The Radiation Safety Officer is responsible for the contents and documentation of this manual. Questions regarding radiation regulations and/or information contained herein should be directed to this Office (909-469-5592).

Donald E. Walters, PhD
Radiation Safety Officer
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Section I. Overview

Sources of ionizing radiation, in the form of radioisotopes, are frequently utilized in research and clinical investigations. Although radioisotopes have beneficial effects when used in these applications, these same sources of ionizing radiation can present a hazard to individual users and others in the immediate environment. Because of the potential hazardous effects of radiation on individual health and the potential for genetic effects, it is imperative that the amount of radiation exposure that is received by an individual be kept to a minimum.

It is the intent of this Radiation Safety Manual to serve as a guide for faculty at Western University of Health Sciences (WesternU) who are interested in becoming licensed for on-campus research use of radioisotopes by the State of California. This manual is also intended to provide an overview of the radiation safety procedures and obligations that are mandated by the Radioactive Materials License for permit holders.

Section II. Introduction

1. Interested faculty can request that they be added to the current Radioactive Material License #4288 by submitting their request for amendment of the license to the Radiation Safety Officer (RSO). Copies of the license and supporting documents are kept on file by the RSO.

2. The use of all radioactive materials and radiation-producing machines is governed by the provisions of Title 17, California Administrative Code in conjunction with Title 10, Code of Federal Regulations.

Section III. Radiation Safety Committee

1. State and Federal radiation safety statutes require that a policy-determining Radiation Safety Committee (RSC) and a Radiation Safety Officer (RSO) be specified for each license.

2. The current members of the RSC include the RSO, Alternate RSO, Director of Environmental Health and Safety and individuals listed as approved users under item #12 of the Radioactive Materials License.

3. Regulations require the RSC to meet annually.

4. Documentation of the annual RSC meeting will include an agenda, a sign-up sheet signed by all members present, and minutes to the meeting. Copies of these documents will be distributed to all members of the RSC and kept on file by the RSO.

5. Meetings may be scheduled on a more frequent basis if there are issues of importance to the RSC.

6. Since WesternU does not carry a broad scope license, the RSO is responsible to the Radiologic Health Branch of the Department of Public Health Services for the state of California.

7. The RSO for WesternU acts as a steward at the purview of the Office of the Vice President (VP) for Research and Biotechnology. The RSO will bring issues related to radiation safety to the attention of Office of the VP for Research and Biotechnology.

Section IV. Radiation Safety Officer

1. The RSO is a requirement of WesternU’s Radioactive Material License.

2. The RSO for WesternU has the following responsibilities:

   A. Document the Annual Review of the Radiation Safety Program for WesternU to ensure all aspects of the Radioactive Materials License are in compliance. Included in this Annual Review will be the following:

      1. Annual meeting of the RSC to include agenda, minutes and sign-up sheet.
2. Ensure that wipe-tests of the laboratories are completed in compliance with the Radioactive Material License and its amendments. Copies of the wipe-tests will be maintained by the approved licensed user listed on the Radioactive Material License in the laboratory and a copy will be maintained by the RSO. Surveys of the laboratory areas will normally occur on a monthly basis. However, during long-term storage of radioactive material without any actual use, surveys may occur on a quarterly basis.

3. Ensure the calibration of the survey meter(s) and scintillation counters is completed annually. Copies of the calibration documents will be maintained in the laboratory and by the RSO. Account for all calibration tracer sources for calibration of the scintillation counters.

4. Ensure that all documents required by state and federal regulations are appropriately posted in the laboratories.

5. Ensure that radiation safety training of laboratory personnel is completed in compliance with state and federal regulations. This should include documentation of the initial training and the annual refresher course. The training in radiation safety will be appropriate for the isotopes used in each laboratory. Records documenting the date of the training and its content and signed by the approved user or his/her laboratory personnel will be kept on file by the listed user responsible for the laboratory personnel. A copy will also be kept by the RSO. Radiation safety training is covered in Section VI H of the Radiation Safety Manual.

6. Review radioisotope receipt records to ensure they are in compliance. The procedures for receipt of radioisotopes are described in Section III B of the Radiation Safety Manual. The radioisotope receipt record should include the following information:
   a. Date of receipt of the isotope
   b. The isotope and its’ activity
   c. The shipping vendor
   d. Exposure at 1 meter from, and on the external surface of, the shipping container
   e. Wipe-test of the outside surface of the shipping container
   f. Physical appearance and/or damage to the shipping container
   g. Wipe-test of the shielded receptacle that is containing the isotope
   h. Following a determination that the shipping container is not contaminated, all radiation labels attached to the container should be removed and disposed of in the radiation waste barrel and the transport container either returned to the vendor or disposed of as non-radioactive waste.

7. Review and ensure that all documents that describe the transfer and disposal of all radioactive materials and radiation equipment received by any licensee at WesternU are available for review. Disposal of radioactive materials will be in accordance with the Radioactive Material License.

8. Ensure that a continuous record of personnel exposure from a licensed dosimetry service is maintained for each person working in the laboratory where radioisotopes are used and in which individual monitoring badges are required.

9. Ensure that the radioactive materials used by occupationally exposed workers shall not exceed the dose limits specified by Title 10, Code of Federal Regulations, Part 20, Subsection C (Sections 20.1201 through 20.1208).

10. Ensure that the licensee is monitoring occupational intake of radioactive materials and assess the committed effective dose equivalent to individuals who may have exceeded, or are likely to exceed, the limits specified in Title 10, Code of Federal Regulations, Part 20, Sections 20.1501(b).

11. Ensure that WesternU is maintaining records on radioactive materials storage, transfer and disposal as specified in our Radioactive Materials License #4288.
B. Maintain an organized record of official correspondence and documents pertaining to Radioactive Material License #4288. This will include documents distributed within WesternU to license holders, occupationally exposed workers and administration.

C. Maintain an organized record of copies of State and Federal regulations. (Licensees should also place copies of State and Federal regulations within the radioisotope work areas.)

D. Provide advice and direction to WesternU Administration regarding radiation protection procedures as follows:

1. The RSO will report all findings to the Vice President of Research and Biotechnology.

2. The RSO will provide reports of violations from unannounced inspections by the California Department of Public Health and/or County of Los Angeles to his or her immediate supervisor.

E. Initiate procedures for safely disposing of radioactive wastes produced by WesternU licensees. This will include assurances that all procedures mandated by the Radioactive Material License #4288 and State and Federal regulations are in compliance. The RSO will maintain copies of documents pertaining to radioactive materials storage and disposal.

F. The RSO will provide direction, leadership and assistance during radiation emergencies.

Section V. Radiation Use Approval

1. Faculty members interested in the use of radioisotopes or instruments emitting radiation should consult with the Radiation Safety Officer (RSO) prior to submitting an application for a Radioactive Materials License.

A. Faculty interested in on-campus use of tracer radionuclides listed in items #6, 7 and 8 of the Radioactive Materials License #4288 should request an amendment to Item #12, which lists approved users, for their inclusion on the current license. If additional tracers are needed for use in biological or chemical in-vitro studies, then an amendment to Items #6, 7 and 8 should be requested.

B. Faculty interested in off-campus use of 99mTc labeled radiopharmaceutical for use in human or animal diagnostic imaging studies may be required to submit a new application to the Department of Health Services in Sacramento.

2. The RSO must ensure that faculty members who wish to use radioactive nuclides or instruments emitting radiation have the proper completed forms on file for inspection by the County of Los Angeles. The following link to the California Department of Public Health’s webpage provides links to all of the forms needed to apply for a Radioactive Material License: http://www.cdph.ca.gov/pubsforms/forms/Pages/RHBLicensingForms.aspx.

A. Institutional Application for Radiation Use Authorization: Information contained in this section is intended for use only by the institution applying for a Radioactive Material License. Individuals within the institution interested in using radioactive materials in bench research are referred to B below.


Assistance on how to properly complete this form can be obtained from the Guide for Applicants for a Radioactive Materials License (RHB 2051) http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/RHB-RH-2051.pdf.

(2) Use of Radioactive Materials for Veterinary Use: Form RH 2050 above is also the form used for veterinary licensing. Assistance and information specific to veterinary licenses may be found at http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/RHB-GuideForVeterinaryLicenses.pdf.

Assistance on how to properly complete this form can be obtained from the Guide for the Preparation of an Application for a Radioactive Materials License Authorizing Medical Use. [http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/RHB-MedicalGuide.pdf](http://www.cdph.ca.gov/pubsforms/Guidelines/Documents/RHB-MedicalGuide.pdf)

Form 2000A, Training and Experience – Medical Authorized User or Radiation Safety Officer must also be completed. This form is on page 108 of the above link.

B. Use of Radioactive Materials in Bench Research: Persons interested in using radioactive materials in bench research must complete and submit the following document to the RSO (Note: Submit all forms to the RSO. Do NOT send forms directly to the Department of Public Health):


C. The prospective users will be issued a copy of this Radiation Safety Manual by the RSO.

D. The Application for Radiation Use Authorization form RH 2050 is a requirement for any project, investigation or student laboratory involvement, including those using license exempt quantities of unsealed radionuclides. Repeated experiments require only one form on file. These forms are available from the RSO.

E. Individuals who are proposed as licensed users or who will supervise the use of radiation sources by others must have their names listed on the radioactive material license under Item #12. They must complete the statement of training and experience (See section V.2.A.(1)(b) above). This form will be submitted in the request for amendment to the Radioactive Material License.

Section VI. Basic Operating Procedures for Approved Users

A. Sources of Overexposure: Overexposure to radiation can arise from external radiation fields, surface contamination and air-borne contamination.

1) **Dose Limits:** The California Department of Public Health amended all Radioactive Material Licences to follow the federal guidelines established by the Nuclear Regulatory Commission on January 1, 1994.

(a) **Occupational Dose Limits:**

1. Annual Dose Limits for Adults:

   (i) Total effective dose equivalent (total of the external dose equivalent and the weighted sum of the committed effective dose equivalent to all internal organs and tissues)……………………………………………………………………….5 rem

   (ii) Dose equivalent to the lens of eyes………………………………………………….15 rem

   (iii) Dose equivalent to the skin of body and extremities……………………………50 rem

   (iv) Committed dose equivalent to individual internal organs and tissues……….50 rem

2. Annual Dose limits for minors are 10% of limits listed in a (1) above.

3. Dose limits to “Declared” pregnant women ………………………………………….0.5 rem
(4) Annual dose limit for unrestricted areas and public at large
Total effective dose equivalent...........................................0.1 rem

(b) External Radiation: If gamma emitting radionuclides are used, dose rates in adjacent unrestricted
areas will be measured with a Geiger counter during routine monthly surveys if radiation levels are
measured within the radioactive material laboratory which exceed a deep dose equivalent rate of 2
mrem/h at 30 cm from any unshielded source, vial, cabinet, refrigerator, freezer or waste container.

(c) Surface Contamination: Removable surface contamination, which often results from spills and/or
leaks, is a serious safety hazard because it can lead to ingestion or skin absorption of radioactive
materials. Therefore, direct measurements and wipe tests should be performed periodically and
whenever a spill or leak is suspected.

(1) Direct measurements for surface contamination should be performed with a thin window Geiger
counter (with a pancake probe if available) in any area where high energy beta and gamma
emitters are used. The action level for direct measurements is 1,000 cpm measured 0.5 cm
above the surface.

(2) Dry wipe tests using a surface-loading filter (such as a membrane filter) or Q-tip should be taken
over an area of 100 cm². Wipes containing low energy emitters (e.g., ³H, ¹⁴C) should be analyzed
using a liquid scintillation counter. High energy beta emitters (e.g., ³²P) or gamma emitters (e.g.,
¹²⁵I) can be analyzed with a liquid scintillation counter or a thin window Geiger counter.

(a) Action levels for removable contamination due to beta or gamma emitters from
environmental surfaces are 200 dpm/100cm² for radionuclides other than ³H and ¹⁴C and
2,000 dpm/100cm² for ³H and ¹⁴C.

(b) Action levels for removable contamination due to beta or gamma emitters on actual vials
containing radioactive material are 2,000 dpm/100 cm² for radionuclides other than ³H
and ¹⁴C and 20,000 dpm/100cm² for ³H and ¹⁴C.

(3) If these levels are exceeded, then decontamination procedures should be initiated immediately
and the source of contamination should be isolated. The RSO should also be informed promptly
so that RSO may evaluate the situation and clear the facility for use.

(d) Airborne Contamination also poses a serious health hazard because it can be inhaled or absorbed
through the skin. The allowed concentration limits of airborne radioactivity are given in Appendix A,
Section 30355 of Title 17 of the California Code of Regulations (not Appendix A of this manual). It is
the user's responsibility to assure that these limits are not exceeded by monitoring for airborne
contamination during critical stages of their operation. Details concerning the type of monitoring
system to use, etc., will be discussed with the RSO before radiation use authorization is granted.

B. Licensee Obligations – The licensee shall ensure that:

1. Radioactive materials shall be used by occupational workers in such a manner that complies with all
guidelines, rules and regulations set forth herein;

2. The laboratory surveys are conducted at the appropriate frequency;

3. Records of the survey must be maintained within the laboratory for inspection.

C. Receipt of Radioisotopes:

1. Purchasing (Shipping/Receiving) Department
a. WesternU will provide training in the handling of radioactive material for those individuals in the shipping/receiving department who will be receiving the radioisotopes.

(1) The individuals receiving the radioisotopes will perform a cursory inspection of the package to determine if they are intact or damaged. Shipping/receiving will then contact the Director of Environmental Health and Safety (EH&S) for delivery of the packages. The RSO and purchaser will be notified immediately if there are any problems with the package.

(2) An isolation area should be set up for temporary storage of packages of radioactive substances prior to pick-up by the Director of EH&S. This area should be separated from other storage sites and activities in the shipping/receiving department.

(3) The Director of the Purchasing Department will be notified to direct all new personnel to meet with the RSO before hiring to undergo training on the receipt and inspection of radioisotopes.

2. Authorized User (AU)

a. All incoming packages of radioactive material must be picked up by the AU immediately upon receipt. The AU will perform the following procedures to ensure the package and its contents are within allowable limits for surface contamination:

(1) Confirm that the package is undamaged.

(2) Record the following on the radioisotope receipt log:
   i. date of receipt of the isotope
   ii. isotope and its' activity
   iii. shipping vendor
   iv. exposure at 1 meter from the shipping container
   v. wipe-test of the outside surface of the shipping container
   vi. wipe-test of the shielded receptacle containing the isotope

   Maximum allowable levels of radiation and removable surface contamination are found in 10CFR20, section 20.205. Maximum surface radiation level = 200 mrem/hour. Maximum level 3 ft. from surface of package = 10 mrem/hour. Maximum activity of removable surface contamination = 22,000 dpm/100 cm².

(3) Following a determination that the shipping container is not contaminated, the radiation label attached to the container should be removed and disposed of in the radiation waste barrel and the transport container either returned to the vendor or disposed of as non-radioactive waste.

b. The AU must also keep a careful record of all receipts, uses and disposals of radioactive materials. Copies of these records must be provided to the RSO for incorporation into a record file for future review by Los Angeles County inspectors.

D. Radioactive waste policies, records and disposal procedures

1. The AU will keep records on all radioactive waste storage and disposal, copies of which will be provided to the RSO for inclusion into a central file for review by Los Angeles County inspectors.

2. Only radioisotopes with a $T^{1/2}$ less than 90 days may be stored for decay for least 7 half-lives and the radioactive waste is at a background level.

a. The material to be stored for decay will be kept in barrels at least 5 meters away from any regular employee’s workstation such that continuous exposure to students or staff is minimal.
b. Separate containers will be provided for each isotope. Laboratory personnel will be instructed to place all waste in the appropriately labeled container.

c. Each waste item will be further identified by:
   (1) Date of placement in container
   (2) The isotope
   (3) The physical and chemical form
   (4) The activity at the time of use
   (5) The exposure rate at the surface of the container and at 1 meter
   (6) The date at which 7 half-lives will be completed
   (7) Special handling precautions or hazards.

d. Each container will be maintained until the last item added is at least 10 half-lives old and then surveyed with a Geiger counter to ensure it is at background levels of radiation. If activity is still detected, the waste will be held longer until it has decayed to background levels of radiation.

3. A radioactive waste logbook will be maintained which records all information about each item placed in the container.

4. All records pertaining to radioactive waste will be maintained for at least 5 years by the RSO.

5. All wastes within the containers are to be labeled with radioactive warning signs. These labels will be removed prior to disposal when the level of exposure is at background levels as determined by a Geiger counter.

6. Isotopes with a $T^{1/2}$ greater than 90 days are not considered for decay by storage.

7. All radioactive waste shall be brought to the RSO for disposal. The AU shall organize the waste in the following manner prior to submitting it for disposal:
   a. Each isotope shall be kept in a separate container and identified so that it includes the isotope, activity, date, physical and chemical form.
   b. Dry waste must be separated from liquid waste.
   c. Liquid scintillation vials must be packaged separately from other liquid wastes.
   d. Surface contamination levels and radiation levels must be within acceptable limits to protect the health of personnel handling the waste.
   e. All containers must be sufficiently strong and durable to retain their contents even if they are dropped or otherwise abused.
   f. All radioactive wastes must be delivered to the Director of EH&S for disposal as soon as possible after it is generated. Waste must never be stored in a non-radioactive material laboratory or faculty office, etc.

E. Identification and Security of Radiation Material Work and Storage Areas

1. Each area or room in which an isotope is stored or used will be posted with a sign bearing the radiation caution symbol and the words **CAUTION RADIOACTIVE MATERIALS**.

2. Access to the storage area is by one door kept locked at all times when personnel are not present. Security is further provided by a card key lock system that automatically locks each time the door is opened and then closed. This area will be posted with a **CAUTION RADIOACTIVE MATERIAL** sign.
a. Every room containing radioactive materials must be locked when the authorized user is not present.

b. All other personnel who have legitimate access to this room must be informed by the AU of the location of all radioactive materials present and of any risks or hazards involved.

c. Students and staff are not allowed to use or have access to radioactive materials except under the direct supervision of an approved user.

d. Contaminated objects (pipettes, vials, etc.) must NEVER be given to technicians or other unauthorized personnel for cleaning, disposal, etc.

F. Intra-Campus Transportation of Radioisotopes

Before transporting radioactive material through corridors or between buildings, it must be enclosed in an unbreakable container with a tight-fitting lid that will prevent spillage if the container is overturned, dropped or otherwise disrupted. Plastic (but not glass) liquid scintillation vials with screw-on caps constitute an "unbreakable container" as specified in this paragraph.

G. Disposal of $^3$H and $^{14}$C in liquid scintillation medium as hazardous, non-radioactive, materials may be done as follows:

1. ONLY $^3$H and $^{14}$C at concentrations of less than 0.05 microcurie per gram can be disposed of as hazardous, non-radioactive, materials.

2. All labels indicating the presence of radioactive material must be removed.

3. The RSO or Director of EH&S, through a hazardous waste broker, will handle disposal of this hazardous material.

4. Records of these disposals must be kept separate from those for Radioactive Waste Disposal as this material is considered "non-radioactive".

H. Training:

(1) Staff, Faculty and Student training:

(a) It is the AU’s responsibility to inform the RSO each time a new person is hired to work on a project wherein they will be exposed to radiation or radioactive materials. The RSO shall interview such persons and provide appropriate training to ensure their safety and that of others.

(b) The person will be issued a copy of the Radiation Safety Manual and must sign and return the Radiation Safety Manual Receipt Form (Appendix A) to the RSO.

(c) The student researcher will not be allowed to use or have access to radioactive material except under the direct supervision of an approved user.

(2) Training of Veterinary Students in Diagnostic X-ray Radiation Safety: Veterinary students for the 2nd, 3rd and 4th year clinical rotations will be provided training in radiation safety procedures relating to diagnostic x-rays. All students will complete this training at WesternU prior to being issued a personnel-monitoring device.

(3) Training of ancillary personnel such as custodians and craft workers who must enter the laboratory is performed by the RSO or the Alternate RSO. The trainer will review a 5 page handout with the trainees and the trainees must certify that they understand the material in the handout and have had any questions answered by the trainer. Topics covered in the handout include:

   a) radiation and radioactivity
b) radiation safety procedures  
c) security of radioactive materials  
d) posting and labeling  
e) shielding  
f) radioactive contamination monitoring  
g) radiation monitoring badges  
h) eating and drinking in radioactive material laboratories  
i) how to obtain additional radiation safety training

(4) Annual refresher training will be required for all persons approved to handle radioactive materials. The training will be limited to isotopes approved by the Radioactive Material License and for which the user is approved. The training material will be compiled by the RSO. Trainees must sign a form stating they have completed the refresher training and return this form to the RSO.

Section VII. PERSONNEL MONITORING

A. Required use of Monitoring Devices

1. Each user of radiation-producing machines and/or large quantities of radioactive isotopes, other than $^3$H and $^{14}$C, must wear a thermoluminescent dosimeter (TLD) body and/or TLD ring badge as appropriate. The badges shall normally be worn for a period of 3 months. If significant doses are routinely recorded on an assigned badge, that person’s badges will be worn for a reduced period of 1 month.

   a. The TLD badge should be worn at the position on the body where the exposure is expected to be greatest. If the exposure is uniform, then the badge should be worn on the trunk since the blood-forming organ and gonads are the critical organs. If a lead apron shields the torso, then the thyroid glands and lenses of the eyes become the critical organs. In this case, the badge should be worn on or near the collar.

   b. The working areas should also be monitored monthly for surface contamination using a Geiger counter. Users of $^3$H and $^{14}$C will monitor themselves and their work areas by making frequent wipe tests each month and anytime there is reason to believe that contamination exists. An up-to-date log should be kept to indicate the results of each test (location, date, isotope, level of contamination).

   c. Students, long-term visitors and other non-occupationally exposed personnel will be badged if there exists a significant chance that they may receive more than 10% of the dose limits described above. A permanent record of each individual’s dose will be maintained by the RSO.

2. The AU is responsible for providing the monitoring devices and the following guidelines apply to their use:

   a. The monitoring device should be worn at all times on the job or in the radiation area unless all sources of radiation or radioactive material in the laboratory are in shielded storage.

   b. The devices should not be stored in the radiation area.

   c. The monitoring device should not be taken home; nor should it be worn during non-job-related radiation exposures such as medical or dental x-ray procedures.

   d. The monitoring device should be worn in an appropriate manner. Body TLD badges are to be worn on the trunk of the body at the waist or chest level. The body badge must always be worn with the open window of the badge holder facing away from the body. TLD finger monitors must be worn with the TLD turned toward the palm of the hand when exposure potential results from picking up or handling radioactive materials with the hands.

   e. Do not intentionally expose personnel monitoring devices to radiation, contaminate it with radioisotopes, or damage it in any way. TLD badges must not be stored in areas of excessive heat or moisture.
f. It is the responsibility of the wearer to change his or her dosimeter during designated change periods. Information on the time period for changing dosimeters will be provided when a dosimeter is issued.

g. If the monitoring device is lost or damaged (broken clip or lost filter, etc.) contact the RSO for replacement.

h. If an individual terminates employment at WesternU, the monitoring device must be returned to the approved user.

3. **Dosimetry Records**: The RSO will maintain permanent records of the dose accumulation by each individual monitored at WesternU. The AUs are responsible to provide the RSO with the quarterly exposure records. Any individual may request information on his or her exposure dose history from the AU or RSO. The RSO will review the radiation dosimetry reports on each individual for each time period. If the radiation dose-limit for that period, or if any unusual dose, is reported, the RSO will notify the individual wearer and make a complete investigation of the circumstances involved in the dose received by the individual.

4. **Off Campus Students/Faculty**

   a. Students from the College of Osteopathic Medicine of the Pacific involved in clinical off-campus rotations in radiology services in partnering hospitals will obtain their personnel monitoring devices from that facility.

   b. Students in the College of Veterinary Medicine involved in off-campus clinical practices will obtain their personnel monitoring devices from the RSO. These personnel monitoring devices will be issued to the students for each quarterly time period. It will be the responsibility of the students to wear the dosimetry badges in the practice when obtaining radiographs of patients and to promptly return them promptly to the RSO for each time period designated.

**VIII. Radiation Laboratory Safety Rules, Radiation Emergency Procedures and Personnel Decontamination**

A. **Radiation Laboratory Safety Rules**:

   1. Eating, drinking and smoking are prohibited in the laboratory.

   2. Use tongs or thumb forceps when handling radioisotopes.

   3. Experiments that use significant amounts of radioactive materials should undergo a "dry run" to reduce exposure time.

   4. Hands and clothing should be monitored when leaving the laboratory.

   5. An assigned monitoring device, such as a TLD badge, should be worn when working in the lab.

   6. Potential radiation exposure should be evaluated before embarking on an experiment.

   7. When working with unsealed sources, the following precautions should be taken in addition to those described above:
      
      a. Wear a lab coat, impermeable gloves and fully enclosed shoes.

      b. **Never pipette by mouth!**

      c. Line working surfaces with absorbent paper having an impermeable base.
d. Store and transport containers of radioactive materials on trays that will hold all of the materials if the container breaks. The trays should be covered with aluminum foil which will be discarded as solid radioactive waste after each use.

e. Significant amounts of unsealed sources must be used only in well designed, exhaust ventilated enclosures such as a fume hood. The quantity of radioactive material that constitutes a "significant amount" depends on the particular isotope used, its physical form (dust, liquid, gas), how readily it is absorbed through the skin, etc. Specific standards have been established in this regard and are available from the RSO.

f. Store liquid forms of radioactive materials in sealed containers.

g. Properly label all containers, storage and use areas in accordance with 10 CFR 20, Subpart J.

h. Store high-energy beta and all gamma emitters in properly shielded containers and/or enclosures.

i. Work with radioactive materials in accordance with radiation safety operating and emergency procedures.

j. Monitor work areas, hands and clothing whenever there is a possibility of contamination and after each day of use.

k. Clean up spills promptly in accordance with written instructions.

B. Radiation Emergency Procedures:

1. Radiation emergencies occur when there is a) a spill of a radiopharmaceutical or isotope on a surface; b) internal uptake of radioactive materials or c) accidental needle punctures from a needle used to transfer radioactive material. **IN ANY RADIOLOGICAL EMERGENCY, IMMEDIATELY NOTIFY** your Instructor or Supervisor and the RSO or Alternate RSO and, as appropriate, outside agencies as listed on the emergency call list posted in each radioactive material laboratory.

2. In the event of contamination of an individual, area or work location by radioactive materials or suspected radiation exposure, the following procedures must be immediately initiated:

   a. Employ every effort to reduce or restrict spread or dispersion of radioactive materials. For example, apply absorbent material over a spill. If personal clothing is contaminated, e.g., laboratory coat, remove and place in plastic container.

   b. Restrict access to the contaminated area.

   c. Identify the precise radioactive contaminant.

   d. If radioactive material reaches any skin surfaces, wash with soap and warm water. Also see the following section for detailed personnel decontamination procedures.

   e. Do not leave the scene until instructed.

   f. If exposure is suspected from radiation generation, medical attention may be necessary. Notify your Instructor, Supervisor or emergency personnel.

3. Reporting Radiological Emergencies
a. If the radiological emergency is associated with a life threatening or serious physical injury, contact emergency assistance by dialing 911. Emergency medical treatment takes precedence over radioactive contamination.

b. Because it is difficult for personnel in the laboratory to determine the extent of radiation exposure resulting from radiation emergencies, it is necessary that the RSO, Alternate RSO and/or the Director of EH&S be contacted IMMEDIATELY.

c. It is important that the laboratory personnel not assess the severity of the radiation emergency as minor and inconsequential. A minor spill might have more serious implications. The RSO and the Director of EH&S will be able to determine the magnitude and seriousness of the emergency.

d. When reporting an emergency, give your name, phone number, the radionuclide, physical and chemical form, activity level and location of the spill (building, room, area within the room, etc.)

C. Personnel Decontamination:

1. External Contamination with Radioactive Materials

   a. Intact Skin: Notify the Radiation Emergency Medical Center.

      1. If incorporation is suspected, get nose swab and sputum sample.
      2. Avoid spread of contamination.
      3. Remove clothing from contaminated person.
      4. Decontaminate affected area of skin with mild soap, water and a soft brush (2-3 min). Repeat at least 3-4 times. Monitor in-between washes. If necessary, use mild abrasive (paste of corn meal and tide, 50/50, in water), repeat 3-4 times. Dry skin and monitor again.

   b. Contaminated Hair

      1. Wear gloves and shampoo hair with head deflected backwards.
      2. Rinse hair with 3% citric acid.
      3. Wash again, rinse, and dry with hair dryer.
      4. Monitor again.

   c. Contaminated Eyes

      1. Spread eyelids, rinse with water from nose to lateral angle of eye
      2. Continue rinsing, monitor and obtain medical assistance.

   d. Whole Body contamination

      1. Remove all clothing, shower immediately with water and brush with mild soap; repeat 3-4 times.
      2. Towel dry and monitor. Repeat using mild abrasive paste if necessary.
      3. If unsuccessful, await emergency medical treatment.

2. Incorporation of Radioactive substances

   a. Uptake may occur by ingestion (swallowing, smoking, eating, drinking, pipetting), inhalation (breathing radioactive dusts, aerosols, gases) or absorption through intact or injured skin (acne, wounds, etc.).

   b. Counter Measures

      i. Determine time of accident, type of uptake, kind of radionuclide, physical and chemical form and level of activity of contaminant.

iii. Only in ingestion should mouth be rinsed and vomiting induced.

iv. Any decision to treat with chelating agents should be made by experts. Chelation should be started within less than one hour in order to be effective.

3. Contaminated Wounds: Any wound acquired in the presence of open radionuclides has to be considered to be contaminated until proven otherwise.

a. FIRST AID:

1. Rinse wound under running water.
2. Delineate contaminated area with waterproof material.
3. Decontaminate skin around the wound.
4. Remove tape, apply sterile dressing.
5. In case of contamination with highly radiotoxic substances – consider applying venous tourniquet close to the wound.

b. MEDICAL TREATMENT: In combined injury, primary care is desirable. With associated burns, less aggressive treatment is the rule.

1. If wounds are contaminated with short lived radioisotopes of less toxicity, rinse the wound with physiological saline or 3% H2O.
2. Monitor and apply sterile dressing.
3. Get a tetanus shot.
4. If the contaminant is highly toxic, obtain emergency medical assistance before attempting any decontamination of the wounds.
APPENDIX A

RADIATION SAFETY MANUAL RECEIPT FORM

To: Radiation Safety Officer, WesternU

I hereby certify that I have received a copy of the WesternU Radiation Safety Manual. As an individual using or having the responsibility for the use of radiation, I have read and comply with all sections of the Manual pertinent to me and I understand that failure to follow the procedures in the Manual may result in my being prohibited from working with radiation.

Signature: ___________________________________________

Print Name: __________________________________________

Date: _______________________________________________

Acknowledgement by Radiation Safety Officer