repair, after relocation, whenever abnormal readings of dosimeters indicate possible increase in radiation levels, and at sufficient other times to ensure that each machine is inspected at least once every two years.
- 7.4.2. Additional Regulations Pertaining to Cabinet Machines
- Regulations listed in 7.4.1 apply to cabinet machines. Additional precautions needed for an individual machine will be listed in the RUA.

- 7.4.3. Additional Regulations Pertaining to Healing Arts Machines
 - 7.4.3.1. Regulations listed in sections 7.1, 7.2, 7.3 apply to Healing Arts machines. Additional precautions not given below will be listed on the RUA.
 - 7.4.3.2. Applicable provisions of 333-106 ORCR, "X-Rays in the Healing Arts" or its successor, shall be strictly adhered to. A copy of the applicable regulations shall be available at or near each machine.
- 7.4.4. Additional Regulations Pertaining to Analytical X-Ray Machines
 - 7.4.4.1. Regulations listed in 7.4.1 apply to Analytical X-Ray Machines. Additional precautions not given below will be listed on the RUA.
 - 7.4.4.2. Applicable provisions of 333-108, ORCR, "Radiation Safety Requirements for Analytical X-Ray Equipment" shall be strictly adhered to. A copy of the applicable regulations shall be available at or near each machine.
 - 7.4.4.3. Unless specified otherwise in the RUA, each analytical machine shall be surveyed by its operator or RS
 - 7.4.4.3.1. each time a camera, beam stop, or other similar device is removed or relocated from its position, whether replaced or not,
 - 7.4.4.3.2. before beginning alignment, at appropriate times during alignment, and immediately upon completion of alignment, and
 - 7.4.4.3.3. at any other times that abnormal radiation conditions are suspected or known. Each such survey shall be properly documented, and a report retained and kept available near the machine.
 - 7.4.4.4. Dosimeter requirements will be specified in the RUA.
 - 7.4.4.5. Each usable port shall be fitted with a safety shutter of fail-safe design. This shutter shall include a "shutter open" light or other prominent status indicator near the port.
 - 7.4.4.6. Each unused port shall be secured by some means requiring tools to open.
 - 7.4.4.7. Inadvertent access to any primary beam during operation shall be prevented by an approved enclosure interlocked to keep the shutter closed or to prevent x-ray production whenever the enclosure is not closed during x-ray production. Manual reset of the shutter or power supply after interlock trip is mandatory. Enclosure shall include sufficient shielding to reduce the radiation level at any accessible point outside the enclosure to no more than 2 mrem/hr. The circuitry must provide for operation with enclosure open by approved operators during sample alignment and by approved repair persons during repair and maintenance.

- 7.4.4.8. Each machine shall be located and oriented to minimize radiation exposure potential to persons in the area.
- 7.4.4.9. Operation of the machine with any of the safety interlocks bypassed requires the prior written approval of the RSO.
- 7.4.5. Additional Regulations for Other Radiation Machines
 - 7.4.5.1. All machines not fitting into the three categories listed in Sections 7.4.2, 7.4.3 and 7.4.4 shall have any additional specific precautions listed in the RUA. The precautions shall be comparable to those listed above but modified to fit the particular situations.

8. Regulations Concerning Radiation Incidents and Occurrences

8.1. Policy

Radiation incidents, occurrences, and other abnormal situations involving radioisotopes or radiation machines shall be handled so as to minimize actual, potential, and perceived harm to persons, equipment, facilities, activities, and the environs; to provide proper notification of authorities; and to provide proper information to interested parties. In life-threatening situations the first priority is preservation of human life; however, this does not excuse the requirement to minimize radiation doses and contamination spread to the extent reasonable under the circumstances.

8.2. Classification

8.2.1. A radiation incident is any situation requiring notification of state or federal regulatory agencies under Oregon Administrative Rules (OAR) 333-120-700, 333-120-710, 333-120-720, or 10 CFR 20.2201, 20.2202, or 20.2203.

8.2.1.1. There are three levels of incident: Immediate Notification, Twenty-Four Hour Notification, and Thirty-Day Notification. Descriptions are listed in the regulations cited.

8.2.2. An unusual occurrence is any abnormal situation considered to require documentation but not requiring handling as an incident.

8.2.2.1. Classification of an event as a radiation occurrence is at the discretion of the University Radiation Safety Officer (RSO). Classification shall be made as soon as possible, and may be changed later if additional information shows that the change is warranted.

8.2.2.2. In general, radiation occurrences include minor personnel contamination (external or internal), minor surface contamination which deserves publicity, personal injuries or fires or similar events in radiation restricted areas where there was potential but no actual personnel contamination or significant personnel doses.

8.3. Management

8.3.1. Actions by Individuals

8.3.1.1. In event of surface contamination involving no immediate health hazard, the first individual recognizing the situation shall:

8.3.1.1.1. alert persons nearby so that they do not accidentally contact the contamination; keep unneeded persons out of affected area,

8.3.1.1.2. take whatever steps to contain the contamination that can be taken safely and immediately,

8.3.1.1.3. notify Radiation Safety (RS) immediately. Phone numbers are listed on each Radiation Use Authorization (RUA),

8.3.1.1.4. not attempt to decontaminate except as directed by RS,

8.3.1.1.5. request that others possibly involved remain until released by RS,

- 8.3.1.1.6. not permit work to resume until approved by RS.
- 8.3.1.2. In event of surface contamination involving immediate health hazard, the first individual recognizing the situation shall:
 - 8.3.1.2.1. alert all nearby persons; keep unneeded persons out of affected area,
 - 8.3.1.2.2. take whatever steps to contain the contamination that can be accomplished safely and immediately, e.g. close windows, turn off hood, turn off ventilation system, put absorbent material onto liquids,
 - 8.3.1.2.3. evacuate the affected area, leaving behind clothing and other articles possibly contaminated,
 - 8.3.1.2.4. keep all possibly affected persons near but outside the contaminated area until released by RS,
 - 8.3.1.2.5. notify RS immediately. Phone numbers are listed on each RUA,
 - 8.3.1.2.6. not attempt decontamination except as directed by RS,
 - 8.3.1.2.7. not resume work in the area until approved by RS.
- 8.3.1.3. In event of internal or external contamination of an individual, the first person recognizing the situation shall:
 - 8.3.1.3.1. take measures necessary to preserve life, but carry out only minimal first aid until help is obtained; keep unneeded personnel out of the affected area,
 - 8.3.1.3.2. if possible, remove the individual from the contaminated location,
 - 8.3.1.3.3. notify RS immediately. Phone numbers are listed on each RUA,
 - 8.3.1.3.4. request that all others possibly involved remain nearby until released by RS,
 - 8.3.1.3.5. decontaminate the individual using mild soap and tepid water. Make note of initial and subsequent contamination levels. Save wash water for later analysis,
 - 8.3.1.3.6. not resume work in the area until approved by RS.
- 8.3.1.4. In event of lost or stolen radioactive material or of suspected or known excessive radiation exposure to an individual, the first person recognizing the situation shall notify RS immediately. Phone numbers are on each RUA.
- 8.3.1.5. In event of personal injury, fire, flood, or other similar situation in any radiation restricted area, the first person recognizing the situation shall notify RS immediately. Phone numbers are on each RUA.

8.3.2. Actions by Radiation Safety

8.3.2.1. Upon being notified of a suspected or known radiation occurrence, radiation incident, or similar situation, the Radiation Safety Officer or Assistant Radiation Safety Officer shall take charge of radiological aspects of the situation until relieved by superiors, and shall:

8.3.2.1.1. ensure that any needed medical assistance is obtained without delay. Use State Police, Public Safety and Corvallis Fire Department for situations at Corvallis; ask them for assistance with situations outside Corvallis,

8.3.2.1.2. ensure that State Police, Public Safety, Corvallis Fire Department and other emergency organizations are notified as needed,

8.3.2.1.3. ensure immediate notification of the University Radiation Safety Officer or, if not available, the designee,

8.3.2.1.4. perform any needed release surveys of persons and equipment from the affected area,

8.3.2.1.5. provide decontamination advice and supervise all needed decontamination of persons, personal effects, facilities, equipment, etc.,

8.3.2.1.6. investigate thoroughly, document findings and recommendations.

8.3.2.2. Upon being notified, the University Radiation Safety Officer or the designee shall:

8.3.2.2.1. ensure that the steps in 8.3.2.1 are being or have been taken,

8.3.2.2.2. notify state and/or federal agencies as required by regulations cited in 8.2.1 above,

8.3.2.2.3. notify affected Program Directors,

8.3.2.2.4. notify News and Research Communications, the RSC chair, and the Assistant Director for Environmental Health and Safety if the situation may be of significant interest to OSU or non-OSU entities,

8.3.2.2.5. review documentation, arrange proper, timely distribution,

8.3.2.2.6. ensure that corrective and preventive actions are completed wherever appropriate to prevent such situations in the future.

8.3.3. Actions by Program Director

The Program Director shall provide or arrange personnel and equipment needed for decontamination of facilities and equipment under supervision of RS, and

shall ensure repair, replacement, or modification of equipment and facilities, procedural changes, and personnel training as needed to prevent recurrence of the situation are completed as requested by RS or RSC.

8.3.4. Actions by Others

Actions required of other entities will vary widely, depending upon the nature of the individual situation. Required actions will be determined by RS, RSC, or management on a case-by-case basis.

9. Regulations Pertaining to Personnel Training

9.1. Policy

No individual may work with radioisotopes or radiation machines, or frequent places where such are used or stored, until receiving acceptable radiation safety training and having documentation for that training on file. Training must be at least commensurate with the degree of potential hazards to be encountered. In addition, refresher training must be received at intervals specified by the RSC.

9.2. Responsibilities for Personnel Training

9.2.1. Radiation Safety (RS)

- 9.2.1.1. RS is responsible for presenting mandatory basic radiation safety orientation at reasonable frequency, and documenting satisfactory attendance.
- 9.2.1.2. RS is responsible for presenting mandatory refresher training at reasonable frequency and documenting satisfactory attendance.
- 9.2.1.3. RS may present other training whenever warranted and time permits.

9.2.2. Program Director

- 9.2.2.1. The Program Director is responsible for ensuring that each individual working in the program receives mandatory radiation safety orientation before beginning radiation work, that each individual receives mandatory refresher training at appropriate intervals, and that documentation is on file.
- 9.2.2.2. The Program Director is also responsible for ensuring that each individual in the program receives adequate additional specific training needed to safely perform the specific tasks assigned.
- 9.2.2.3. The Program Director is responsible for ensuring that non-radiation workers who frequent areas with radioisotopes or radiation machines receive adequate safety training and that documentation of the training is kept on file.
- 9.2.2.4. The Program Director (via the semi-annual personnel verification report) is responsible for informing RS of individual radiation workers who have left the lab, or radiation workers who should be added to RS records.

9.2.3. Individual Radiation Worker

- 9.2.3.1. Each individual worker is responsible for working within the limits of radiation training received.
- 9.2.3.2. Each individual is responsible for seeking additional information and training whenever appropriate.

9.2.4. Instructors of Formal Courses

- 9.2.4.1. The instructor in charge of a course involving student use of radioactive materials or radiation machines must provide adequate safety instructions, document attendance and instructional content, and forward a copy of documentation to the RS office.

9.3. Training for Use of Nuclear Soil Moisture/Density Gauges

In addition to the above, persons using nuclear gauges for measurement of soil moisture or soil density must have completed a State-approved training course and have certification on file at the RS office. Courses are presented periodically by commercial firms. Contact RS for current information about availability.

9.4. Additional Training

Additional training requirements will be specified in the RUA.

10. Bylaws of the Radiation Safety Committee

ARTICLE I - Object

The Radiation Safety Committee has the authority and responsibility delegated from the President for developing and maintaining a radiation safety program for the University to ensure the safe handling of ionizing radiation in the University's instructional, research, and operational programs. It is the first duty of the Committee to ensure the safe use of any source of ionizing radiation employed within the jurisdiction of the President of Oregon State University. It is the second duty of the Committee to facilitate the use of ionizing radiation and to provide advice and counsel as requested. Among its duties, it shall recommend University policy with respect to radiation safety; establish standards and regulations for radiation safety at all University-controlled facilities; review and record safety evaluations of all activities involving ionizing radiation at University-controlled facilities and authorize those found to be acceptable; review annually the operations and procedures of Radiation Safety; and act as the statutory radiation safety committee required by the University's state and federal licenses pertaining to radioactive materials and radiation generators.

The Radiation Safety Committee serves as the advisory group on OSU policies relating to laser safety."

ARTICLE II - Members

Section 1. The membership of this Committee shall consist of not fewer than five but not more than ten members, and shall include the University's Radiation Safety Officer and a representative of management.

Section 2. All members are appointed by the Vice President for Finance and Administration.

Section 3. Members-at-large are appointed for terms of three academic years. Depending on the size of the Committee, up to one third of the total membership shall be appointed each year, thus establishing a system of rotation in office. If a vacancy occurs in the Committee, the person appointed shall serve the unexpired term of the predecessor.

Section 4. Members shall be appointed on the basis of knowledge of the principles and practices of the control of hazards from the use of radiation, and on experience in the use of radioisotopes and/or radiation producing machines. Committee membership shall reflect the diversity of the scientific disciplines using ionizing radiation on campus.

Section 5. At a regular meeting held no later than June 30, the Committee members shall nominate candidates to fill vacancies among its membership created by the expiration of Committee tenure. The Chair and the Secretary shall report to the Vice President for Finance and Administration no later than August 30.

ARTICLE III - Officers

Section 1. The Officers of the Committee shall be the Chair, Vice Chair, and Secretary. These officers shall perform the duties prescribed by these bylaws and by the parliamentary authority adopted by the Committee.

Section 2. The Chair shall be appointed by the Vice President for Finance and Administration to serve for one year or until a successor is chosen. The term of office shall be effective at the

beginning of the academic year in September, or, in the case of a vacancy in the position, when appointed to the position. No Chair shall be eligible to serve for more than two consecutive terms.

Section 3. The Secretary shall be the Radiation Safety Officer.

Section 4. The Vice Chair shall be appointed by the Vice President for Finance and Administration. The Vice Chair will assume all responsibilities of the Chair in his or her absence.

ARTICLE IV - The Executive Board

Section 1. The Chair and the Secretary shall constitute the Executive Board. If the Chair is absent, the Vice Chair shall assume the Chair's position on the Executive Board.

Section 2. The Executive Board shall have general supervision of the affairs of the Committee between its business meetings, fix the hour and place of meetings, make recommendations to the Committee, and shall perform such other duties as specified in these bylaws. The Board shall be subject to the orders of the Committee, and none of its acts shall conflict with action taken by the Committee.

ARTICLE V - Meetings

Section 1. There should be at least one regular meeting in each calendar quarter.

Section 2. Special meetings may be called by the Chair or Secretary and shall be called upon the written request of three members of the Committee. Except in cases of emergency, at least three days notice shall be given.

Section 3. In an emergency, meetings via the telephone or electronic communication are permitted. If action on such a basis is necessary, it must be ratified at the next regular or special meeting.

Section 4. A simple majority of the total membership shall constitute a quorum.

Section 5. If a quorum is not present at a regular committee meeting, voting may take place following the meeting via telephone or electronic communication. Non-attending members will be provided supporting documentation prior to voting.

ARTICLE VI - Subcommittees

Subcommittees, either standing or special, shall be appointed by the Chair as the Committee shall from time to time deem necessary to carry on the work of the Committee. The Chair shall be ex-officio a member of all subcommittees and task forces.

ARTICLE VII - Specific Administrative Procedures

The Committee shall establish written procedures for:

Section 1. Possession and use of all sources of ionizing radiation at University-controlled facilities.

Section 2. Submission and processing of requests to authorize such possessions and uses. After considering the evaluation and advice of the Radiation Safety Officer, the Committee shall review and grant permission for, or disapprove of, the use of radioactive materials or machine sources of ionizing radiation within the University; approve or disapprove all

specific users of radioactive materials and machine sources of ionizing radiation with the University; prescribe any special conditions that will be required during a proposed use of ionizing radiation, such as minimum level of training and experience of user, special facilities, and unusual monitoring requirements and attend to other matters as required and recommend or require remedial action to correct safety infractions. Reviews and approvals may be made by the Executive Board in accordance with Article IV, Section 2.

Section 3. Annual reviews of Radiation Safety operations and procedures. The Committee shall, with the assistance of the Radiation Safety Officer, formulate and review the University training programs for the safe use of radionuclides and machine sources of ionizing radiation. The Committee shall inform the Public Health Division of any changes in Committee practices. The Committee shall ensure the maintenance of written records of receipts, transfers, and disposal of all radioactive materials in the University and the maintenance of an inventory of the total quantity of each radionuclide possessed by the University.

Section 4. Semi-annual reports. The Committee shall require and review semi-annual reports for the period from 1 July through 31 December and 1 January through 30 June by the Radiation Safety Officer, specifically including the following: a) a report on compliance with respect to the health and safety of workers and the public in the use of ionizing radiation, b) a summary report on personnel exposure to ionizing radiation, c) a summary report on radioactive waste disposal, d) a summary report on radiation safety surveys, and e) other items of significance to the radiation safety program.

Section 5. Periodic reviews of all radiation safety standards and procedures, and institution of changes whenever appropriate. The Committee shall require the preparation, distribution, and periodic maintenance of guides and the Oregon State University Radiation Safety Manual. The Committee shall require the Radiation Safety Officer to report conditions not in compliance with license requirements. The report will include a description of how the deficiencies are to be corrected. The Committee shall signify approval in writing.

Section 6. The Committee shall establish additional internal procedures as it deems desirable.

ARTICLE VIII - Parliamentary Authority

The rules contained in the current edition of Robert's Rules of Order Newly Revised shall govern the Committee in all cases to which they are applicable and in which they are not inconsistent with these bylaws and applicable to this organization.

ARTICLE IX - Amendment of Bylaws

These bylaws may be amended at any meeting of the Committee by a two-thirds vote, provided that the amendment has been submitted in writing to the entire membership at least two weeks prior to the vote.