

Weber State University

Radiation Safety Manual



WEBER STATE UNIVERSITY
Environmental Health & Safety

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1. Introduction

Safety precautions and approved procedures are required of authorized individuals because of the uniqueness of radioactivity. Since radiation cannot be detected directly with the human senses, everyone who is involved in the use of radioactivity must make a conscientious effort to avoid exposure to and contamination from the radiation. This conscientious effort should allow resultant doses from radioactivity to be as low as reasonably achievable (ALARA).

1.1 The Purpose of the Radiation Safety Committee

The stated purpose of the Radiation Safety Committee (RSC) is to promote the safe and prudent use of sources of radioactivity. The services of the RSC are readily available to all users, faculty, staff, and students.

This committee is responsible for implementing and enforcing the university regulations through the Radiation Safety Officer (RSO).

Additionally, the RSC is responsible for oversight of any official use of controlled substances on the WSU campus.

1.2 Radiation Safety Officer

The RSO derives authority, indirectly, from the State of Utah Waste Management and Radiation Control Board through the president of Weber State University (WSU), who is a signatory to the Broad Scope License granted to WSU. The RSO is the Radiation Safety Committee's representative in matters that pertain to radiation protection and safety.

1.3 Radiation Safety Manual

The RSC issues this manual to provide information and radiation safety requirements. The procedures, policies, and rules within this manual shall not be amended or changed without the approval of the WSU Radiation Safety Committee, who are appointed by the President of Weber State University. The contents of this manual are considered part of the license granted to WSU by the State of Utah Waste Management and Radiation Control Board. The contents of this manual and any subsequent revisions to it include all current considerations by federal and state laws which are pertinent to the use of radioactivity at universities

2. Organization

By law, the president of the university has responsibility for the enforcement and interpretation of policies pertaining to the acquisition, possession, use, and disposal of radioactive materials and radiation-producing equipment. Federal and state regulations require the president to appoint a radiation safety committee and a radiation safety officer. The president has delegated appropriate authority and responsibility to the Radiation Safety Committee and the Radiation Safety Officer.

2.1 Radiation Safety Committee

The committee members are appointed by the university president. The committee includes the radiation safety officer, a representative from the Department of Public Safety, a Department of Public Safety Environmental Health and Safety Officer (or representative), the University Fire Marshal, one faculty representative from each department using radioactive materials, at least one representative from a department not using radioactive materials, and an administrative representative. A member other than the RSO should serve as committee chair. The chair shall be instrumental in promulgating the policies established by the committee.

A quorum consists of a majority of the committee and must include the Radiation Safety Officer. The Radiation Safety Committee shall meet no less than twice annually. Any member of the committee may petition to have the committee meet at times other than the regularly scheduled meetings.

The duties of the RSC are as follows:

- 1) Document and maintain the records of all committee actions.
- 2) Prescribe and recommend any special requirements or conditions that may be necessary for the safe handling of radioactive materials. Include required training, shielding, dose limits, area designations, disposal methods and/or techniques and protocols to be adhered to. If necessary, recommend "dry runs" to determine the method(s) of reducing exposures ALARA.
- 3) Has access to current reports from the RSO including:
 - a. a Laboratory and facility surveys
 - b. Radiation incident reports of spills and accidents
 - c. Possession limit control (procurement and disposal)
- 4) Recommend remedial actions to assure safe compliance when circumstances dictate this is needed.
- 5) Provide "state of the art" information to the departments involved with the use of radioactive materials or radiation-producing machines.
- 6) Conduct a periodic walk-through inspection of radiation laboratories and facilities.
- 7) Conduct a formal review of the WSU radiation safety program annually. This could be combined with a walk-through inspection.

2.2 Radiation Safety Officer

The RSO is responsible for the day to day implementation of policies, procedures, and actions required by the Radiation Safety Committee and as defined by the President of WSU and the Vice President for Administrative Services. The responsibilities of the RSO are as follows:

- 1) Prepare all applications to the State Division of Radiation Control for licenses, renewals and/or amendments.
- 2) Review and approve or disapprove all applications for the purchase, possession, and use of ionizing radiation or radiation producing equipment along with EHS.
- 3) Review all new project authorization requests and make recommendations to the committee.
- 4) Conduct routine surveys of labs and other areas as needed.
- 5) Conduct special surveys when appropriate.
- 6) Provide training and instruction on radiological health and safety for faculty, staff and students as needed.
- 7) Assist users with radiation safety.
- 8) Administer the personnel monitoring TLD (Thermoluminescent Dosimeter) service, including distribution, exchange and record documentation.
- 9) Maintain all pertinent radiological records to include but not limited to:
 - a. Authorized user applications and renewals
 - b. Regulations pertaining to the use and disposal of radioactive materials
 - c. Leak testing
 - d. Personnel exposure records
 - e. Inventories of radioactive materials and radiation producing equipment
 - f. Shipment, receipts, or transfers of radioactive materials
 - g. Radiation incidents
 - h. Environmental dosimetry surveillance
 - i. Confidential medical and bioassay information
 - j. Inspections and surveys

2.3 Authorized Users

The authorized user is responsible for compliance with all pertinent regulations in and pertaining to this manual. Cooperation with the RSO and the Radiation Safety Committee on general and radiological safety for approved projects is expected. The authorized user must:

- 1) Ensure compliance with all safety rules by personnel under her/his supervision:
- 2) Report any suspected incident where over-exposure to radiation or contamination may have occurred.
- 3) Post copies of procedures and protocols in a conspicuous place for guidance of personnel.
- 4) Assure that all personnel under your supervision are properly trained in radiation protection methods and procedures.
- 5) Assure proper storage and labeling of all radioactive materials under the authorization.
- 6) Order radioactive materials or radiation producing equipment through the Purchasing Department. (See Section 3.3, Procurement and Transfer, for details of the purchasing process.)
- 7) Cause surveys and/or swipe counting to be performed as soon as possible after the use of any one of the licensed liquid radioisotopes. This would be no less than daily during use.
- 8) Confirm that all licensed sealed sources in your possession are leak-tested at least once every six months [10 CFR 39.35 (c)].
- 9) Verify that necessary and appropriate survey instruments are functional and properly calibrated.
- 10) Assure proper decontamination of all spills occurring within the project.

- 11) Follow proper and legal disposal of all radioactive waste and maintain proper and accurate disposal records.
- 12) Wear proper and current dosimetry while conducting the project and cause support personnel under your supervision to wear it also.
- 13) Use time, distance, shielding, personal hygiene, knowledge and planning to maintain exposure to radiation as low as is reasonably achievable.
- 14) Maintain all radioactive material and/or radiation producing machines so that they are under direct control and/or observation so that no unauthorized person has access to the radiation.
- 15) Plan or direct the planning of emergency procedures appropriate to ensure safety under the worst possible scenario that might occur in your laboratory.
- 16) Communicate to the RSO changes in procedure, technique, personnel, increase in hazard potential, or termination of the project.
- 17) Limit the use and transfer of radioisotopes only to persons who are authorized to possess the isotopes.
- 18) Maintain current records of receipt, use, storage, decay, and disposal.
- 19) Prepare an inventory of radioisotopes on an annual basis or as required.
- 20) Assure that all required signs, labels, and postings are maintained, including the required DWMRC-4 "Notice to Employees" as per R313-18-11(3).
- 21) Use radioisotopes in such a manner that products of volatilization, dust dispersion, or spattering are minimized.

3. USE OF RADIOACTIVITY

Weber State University is authorized to purchase, possess, and use radioactive materials under a license issued by the Utah Division of Waste Management and Radiation Control. Radioisotopes may only be used under this specific license.

Anyone who uses radioactivity or a radiation production device must be authorized by the Radiation Safety Committee to do so and are subject to the conditions of the Utah Radiation Control Rules and this WSU Radiation Safety Manual as adopted and approved by the committee.

3.1 Authorization for Radioisotope Use

The WSU Radiation Safety Committee is authorized to grant or deny the use of radioisotopes by personnel under the jurisdiction of the university. Prospective authorized users of radioactive materials must document adequate training and/or experience. The applicant must submit both a Statement of Training and Experience form (Appendix A, form 2) and an Application for Possession and Use of Radioisotopes form (Appendix A, form 1) to the RSO.

The prospective user should take special care in writing the project description as it will be considered in the approval process. The project description should emphasize all radiation safety controls, procedures, and monitoring methods. The RSO is available for consultation in these matters.

Applicants must meet the following minimum requirements:

- 1) A college degree at least at the bachelor level, or equivalent training and experience in the physical or biological sciences, or engineering; and
- 2) At least forty hours of training and experience in the safe handling of radioactive material, and in the characteristics of ionizing radiation, units of radiation dose and quantities, radiation detection instrumentation, and biological hazards of exposure to radiation appropriate to the type and form of radioactive material to be used. [R313- 22-50(4)(b)].

Furthermore, radioactive material will be used only by or under the direct supervision of individuals who are Authorized users.

The facility where the isotope(s) will be used is very important to the authorization. Its design must allow for the safe handling or storage of radioactive materials, and provisions for good personal hygiene must be available. The RSO will inspect the facility prior to approval to assure the facility is adequate for hazard control and radioactive material usage. Any new facility that is to be designed for the use of radioisotopes must first be reviewed by the Radiation Safety Committee, before approval to build is granted.

3.2 The Authorization Process

The applicant for authorization must document adequate training and experience by completing and submitting to the RSO the following forms: Application for Possession and Use of Radioisotopes-Form 1, Statement of Training and Experience-Form 2 (Appendix A). After initial review by the RSO, the application shall be considered at the next meeting of the Radiation Safety Committee.

If the application is approved by the committee, the signatures of the Committee Chair and the RSO on the application indicate authorization for ordering the approved isotopes. A copy of the approved application will be sent to the newly authorized user.

All authorizations must be reviewed on an annual basis. When a user wishes to cancel their authorized status, they must officially notify the RSO by completing a Cancellation of Authorization form. (Appendix A, form 5.)

3.3 Procurement and Transfer

Radioisotopes may be procured only by persons designated and authorized by the Radiation Safety Committee. Upon receiving authorization, the user may purchase the approved radionuclides listed on the authorization. The quantities ordered at any one time and on hand may not exceed the established possession limit of the authorization.

The purchaser will need to enter a non-catalog request in Paw Place. They will need to show the content of what they are purchasing, at that time it will flag EHS (the chair of the Radiation Safety Committee and or the RSO for authorization.

The RSO (or EHS the chair of the RSC) will verify that the requested materials fall within the scope of this user's authorization, and if approved, will sign and forward the requisition to the purchasing department. The purchasing department will assign a purchase order number and

order the material. The inventory will be adjusted to reflect the new acquisition when it arrives and is checked by the RSO, following the procedures outlined in section 3.4

An Authorized User who wishes to transfer radioactive material to another Authorized user must complete and submit to the RSO a Radioactive Material Transfer form (Appendix A, form 4).

3.4 Receipt and Delivery of Purchased Radioactive Material

All purchased radioactive materials shall be delivered to the receiving department. Upon receipt of a shipment of radioactive materials, Receiving will perform the initial inspection of the shipping package(s) and call the RSO or Environmental Health & Safety Office to arrange for the package(s) to be monitored and delivered. Regulations require that a package containing radioactive materials be inspected within three hours of its receipt on campus or not later than three hours of the next working day if received at the end or after the working day hours.

This procedure should be followed, for packages that exceed type A quantities ¹, during the inspection of an incoming shipment of radioactive material:

- 1) Check the dose rate at contact and at two meters from the package. If the reading is greater than 200 mr/hr at contact or 10 mr/hr at two meters, the RSO must be notified immediately.
- 2) Wipe the outside (300 cm²) of the package for removable contamination. If the removable activity is greater than 22 disintegrations per minute (DPM) per square centimeter above background, notify the RSO immediately.
- 3) Such packages shall be secured against unauthorized removal in leak-proof metal containers, appropriately labeled on the outside with a radioactive materials sign.
- 4) If the package is obviously damaged, Receiving should call the RSO at once.

The consignee shall provide the necessary delivery service. Persons making the delivery must be named on the authorization application and must wear an appropriate monitoring device, where the need is shown by the initial monitoring.

3.5 Safe and Prudent Usage of Radioactive Materials

The presence of radioactivity is not readily detected by the human senses and thus radioactive contamination may be present and spread without one immediately knowing unless proper procedures and rules are followed. The level of activity and the hazard of the particular isotope(s) should determine the degree of precaution used and required. However, it is the policy of Weber State University that exposures to radioactivity are kept as low as reasonably achievable (ALARA). This basically means to maintain exposures to radiation as far below the dose limits as is typical considering the costs, benefits and technical means available at the time of usage.

¹ Type A quantities are legally described in the Utah Radiation Control Rules R313-19-100 (Transportation)

WSU operations related to the use, storage, and disposal of radionuclides shall be, first and foremost, dedicated to achieving levels of exposure to personnel and the general public ALARA. This includes maintaining levels of stored, soluble isotopes at low levels and maintaining publicly accessed sites at levels at or below an exposure rate of two mr/hour². Additional ALARA concepts at WSU are: seeking new sensitive state of the art instrumentation as the funds are made available, limiting restricted radioactive material usage areas to the fewest possible laboratory spaces and limiting access to individuals who are not directly engaged in authorized uses of radioactive materials. Providing a library of training materials for those who will use devices that generate ionizing radiation, retaining paid outside expert consultants to provide reviews, etc., of the WSU radiation safety program, as needed, and periodically soliciting ALARA recommendations from users and former users of radioactive materials and devices at WSU are actions that will assist in maintaining exposures to radioactivity as low as they can reasonably be achieved.

3.6 Precautionary Procedures

Regulations and prudent usage of radioactive materials require the posting and/or labeling of areas, laboratories and containers containing such material. Authorized users are responsible for the labeling and posting of signs and symbols on containers and other laboratory apparatus involved in the use or storage of radioactive materials in authorized facilities. At WSU, a "restricted area" is an area where access is limited for the purpose of protecting individuals against undue risks from exposure to licensed radiation and radioactive materials. These areas should be posted so that adequate warning is given. Signs bearing the standard radiation symbol should be displayed in magenta, purple, or black displayed on a yellow background and should indicate the words "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)". The regulations do not allow any residential quarters to be posted in this manner.

A "radiation area" at WSU is defined as an area accessible to individuals, in which radiation levels could result in an individual receiving a dose equivalent in excess of 0.05 mSv (5 millirems) in one hour at 30 centimeters from the source of radiation or from any surface that the radiation penetrates. Each radiation area must be posted with a sign that bears the words, "CAUTION, RADIATION AREA."

If the area radiation levels could result in an individual receiving a dose equivalent in excess of 1mSv (100 millirems) in one hour at 30 centimeters. The area is considered to be a "High Radiation" area and must be posted with a conspicuous sign that says "CAUTION, HIGH RADIATION AREA" or "DANGER, HIGH RADIATION AREA."

In the interest of ALARA, and in addition to the wording required on signs and labels, the user may provide, on or near the signs and/or labels, additional information, as appropriate, to make others aware of any potential dangers or hazards.

² R313-15-301 (1)(b) Dose Limits for Individual Members of the Public indicates the words, "CAUTION, RADIOACTIVE MATERIAL(S)" or "DANGER, RADIOACTIVE MATERIAL(S)." The regulations do not allow any residential quarters to be posted in this manner.

All containers in which radioactive materials exceeding activities listed in Table 1 are stored must be labeled with the radiation symbol and words "CAUTION, RADIOACTIVE MATERIAL". For purposes of the WSU Radiation Safety Manual, "container" refers to a holder of radioactive material. This may mean a rack or other device or a container holding much smaller units too small to label (See TABLE 1: Minimum Labeling Requirements).

1000 μ Ci	100 μ Ci	10 μ Ci	1.0 μ Ci	0.1 μ Ci
Tritium	Carbon-14	Sodium-22	Iodine-125	Radium-226
Chromium-51	Phosphorus-32	Phosphorus-32		
	Sulfur-35	Scandium-48		
	Potassium-40	Iron-59		
	Calcium-45	Zinc-65		
	Iron-55			
	Nickel- 63			

TABLE 1: Minimum Labeling Requirements

When these containers are in storage, the container information must provide:

- 1) The name of the nuclide that is present
- 2) An estimate of the quantity
- 3) The date of the estimation
- 4) The radiation levels and
- 5) The kind(s) of Materials

Before removing or disposing of any empty uncontaminated container, each user must remove or deface the radioactive material label.

4. Sealed Sources

A licensed sealed source is defined as any radioactive material that is permanently bonded (or fixed in a capsule or matrix designed to prevent the release and dispersal of the radioactive material) and is listed on WSU's radioactive materials license (granted by the State of Utah).

Isotopes with activities less than those listed in 10 CFR 20 Appendix C are not required to be licensed. At WSU the ALARA intent is to use the emitted radiation from the sealed source rather than the radioactive material within it.

High level sealed sources should not be handled directly with the hands. Remote handling tools such as tongs should be used to help keep exposure to the hands and body as low as reasonably achievable.

Low level sealed sources can be handled by hand, but handling should be minimized as much as possible.

Users of sealed sources with the potential of rupture should monitor themselves while working with the sources to assure the sealed source has not accidentally ruptured or begun to leak.

Monitoring should also help to reduce further contamination of the worker.

Do not attempt to repair a ruptured or leaking source.
Call DPS immediately if a ruptured source is detected.
Department of Public Safety
Extension 6460

Leak tests shall be conducted by an authorized user on all licensed sealed sources, greater than or equal to 100 microcuries, at intervals that do not exceed six months. If the result of a leak test reveals the presence of 0.005 microcuries of removable contamination, the source must be removed from use immediately and disposed of at the user's expense or returned to the manufacturer. Consultation with the RSO is also required

5. Dosimetry

Any person working with radioactive material under Weber State University's license is required to wear a personnel dosimetry monitoring device whenever entering a restricted area where they are likely to receive in one (1) year a dose in excess of 10% of the annual limits. In addition to this general guideline, personal dosimetry is required for university faculty and staff when working with:

- a. Beta emitters of energy greater than 0.25 MeV. This excludes such isotopes as tritium, ^{14}C , ^{35}S , and ^{45}Ca .
- b. Gamma emitters of any energy.
- c. X-ray producing devices

5.1 Dosimetry Types

Unless otherwise specified by the RSO, whole-body thermoluminescent dosimeters (TLDs) will normally be the type of dosimeter issued and required. The TLD must be worn on the person so that any recorded exposure will show a representative exposure to the whole body (at the chest, pocket, collar, or waistline; except extremity monitoring, i.e., ring, wrist, or ankle badges worn on the extremities). When any protective shielding is worn, dosimeters should be outside the shielding, in a location likely to receive the highest whole-body dose. When a protective apron is worn, the location of the individual monitoring device is typically at the neck (collar).

Personal dosimetry devices of any kind are not to be worn when an individual is undergoing diagnostics or therapeutic radiation exposure. This includes dental exam x-rays.

When not in use, TLDs should be stored away from excessive heat, light, and moisture.

The issued TLDs are personal dosimeters and must be worn or used only by the person to whom they are issued.

Do not wear anyone else's dosimeter or allow them to wear yours.

Some isotopes, by their very nature, can be inadvertently taken into the body by inhalation, ingestion, absorption, or injection (puncture of the skin). Internal exposures to radioisotopes are determined by bioassay procedures, typically urinalysis. Individuals who are known or suspected to have received an internal exposure to radioactive material at WSU must contact the RSO immediately and are required to avail themselves of bioassay procedures to determine the total effective dose equivalent. The type, number, and frequency of bioassay samples will be determined by the RSO. (See Radioisotope Laboratory Safety Rules in Appendix E.)

5.2 Dosimetry Records

An individual who uses radionuclides under Weber State University's license is required to assist the university in obtaining their previous radiation exposure records. WSU maintains exposure records of all individuals who have used radioisotopes and worn personnel dosimetry at WSU. These records are considered confidential and are protected under the Privacy Act of 1974, Pub Law 93-579, 5 U. S. C. 552a, and other State and Federal laws that apply. The RSO can provide an individual their own record upon written request. Exposure records will only be sent to a WSU employee's future employer if the RSO has received a properly executed and signed release from the individual listed on the record of concern.

6. OCCUPATIONAL DOSE LIMITS

A five-rem annual effective dose limit for whole body occupational exposures is the accepted standard. This effective dose limit, as defined, makes it possible to combine both the internal and external doses and provides a means to assess the overall risk of any health effects resulting from radiation exposure. Previously, quarterly exposure limits were also in place. These quarterly limits are no longer in effect.

Table 2 shows the annual occupational dose limits. (See Exposure/Dose Limits, Appendix B.)

TABLE 2: Occupational Dose Limits

Site	REM	mSv
------	-----	-----

Deep Dose (Whole Body)	5	50
Eye Dose	15	150
Skin Dose	50	500
Extremity Dose	50	500
Organ Dose	50	500
Embryo/Fetus (entire gestation)	0.5	5
Embryo/Fetus (monthly limit)	0.05	0.5

6.1 Dose Limits for the General Public

Authorized users at WSU shall conduct their radiological operations so that individual members of the general public shall not be exposed to radioactivity at levels that would allow them to receive a dose in excess of 100 millirem (1 mSv) in any one year or two millirem (0.02 mSv) in any one hour. All students, staff, and faculty who are not officially engaged in the authorized use of radioactive materials are considered members of the general public and these dose limits apply to them as well.

A special consideration for minors (an individual who is under the age of 18 years) is in force by regulations that do not allow minors to be occupationally involved with radioactive materials or do not allow them to be in areas where they will be exposed to amounts of radioactivity that would cause them to receive an exposure greater than 10% of the occupational limits

6.2 Dose Limits for the Embryo/Fetus

Individuals working in or frequenting any portion of a restricted area are required to receive information concerning prenatal radiation exposure and the biological risk (Contact the RSO at extension 7982).

A special situation arises when a female occupational worker becomes pregnant and is exposed to radioactivity. Exposure of the abdomen of such a worker to penetrating radiation would involve exposure to the embryo/fetus. The first trimester (three months) of pregnancy is the most important to the developing child if it is being exposed to radioactivity. Concerns about prenatal exposure are based upon studies of increased risk. These studies and scientific guidance are given by professional organizations that recommend reduced exposure limits for the embryo/fetus of a pregnant radiation worker.

A "declared pregnant worker" (DPW) is a woman who has voluntarily informed the university, in writing, of her pregnancy and the estimated date of conception. It is the responsibility of the worker to decide when or whether she will formally declare her pregnancy. Once declared, it is the responsibility of the worker and the university to ensure that the dose to the embryo/fetus during the term of the pregnancy as described in Table 2. Separate exposure records will be kept for the exposed child of a declared pregnant worker.

Further information pertaining to prenatal exposure may be found in the U.S. Nuclear Regulatory Commission Guide 8.13, latest revision.

7. RADIOACTIVE WASTE DISPOSAL

Approval by the RSO is required before a radionuclide can be disposed of by any means. Generally, wastes at WSU will be held for decay in storage. These isotopes should be stored for a period of time equal to ten (10) half-lives before discarding. Consult the RSO for advice before becoming involved in this process. Any radiological waste held for decay in storage must be monitored before disposal to assure no long-life waste has entered the waste stream.

Disposing of radioactive waste into the sanitary sewer system may be a useful alternative to decay in storage but strict rules apply to this methodology. Only incidental washes from labware clean up and personal hygiene may be flushed down the drain without prior approval of the RSO. (See the State of Utah Radiation Control rule R313-15-1003.)

The RSO maintains an inventory of radioactive materials on the WSU campus. An item may be removed from the inventory after ten (10) half-lives have elapsed or it has been disposed of in the sanitary sewer, as appropriate. (NOTE: Ten half-lives of any isotope will normally bring the activity level to the background.) However, the user should maintain a log and document receipts and disposals affecting authorizations.

7.1 Specific Waste

An authorized user may dispose of the following material as if it were not radioactive: 0.05 microcuries or less of hydrogen-3 (tritium) or carbon-14 per gram of medium used for liquid scintillation counting; and (2) 0.05 microcuries or less, of tritium or carbon-14 per gram of tissue, averaged over the weight of the entire animal. However, the user may not dispose of the animal either as food for humans or as animal feed. Records must be kept of all disposals regardless of the disposal technique. Nothing relieves the user from complying with other applicable regulations governing any other toxic or hazardous properties of these materials.

7.2 Special Waste Considerations

Sharps or puncturing objects should be disposed of in puncture-resistant plastic containers before being consigned to solid waste. Such waste will be temporarily stored for ten (10) half-lives and eventually disposed of through an appropriate commercial service. Frozen storage must be provided for perishable waste. It is recommended that frozen storage be "frost-free." Freezers that are not frost-free tend to have radioisotopes migrate into the frost and when defrosted present a contamination hazard.

In cases where the release of any volatile radioactive material or aerosol is anticipated, means must be provided to trap and contain the materials. The products of such traps or containments may then be disposed of as liquid or dry radioactive waste as appropriate.

Animal waste such as excreta may be disposed of as ordinary waste if there is no detectable radioactivity above the background. Excreta or animal carcasses that contain short half-life radioactive material should be held by the user for at least 10 half-lives from origination and the activity verified before disposal. They should be held in individual watertight containers. Each individual package should be properly labeled and identified so they can easily be retrieved and disposed of after radioactive decay has occurred. Animals

not sacrificed may be retained for future research use if their excreta are collected for a sufficient time to assure low levels of activity.

8. EMERGENCIES INVOLVING RADIOACTIVE MATERIALS

The term "emergency", when referring to WSU radiological operations, means any incident resulting from the use of radioactive material with the potential of creating an external or internal hazard to anyone. The emergency may vary from a small spill or splash of low-level activity to a major fire that spreads large amounts over a large area.

8.1 Fire Emergencies

If an uncontrollable fire breaks out in any WSU radiation facility, do the following:

- 1) Activate the fire alarm system.
- 2) Leave the building.
- 3) Call 9-911 to notify the emergency dispatcher of a fire in progress with the possible involvement of radioactive material.
- 4) Notify University Police Dispatch (extension 6460).
- 5) Follow any instructions and advice given by the RSO for prudent radiological control.

8.2 Major Spills

If a spill involves more than one millicurie of radioactivity, do the following:

- 1) Notify all persons not involved in the spill to vacate the room.
- 2) To prevent radioactive contaminants from spreading throughout the facility, immediately turn off any fans and/or air conditioning.
- 3) Remove and leave in the room any articles of clothing involved in the spill.
- 4) Leave the room, close the door and prohibit entry.
- 5) Call the DPS immediately (extension 6460).
- 6) Begin decontamination of personnel.
- 7) Follow directions from the RSO.

8.3 Minor Liquid Spills

Spills are a possibility in any WSU laboratory or area where radioactive materials are used, stored, moved or transported. Each spill and its resultant emergency differ and fixed rules to cover all emergencies are not possible. However, a few guidelines are offered here for aid in handling minor (less than 1 millicurie) liquid spills.

Guidelines for Handling Minor (less than 1 millicurie) Liquid Spills: ·

- 1) Confine and concentrate the spill. Drop paper towels or other absorbent material upon it immediately.
- 2) Work from the outer edges of the spill toward the center.
- 3) Wear protective clothing such as appropriate gloves, safety glasses, etc.
- 4) Mark off and/or isolate the suspect area. Permit only the minimum number of people necessary to deal with the spill to be in the area.
- 5) The person responsible for the spill should clean it up. If there is serious doubt call the RSO.
- 6) Generally speaking, inexperienced personnel should not attempt to clean up a spill.
- 7) A survey meter may be used to verify and confirm that decontamination has occurred and is adequate. Swipes may be taken and counted for low energy beta emitters

- 8) Upon completion of the decontamination, all contaminated material should be properly disposed of. Make sure your hands are thoroughly washed and monitor yourself for residual contamination before exiting the lab.

8.4 Minor Dry Spills

Dry spills involving radioactivity at levels less than one millicurie may occur occasionally. Natural dusts, aerosols and particles may also become a source of dry contamination.

Generally, minor dry spills are easily picked up with masking tape rolled with the sticky-side out. Moist absorbent paper may also be used.

9. IONIZING RADIATION PRODUCTION DEVICES

Before individuals are allowed to operate ionizing radiation production devices, they must be authorized by the Radiation Safety Committee.

The RSO must authorize the purchase of all instruments, machines and devices capable of producing ionizing radiation. One must also ensure the devices are registered with the State of Utah Division of Waste Management and Radiation Control.

Prior to the initial operation, the RSO or the RSO's representative should conduct an inspection of the equipment and facility. This inspection should include, but not necessarily be limited to:

- a. machine function
- b. facility design
- c. operational procedures

The inspection may also include:

- a. recommendations for interlocks
- b. timing and exposure termination devices and/or warning lights or signs

The following should also be determined:

- a. hazard control
- b. device output
- c. filtration
- d. leakage
- e. any necessary additional shielding requirements

Operating procedures, specifically written for each particular installation, shall be made available to persons using the machines.

Periodic inspection and maintenance must be performed as per the manufacturer's and other regulatory body guidelines.

9.1 Specific individual equipment operation

Only approved and authorized faculty or students will be allowed to operate specific individualized equipment. Final approval for such use will be given by a designee of the RSC.

Any student who has been approved to operate specific individual equipment will be supervised by the designee of the RSC. This supervision will include but is not limited to standard operation of the specific individual equipment.

Anyone operating such devices must have first been issued a personal dosimetry badge as required. Operators are required to wear the dosimetry badges, at all times, during operation.

All equipment must be operated in accordance with manufacturer's guidelines.

9.2 Registration

The Radiation Safety Officer is responsible for registering ionizing radiation production devices that meet the requirements of the State of Utah Division of Radiation Control. Operators are required to cooperate with the RSO so that WSU is following the Division's regulations.

9.3 Radiation Exposure

It is not expected that anyone operating an ionizing radiation production device will receive direct exposure from this device. However, in the event of such exposure, the RSO will notify the person of concern when the Vendor's report is received.

The RSC designate or other assigned supervisory personnel are required to notify the RSO immediately if it is known or suspected that radiation exposure to an individual or individuals has occurred as a result of operating this equipment.

APPENDIX A – FORMS

FORM 1 – Application for Possession and Use of Radioisotopes

FORM 2 – Statement of Training and Experience

FORM 3 – Authorized User Annual Renewal and Inventory

FORM 4 – Radioactive Material Transfer

FORM 5 – Cancellation of Authorization

FORM 6 – Radioactive Material Transfer/Receipt Authorization

APPENDIX B – Exposure Dose Limits

APPENDIX C – 10 CFR 20.1001 APPENDIX C

APPENDIX D – Required Notification and Reports

APPENDIX E – Radio Isotope Laboratory Safety Rules

APPENDIX F – Radiological Emergency Procedures

Weber State University
Radiation Safety-Form 1

Application for Possession and Use of Radioisotopes

USER'S INFORMATION

_____ Name	_____ Date of Application
_____ Department to Use Material	_____ Department Chair/Supervisor
_____ Building and Room(s) to Be Used	_____ Phone Number(s)

COLLABORATORS

List any WSU employees that will be collaborating on this project:

1. _____
2. _____
3. _____

ISOTOPES REQUESTED

Isotope	Total Quantity _____ mCi	Quantity/Experiment _____ mCi	Chemical Form _____
_____	_____ mCi	_____ mCi	_____
_____	_____ mCi	_____ mCi	_____
_____	_____ mCi	_____ mCi	_____
_____	_____ mCi	_____ mCi	_____

Describe the experiment:

APPROVALS

_____ Applicant's Signature and Date	_____ Department Chair Signature and Date
_____ RSC Chair Signature and Date	_____ RSO Signature and Date

____ Approved Renewal Date: _____
____ Not Approved Reason: _____

RADIATION SAFETY MANUAL – APPENDIX A

Weber State University
Radiation Safety-Form 2

Statement of Training and Experience

Name

Date of Application

Department

Phone

Training Type	Location	Date/Duration	On the Job (J), Formal Course © or Both (B)
Principles and practices of radiation protection			
Radiation measurement techniques and instruments			
Radiation units and dose units			
Biological effects			

List any formal courses taken in radiation science, health physics, radio chemistry, radio biology, nuclear engineering, radiation protection, etc.:

List use of radioactive material and devices in working situations:

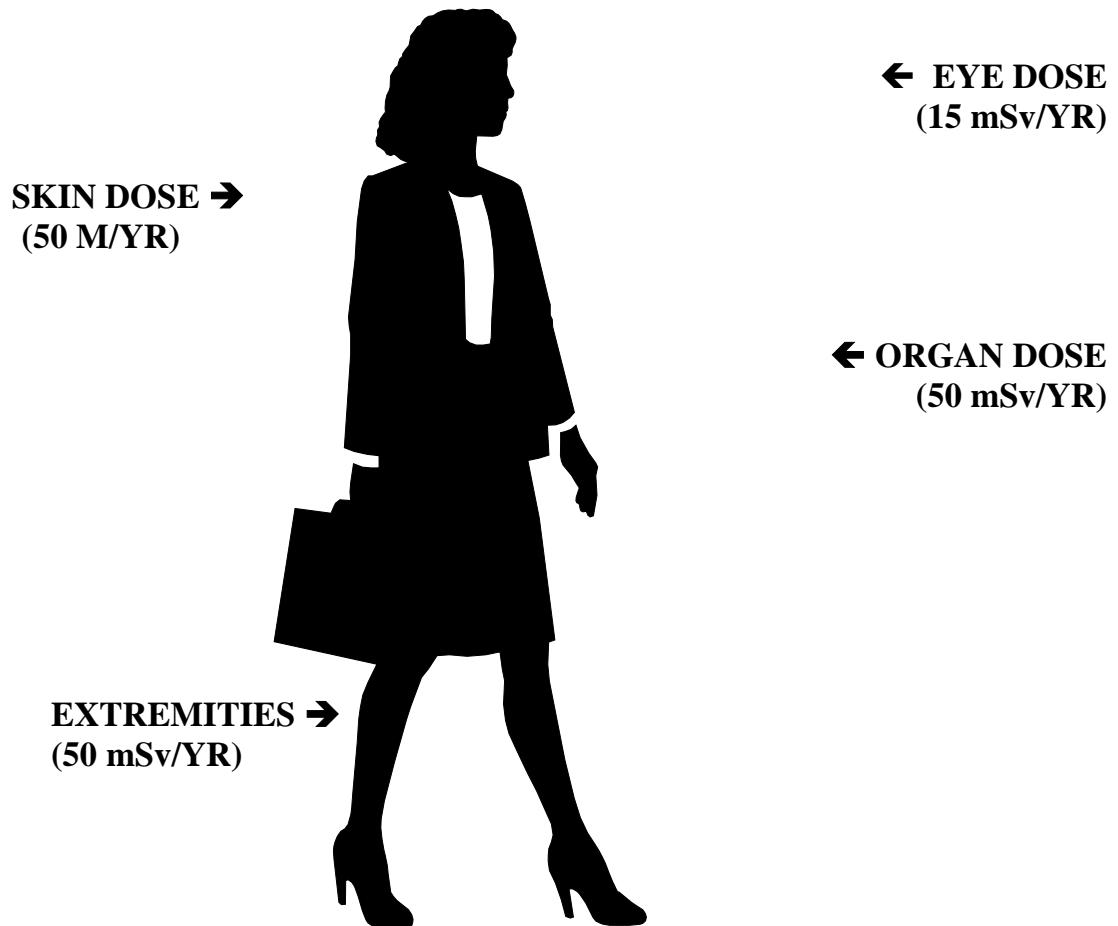
Isotope/Device	Maximum Activity	Employer	Dates/Duration

Appendix B

EXPOSURE/DOSE LIMITS

Based upon values stated in NCRP Report No. 116.

WHOLE BODY DEEP DOSE
(50 mSv/yr)



1. The limits depicted above are for occupational exposures to adult radiation workers at WSU.
2. Adult workers may be authorized to receive planned doses in addition to the occupational exposures which are separately accounted for in NCRP Report No. 116

Appendix C

Radiological Emergency Procedures

(For more information about emergencies See Section 8 of the Radiation Control Program)

The term "emergency", when referring to WSU radiological operations, means any incident resulting from the use of radioactive material with the potential of creating an external or internal hazard to anyone. The emergency may vary from a small spill or splash of low-level activity to a major fire that spreads large amounts over a large area.

Follow these Procedures in radiological emergencies:

1. Call 911 for spills involving fire.
2. Notify other employees in the area when a major spill has occurred, and evacuate the lab.
3. A major spill involves an amount greater than 1 millicurie.
4. Handle liquid spills Immediately.
5. Wear the appropriate PPE, ie. Gloves, glasses, and lab coat.
6. Work from the outer edge of the spill to the center.
7. Use a survey meter to verify the spill is removed.
8. Properly remove and dispose of the contaminated material.
9. If you have serious doubts about cleaning the spill, call the Radiation Safety Officer.
10. Call the Radiation Safety Officer about major spills.

Appendix D

Required Notifications and Reports

- I. Reports of Stolen, Lost, or Missing Licensed Materials
 - A. Immediately telephone the Division of Radiation Control (DRC), through the WSU RSO upon the occurrence of the recognized loss of any licensed radioactive material in an aggregate quantity equal to or greater than 1,000 times the quantities specified in Appendix C of 10CFR20.1001, which is added as part of this appendix. (See R313-15-1201.1)
 - B. Call the DRC within 30 days after the occurrence of a loss of radioactive material in an aggregate quantity greater than 10 (ten) times the quantity specified in 10 CFR 20.1001 Appendix C.
 - C. Call immediately if a radiation-producing machine is missing.
 - D. Forward a written report to the executive secretary of the DRC within 30 days of a telephone notification to the DRC. (See R313-15-1201(2) for details.)

- II. Notification of Incidents (R313-15-1202)
 - A. **Immediate Notification**—Immediately report any event involving licensed radioactive material that may have caused (or threatens to cause) any of these conditions:
 1. An individual to receive:
 - a. A total effective dose equivalent of 25 rem or more, or
 - b. A lens dose of 75 rem or more, or
 - c. A shallow dose equivalent to the skin or extremities or a total organ dose equivalent of 250 rad or more or
 2. The release of radioactive material, inside or outside of a restricted area, so that had an individual been present for 24 hours, the individual could have received an intake five times the occupational ALI.
 - B. **Twenty-Four Hour Notification-Report** to the DRC any event involving licensed radioactive material that may have caused or threatens to cause any of these conditions:
 1. An individual to receive in a 24-hour period:
 - a. A total effective dose equivalent exceeding five rem or
 - b. A lens dose of equivalent exceeding 15 rem, or
 - c. A shallow dose equivalent to the skin or extremities or a total organ dose equivalent exceeding 50 rem.
 2. Had an individual been present for 24 hours, the individual could have received an intake in excess of one occupational ALI.

III. Other Reportable Events (R313-15-1203)

- A. In addition to the notification required by Section R313-15-1202, each licensee or registrant shall submit a written report within 30 days after learning of any of the following occurrences:
 - a. Incidents for which notification is required by section R313-15-1202, or
 - b. Doses in excess of any of the following
 - i. The occupational dose limits for adults in section R313-15-201, or
 - ii. The occupational dose limits for a minor in Section R313-15-207, or
 - iii. The limits for an embryo/fetus of a declared pregnant woman in section R313-15-208, or
 - iv. The limits for an individual member of the public in Section R313-15-301.
- B. The licensee (WSU) shall submit a written report to the director within 30 days following any planned special exposure conducted in accordance with Section R313-15-206
- C. If a leak test of a sealed source indicates (according to R313-15-401) that a source is indeed leaking a report will be made to DRC within five (5) days.
- D. Thirty (30) days before the vacating or cessation of use of all radioactive materials at WSU the university must notify the DRC. (See R313-15-1301).

Appendix E

RADIOISOTOPE LABORATORY SAFETY RULES

1. Do not eat, store or prepare food, smoke, or apply cosmetics in areas where radioactive materials are stored or used.
2. Survey all radioactive samples and determine safe working distances and shielding requirements before beginning work.
3. Avoid direct contact with radioactive materials by using protective lab coats, disposable gloves, safety pipettes, etc.
4. Report all spills of radioactive materials to the lab supervisor and to the health physicist. Prepare to decontaminate immediately.
5. Maintain complete and accurate records of receipts, transfers, lab surveys, and disposal of radioactive materials.
6. Wear a personnel monitor (TLD) any time you work with energetic beta, x-ray, or gamma-ray emitters. (Occupational radiation exposure records are maintained in the Weber State University Public Safety Office, MC 3002.)
7. Perform all isotope work on bench tops covered with absorbent paper to contain minor spills. Change the paper covering frequently during active work periods.
8. Perform as much work as possible in a radio-chemical hood to contain product volatilization, dust dispersion, or splattering.
9. Properly label each radioactive sample, and clearly indicate identity and activity. Keep samples covered and shielded when not in use.
10. Store liquid radioactive wastes in properly identified containers until prepared for final disposal. Properly log the number of disposed of materials.
11. Label and store contaminated solid wastes separate from other trash. Log the amount of activity stored for disposal.
12. Obtain approval from the Radiation Safety Officer before disposing of gaseous wastes through a hood.
13. Store all radioactive materials in properly designated areas and lock unattended storage areas.
14. Monitor laboratory work surfaces after each handling of radioactive materials. (Keep these measurements permanently recorded and available for inspection by authorized persons.)
15. Before leaving the laboratory after working with radioactive materials, thoroughly wash your hands and monitor them with the lab survey meter.
16. Check and, if necessary, decontaminate all laboratory glassware and equipment used with radioactive materials before returning it to general usage.
17. Request the RSO to perform a decontamination confirmation wipe test on any uncertain area.

DWMRC-04
08/18

UTAH DEPARTMENT OF ENVIRONMENTAL QUALITY
Division of Waste Management and Radiation Control

NOTICE TO EMPLOYEES

STANDARDS FOR PROTECTION AGAINST RADIATION (R313-15); NOTICES, INSTRUCTIONS AND REPORTS TO WORKERS; INSPECTIONS (R313-18)



WASTE MANAGEMENT
& RADIATION CONTROL

WHAT IS THE DIVISION OF WASTE MANAGEMENT AND RADIATION CONTROL?

Within Utah, the Division of Waste Management and Radiation Control (DWMRC) of the Department of Environmental Quality is the regulatory agency responsible for licensing and inspecting the use of radioactive materials and registering and inspecting radiation producing machines.

WHAT DOES THE DWMRC DO?

The DWMRC's primary responsibility is to ensure that workers and the public are protected from unnecessary or excessive exposure to radiation. This is accomplished by the Utah Waste Management and Radiation Control Board (Board) establishing requirements in the *Utah Radiation Control Rules* (R313).

WHAT RESPONSIBILITY DOES MY EMPLOYER HAVE?

Any person conducting activities licensed or registered by the DWMRC must comply with the *Utah Radiation Control Rules*. If a violation of the Board's requirements occurs, the license or registration can be modified, suspended or revoked and/or the licensee or registrant can be fined.

Your employer must post or make available the *Utah Radiation Control Rules*, the license, and must post DWMRC Notices of Violation involving radiological work conditions.

WHAT IS MY RESPONSIBILITY?

For your own protection and the protection of your co-workers, you should know how DWMRC requirements relate to your work and should follow them. If you observe violations of the requirements or have a safety concern, you should report them.

HOW DO I REPORT VIOLATIONS?

If you believe that violations of the Board's rules or of the terms of the license or registration have occurred, you should report them immediately to your supervisor. If you believe that adequate corrective action is not being taken, you may report this to a DWMRC inspector.

WHAT IF I CAUSE A VIOLATION?

If you engaged in deliberate misconduct that may cause a violation of the Board's rules, or would have caused a violation if it had not been detected, or deliberately provided inaccurate or incomplete information to either the DWMRC or to your employer, you may be subject to enforcement action. If you report such a violation, the DWMRC will consider the circumstances surrounding your reporting in determining the appropriate enforcement action, if any.

WHAT IF I WORK IN A RADIATION AREA?

If you work with or in the vicinity of radioactive materials or radiation producing machines, the amount of radiation exposure that you may legally receive is limited by the Rules. The limits on your exposure, as well as limits for an embryo/fetus, are contained in R313-15. While those are the maximum allowable limits, your employer should also keep radiation exposure as far below those limits as is *reasonably achievable.*

MAY I GET A RECORD OF MY RADIATION EXPOSURE?

If the Rules require that your radiation exposure be monitored, your employer is required to advise you annually of your dose. In addition, if you terminate employment with the licensee or registrant, you may request that your employer provide, at termination, a report of your radiation exposure during the current year.

HOW ARE VIOLATIONS OF THE BOARD'S RULES IDENTIFIED?

The DWMRC conducts regular inspections at licensed and registered facilities to assure compliance with the *Utah Radiation Control Rules*. In addition, licensees and registrants are required to perform audits, surveys and/or measurements to assure compliance.

MAY I TALK WITH A DWMRC INSPECTOR?

Yes. Your employer may not prevent you from talking with a DWMRC inspector and you may talk privately with an inspector and request that your identity remain confidential.

MAY I REQUEST AN INSPECTION?

Yes. If you believe that your employer has not corrected

violations involving radiological working conditions, you may request an inspection. Your request should be addressed to the Division of Waste Management and Radiation Control, Utah Department of Environmental Quality, and must describe the alleged violation in detail. You or your representative must sign it.

HOW DO I CONTACT THE DWMRC?

Call the Division at (801) 536-0200 [After hours emergencies (801) 536-4123]. DWMRC staff wants to talk to you if you are worried about radiation safety or other aspects of licensed or registered activities.

CAN I BE FIRED FOR RAISING A SAFETY CONCERN?

Federal law prohibits an employer from firing or otherwise discriminating against you for bringing safety concerns regarding sources of radiation to the attention of your employer or the DWMRC. You may not be fired or discriminated against because you: *

- # ask the DWMRC to enforce its rules against your employer;
- # refuse to engage in activities which violate DWMRC requirements;
- # provide information or are about to provide information to the DWMRC or your employer about violations of requirements or safety concerns;
- # are about to ask for, or testify, help or take part in a DWMRC, Federal or State proceeding.

* Note: Federal provisions do not apply to workers using only radiation producing machines (X-ray machines); however, UOSH regulations provide for the safety and health of all employees.

WHAT FORMS OF DISCRIMINATION ARE PROHIBITED?

It is unlawful for an employer to fire you or to discriminate against you with respect to pay, benefits, or working conditions because you help the DWMRC or raise a safety issue.

HOW AM I PROTECTED FROM DISCRIMINATION?

If you believe that you have been discriminated against for bringing violations or safety concerns to the DWMRC or your employer, you may file a complaint with Utah Occupational Safety and Health (UOSH) and the U. S. Department of Labor (DOL). Complaints pursuant to Section 211 of the Energy Reorganization Act of 1974 (42 U.S.C. 5851) are handled by the U. S. Department of Labor. Your complaint must describe the firing or discrimination and must be filed within 180 days of the occurrence. To file your complaint, you may directly contact the Occupational Safety and Health Administration (OSHA) Regional Office:

Department of Labor/OSHA
1999 Broadway, Suite 1690
Denver, Colorado 80202-5726
(303) 844-1600

Complaints pursuant to Section 11(c) of the Occupational Safety and Health Act of 1970, Public Law 91-596, as amended, are handled by UOSH. Your complaint must describe the firing or discrimination and must be filed within 30 days of the occurrence. To file your complaint, you may directly contact UOSH:

Utah Occupational Safety and Health
160 East 300 South, 3rd Floor
P. O. Box 146650
Salt Lake City, Utah 84114-6650 (801) 530-6901

WHAT CAN THE DEPARTMENT OF LABOR DO?

The Department of Labor will notify the employer that a complaint has been filed and will investigate the case. If the Department of Labor finds that your employer has unlawfully discriminated against you, it may order that you be reinstated, receive back pay, or be compensated for any injury suffered as a result of the discrimination.

WHAT CAN THE DIVISION OF RADIATION CONTROL DO?

If the DOL or the DWMRC finds that unlawful discrimination has occurred, the Division may issue a Notice of Violation to your employer, impose a fine, or suspend, modify, or revoke your employer's license or registration.