Oakland University Safety and Procedures Manual

For Use of Radiation in Laboratories

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Foreword

Federal and State agencies are strict in the enforcement of radiation safety regulations. These agencies routinely conduct unannounced inspections of establishments using radioactive materials.

Radiation Safety personnel will conduct periodic audits of your laboratory and records. These inspections will be done so as to minimize disruption of normal laboratory functions and may be announced or unannounced. The possession of improper or incomplete records may result in a notice of violation and loss of the privilege to use radiation at Oakland University. Please contact the Radiation Safety Officer for clarification of any of the items contained in this manual.

The procedures contained herein are ultimately aimed at ensuring the safety of radiation workers and the general public.

This manual contains specific, detailed instructions on procedures and requirements for the use of radioactive materials and radiation producing machines (cold-cathode discharge tubes, particle accelerators, electron microscopes, densitometers, x-ray diffraction devices, diagnostic x-ray machines, etc.) at Oakland University. Permit Holders and all laboratory personnel working with radiation are expected to be familiar with and to fully implement these safety procedures. Serious negative consequences for Oakland University and individual Permit Holders may result from failure to follow the contents of this manual. The Radiation Safety Officer will strictly enforce these requirements and may restrict or suspend the privilege to use radiation for individuals or laboratories where serious or repetitive items of non-compliance have occurred.

Future notices to Permit Holders may supersede portions of this manual. Permit Holders are responsible for incorporating such changes into this manual as well as their laboratory programs, and for disseminating information concerning revisions to their staff.

Permit Holder Responsibilities

As a Permit Holder, you are responsible for the following

1. Proper use and storage of all radioisotopes or radiation producing machinery,
2. Proper maintenance of the facilities used for research using radioisotopes or radiation producing machinery, and
3. Proper maintenance of all required records.
4. Make readily available all equipment necessary for radiation safety
5. Proper maintenance of radiation survey instruments.
6. Assure that radioactive material use is confined to permitted area and that radiation use areas are monitored to prevent release outside the permitted areas.
7. Securing radioactive materials and controlling access to the permitted work space.
8. Assure that all radiation workers are properly trained on the permitted procedures and emergency response.
9. Because of the limits of the University's license, and in order to keep radioactivity at Oakland University to a minimum, Permit Holders are discouraged from maintaining an isotope bank. Permit Holders must submit a written protocol for each radioisotope and chemical form in their possession. The Radiation Safety Committee may require the disposal of Isotopes/chemical forms which a Permit Holder has not used for more than two years.
10. In case the Permit Holder anticipates that he/she would not be able to supervise their radioactive research operations at all times, they will appoint a Radiation Safety Proctor. The Proctor is a worker of the permit holder that is certified to use radionuclides and is experienced in the research procedures of the lab.

Notification Requirements

Notify the Radiation Safety Officer immediately if:

1. Personnel have been contaminated with radioactive material, or there is an injury involving radioactive material.
2. Radioactive material is lost, stolen, or otherwise unaccounted for.
3. Radioactive material is observed to be unsecured and not under the immediate and direct control of an authorized individual.
4. A spill involving greater than 1 mCi of radioactive material has occurred.
5. A survey reveals removable surface contamination in excess of 10,000 dpm/100 cm^2, and the cause of the contamination is unknown.
6. Personnel dosimeters are lost, damaged, non-occupationally exposed or contaminated by radioactive material.
7. Packages of radioactive material are delivered by anyone other than a representative of the Radiation Safety Officer.
8. Radiation detection instruments malfunction, and an adequate substitute is not available for radioactive material work.
9. You become aware of any other unsafe condition or violation of regulations or Oakland University procedures.

Permit Holders must notify the Radiation Safety Officer in advance if they plan to:

1. Transfer radioactive material to another Permit Holder or institution.
2. Relocate, remove or add radioisotope laboratory facilities.
3. Add new/different uses of radioactive material, or increase levels of use above current User Permit conditions.
4. Take an extended leave from the University greater than 30 days.
5. Permanently leave Oakland University or otherwise terminate all radioactive material work.
6. Arrange for radiation safety training of personnel.
7. Obtain additional dosimeters.

Notify Radiation Safety Officer as soon as possible if:

1. There are any other changes (including deletions) regarding personnel dosimetry.
2. Assistance is required for decontamination of small spills.
3. You have any other questions or problems, or require other assistance or services from the Radiation Safety Officer.

Obtaining Approval to Use Radiation

Oakland University's radiation licenses require that sources of radiation be used by, or under the supervision of, individuals approved by the Radiation Safety Committee (RSC). User Permits are required for the use of all unsealed radioisotope sources, machines generating ionizing radiation, and regulated-quantity sealed sources. Exempt-quantity sealed sources must be registered with the Radiation Safety Officer, but do not specifically require a User Permit.

- Only full time faculty members or principal investigators at Oakland University may be authorized as radiation users. All others desiring to use radiation must work under the supervision of a full time faculty member or principal investigator who holds a current User Permit.

- A typed *Application for Radiation Usage* shall be submitted to the Radiation Safety Committee through the Radiation Safety Officer. Committee authorization to use unsealed and sealed sources is obtained through this registration; machine users must submit a typed *Application for Radiation-Generating Machine Usage*. The Application for Use must include detailed protocols describing the experiments in which radioactive material or radiation-generating machines will be used. The Radiation Safety Committee will review the Use Permit after the first year and every three years thereafter.

- Prior to submitting an application to the Radiation Safety Committee for approval, the Radiation Safety Officer will inspect the site to determine if the required safety equipment and supplies are present. Obtaining these supplies is the exclusive responsibility of each applicant.

The Radiation Safety Committee issues the User Permit only after on-site inspection of isotope work/storage areas and supplies.

- The Radiation Safety Committee, which meets quarterly, approves, disapproves, or conditionally approves each application. The User Permit will indicate the quantities and types of radioisotopes that may be used, details on the specific radiation-generating machines to be used, and where each may be used. The RSC has ultimate authority to decide what facilities and equipment will be required for each use of a radionuclide or a radiation-generating machine.

- The Chair of the Radiation Safety Committee may grant interim authorization to an individual for use of radiation pending final action of the RSC. This interim authorization may be for the use as requested in the application or may be of limited applicability. The applicant should be aware that the interim authorization is only temporary and the RSC may, upon the completion of its review, request additional information or impose specific conditions of use as deemed appropriate.

Amending an Existing User Permit

If a Permit Holder wishes to change the conditions of the User Permit, they may do so by submitting an amendment to the original Application for Radiation Usage.

> All requests to amend User Permits are subject to the same approval as described above for initial applications or renewals.

Permit Termination

Once an individual has completed work with radiation at Oakland University, the Radiation Safety Committee must formally terminate the User Permit. The Radiation Safety Officer will then ensure that:

- The laboratory area is free of radioactive contamination and all signs and labels are removed.
- All radioactive materials or radiation-generating machines in the possession of the Permit Holder are properly disposed of.
- Personnel monitoring is discontinued.

Permit Suspension or Revocation

The User Permit may be suspended or revoked for any violation of Radiation Safety Regulations as given in the Radiation Safety & Procedures Manual or the applicable license. The Radiation Safety Officer or the Radiation Safety Committee, depending on the seriousness of the violation, may effect the suspension. Revoked User Permits will be reinstated after the Permit Holder corrects the violation, and appears before the Radiation Safety Committee to re-submit a Permit Application.

Safety Practices in Radiation Laboratories

The practices described in this section are a condition of the licenses issued to Oakland University, and as such must be carefully followed for all use of radioactive materials and radiation generating machines.

Flagrant disregard of the specific conditions of an individual User Permit or the safety practices described below may result in the suspension or revocation of the Permit.

Unless specifically modified in writing as a condition on an individual User Permit, the safety practices described below apply to all uses of radioactive materials at Oakland University.

1. Do not mouth-pipette radioactive solutions.

2. Do not eat, drink, smoke, chew gum, handle contact lenses or apply cosmetics in any radioisotope work area. Do not store these items in a radioisotope work area. Do not carry these items in lab coat pockets.

3. Conduct dry runs without isotopes before instituting new protocols. Review safety practices frequently, especially before using a new radionuclide.

4. Procure, store and use radioactive material in strict accordance with the conditions of the current Permit Holder's authorization.

5. Procure and/or transfer radioactive material only with the approval of the Radiation Safety Officer.

6. When using radioisotopes wear appropriate personal protective equipment. Change gloves periodically during lengthy or repetitive procedures. Double-glove when performing decontamination. While wearing gloves, do not handle any item that you might later handle without gloves (e.g., faucets, notebooks, calculators, drawer handles, etc.). Assume that gloves are contaminated, and either clean or discard them as radioactive waste. Do not place potentially contaminated items in laboratory coat pockets.

7. Wear closed-toe footwear.

8. Wear prescribed personnel monitors in all areas where radioactive materials are stored or used.

9. Conduct radioisotope work on easily cleaned and impervious trays or pans, lined with absorbent paper or pads.

10. Collect and store all radioactive wastes in the appropriate containers and/or areas.

11. Use and store radioactive materials behind shielding of a type and amount

appropriate to the radionuclide(s) involved. Maximize distance from radiation sources whenever possible. Storage devices and waste receptacles must be properly shielded. Shielding specification must be stated in the application to use radiation as well as the intended use of the shielding.

12. Do not store food or beverages intended for human consumption in refrigerators, freezers or other containers designated for radioactive material storage.

13. Survey frequently and make proper notations of such surveys in the Permit Holder's Radiation Safety Logbook. The laboratory surveys conducted by Radiation Safety personnel are designed to audit the User Permit Holder's required day-to-day checks, and should not be viewed as a substitute for a laboratory contamination control program.

14. Thoroughly wash hands after handling radioisotopes, and/or before eating, smoking or drinking.

15. Before leaving the area or after final use of radioisotopes for the day, monitor hands, shoes and clothing with the appropriate survey meter. Do not continue to wear contaminated protective clothing. Contact the Radiation Safety Officer if personal clothing has been contaminated.

16. Label all containers of radioactive material and any item of laboratory equipment likely to become contaminated during routine use. Be sure radioisotope storage areas, refrigerators, sinks, and laboratory entrance doors are appropriately labeled.

17. Secure all radioisotopes against theft or unauthorized access. Laboratories and storage containers must be locked at all times when authorized personnel are not present.

18. Maintain proper records of receipt, use, transfer and disposal of radioactive materials in your Radiation Safety Notebook.

19. Immediately report accidental inhalation, injury, personal contamination, spills or loss of radioactive material to the Radiation Safety Officer.

20. Make sure that all of your procedures are in keeping with the ALARA (As Low As Reasonably Achievable) philosophy. Contact the Radiation Safety Officer for consultation, advice or assistance with radiation safety matters.

21. Contact the Radiation Safety Officer if you believe an unsafe situation or a violation of federal regulations or Oakland University procedures exists.

Unless specifically modified in writing as a condition on an individual User Permit, the safety practices described below apply to all uses of radiation generating machines at Oakland University.

1. All general radiation protection rules contained in this manual apply equally well to the ionizing radiation emitted by any machine or device.

2. The Radiation Safety Committee is authorized to require the use of any and all equipment and procedures it deems necessary to insure radiation safety, including shielding, interlocks, warning signs and devices, operation restrictions, area monitors and personnel dosimeters.

3. Changes in the location, operational parameters or disposition of radiation generating machines must have the prior approval of the Radiation Safety Committee. Users must notify the Radiation Safety Officer prior to the acquisition, disposal, relocation or transfer of any radiation-generating machine. The Radiation Safety Officer will advise the State of Michigan of any changes to the status of a machine.

4. Machine users must contact the Radiation Safety Officer for information regarding radiation safety or radiation survey instrumentation. A copy of the Michigan Ionizing Radiation Rules is available in the office of the Radiation Safety Officer.

5. A Permit is required for active and inactive radiation-generating machines. Each machine must be under the supervision of a full-time researcher or faculty member at Oakland University. The State of Michigan must license any machine capable of being energized. Permit Holders in possession of inactive machines may avoid the licensing requirement for a specific machine by requesting the installation of a keyed lockout device. The Radiation Safety Officer will be the sole possessor of the keys to any locked-out machine. Lockout keys will only be relinquished to the Permit Holder after an appropriate machine license has been obtained from the State of Michigan.

6. The Radiation Safety Officer will conduct a complete radiation safety survey prior to the operation of any new machine, or any machine that has been relocated, repaired or modified. It is the responsibility of the Permit Holder to notify the Radiation Safety Officer of any change in the status of a machine.

7. Rooms housing radiation-generating machines must be posted with an appropriate radiation warning sign on every access point to the area.

8. X-ray generating machines must be clearly labeled with the following statement: "Caution – X-Rays. This equipment produces x-rays when energized."

9. Only authorized personnel may operate radiation-generating machines. Authorization may be obtained by completing the required training and demonstrating competency in both the routine operation and emergency shutdown of the specific machine.

10. Personal dosimetry is required for all personnel working with radiation-generating machines.

11. Radiation generating machines must be secured against unauthorized use.

12. Routine operating and emergency shutdown procedures must be available at the

operator's station of each machine. These procedures must include:
(a) List of authorized users;
(b) Procedures for becoming an authorized user;
(c) Personal dosimetry requirements;
(d) Procedures for maintenance and service;
(e) Procedures for, and frequency of, safety checks;
(f) Emergency shutdown procedures;
(g) Safety protocols for stains and dyes.

13. An operating log must be maintained for each radiation-generating machine which includes the following information:
(a) Date of operation;
(b) Operator;
(c) Beam voltage (kVp), current (mA) and duration (s);
(d) Protocol performed;
(e) Safety checks performed and appropriate operational notes;
(f) Maintenance performed and appropriate operational notes.

Oakland University's ALARA Program

- In accordance with Federal regulations and the terms of Oakland University's Materials License as issued by the Nuclear Regulatory Commission (NRC), a program has been established at OU to provide for policies, procedures and instructions intended to maintain individual and collective doses of radiation **A**s **L**ow **A**s **R**easonably **A**chievable (ALARA).

- One must assume there is some amount of risk associated with any level of exposure to radiation. ALARA means making every reasonable effort to minimize exposure to ionizing radiation, with consideration given to socioeconomic factors. In other words, operating procedures, maintenance procedures, facilities and/or equipment will be modified only if radiation dose can be significantly reduced at a reasonable cost.

- The philosophy of ALARA can be historically traced to the earliest days of radiation protection, but has only recently been formally incorporated into federal regulations. Consequently, ALARA principles have been employed at Oakland University in the establishment of the rules and procedures by which radioactive materials are used. Oakland University Administration, the Radiation Safety Committee and the Radiation Safety Officer have been and will continue to be committed to implementing the ALARA concept.

- Some key points about the specifics of the ALARA program are as follows:

    1. The Radiation Safety Officer and the Radiation Safety Committee are available to assist users and workers in developing ALARA procedures.
    2. The Radiation Safety Officer and the Radiation Safety Committee will accept and evaluate the suggestions of individual workers for improving radiation safety practices.

3. Workers are encouraged to contact the RSO if they feel that ALARA principles or other established safety procedures are not being followed.
4. Individual Permit Holders are responsible for ensuring that supervised individuals subject to occupational radiation exposure are trained and educated in good radiation safety practices, including ALARA principles. Individuals must be qualified to work with radioisotopes with respect to the type and quantities of material, and the nature of use.

- Each individual who works with radiation has specific responsibilities, including the following:

1. Radioisotope workers are to be familiar with safe handling procedures, good radioisotope work habits, and the principles of radiation protection.
2. Radioisotope workers should be familiar with the specific step-by-step procedures to be followed during actual use. Careful planning, including trial runs, should be employed for new ideas.
3. In the absence of specific instructions, individuals should always utilize the concept of ALARA in relation to work procedures and conditions. For example, if a radiation source can be stored in more than one place, choose the area expected to be less occupied by personnel.
4. Methods that may reduce a single individual's exposure while at the same time increasing the exposure of others resulting in a higher collective dose are not to be used under any circumstances.

- With everyone's cooperation, Oakland University can continue to have an effective program for maintaining radiation doses to all workers, students, visitors and the general public to levels As Low As Reasonably Achievable.

Record Keeping

Permit Holders are provided a *Radiation Safety Logbook* with which to maintain required records. The following will help you to maintain these records in a logical and uniform manner.

1. General Directions

The *Radiation Safety Logbook* is designed to hold all of the important records required to keep in compliance with the rules and regulations of the NRC, the State of Michigan and Oakland University. The latest version of each form should be used. There are eight sections in the notebook: Isotope Utilization, Swipe Tests/Surveys, Waste Logs and Quarterly Inventories, Violation Notification, Training, User Permit and the Safety Manual.

There is enough space in the *Radiation Safety Logbook* for most Permit Holders to maintain at least one year's worth of information. If needed, a second "duplicate" book may be used to hold records more than one year old.

2. Isotope Utilization

The Isotope Utilization form is the key form to the record keeping process. All other forms are keyed to it by usage dates. It identifies the nuclide by name, lot number, PO number, the amount received and date received. It has the location for the required survey and swipe data of the nuclide container. The survey and swipe data required for disposal of the package is recorded on this form. The date of each use or dilution is recorded indicating the amount used. The date is used to track the nuclide through the remaining forms.

3. Surveys

Surveys forms are used to record the required daily, weekly and monthly surveys. Daily, weekly and monthly surveys are NOT recorded in separate sections, rather they are recorded in the same section in chronological order (much the same that research is recorded in a laboratory notebooks).

4. Waste Logs

Separate waste forms are used to record liquid and solid waste generation. All solid and liquid wastes must be recorded, on the appropriate form, in chronological order as generated.

5. Quarterly Inventories

The RSO will provide an updated material inventory list with each order of radioactive material. It is recommended that a signed copy of this form be provided to the RSO every time a drain or waste disposal is made. It is required that a signed copy of the inventory be provided to the RSO on a quarterly basis (March, June, September and December). This inventory is based on the amounts listed on the Isotope Utilization forms. Permit Holders are expected to perform a physical inventory of radionuclides every time an inventory

update is submitted to the RSO.

6. Violation Notification

All correspondence concerning violations are kept in this section.

7. Training

Copies of all training forms are kept in this section.

8. User Permit

Copies of the current "Application for Radiation Usage" and User Permit are kept in this section.

9. Safety Manual

The current copy of the *Oakland University Safety and Procedures Manual for Use of Radiation in Laboratories*, with all changes and corrections, is kept in this section.

10. Extra

Multiple notebooks may be needed if a Permit Holder has difficulty fitting one year's worth of material in the notebook furnished. The current year's data for the six items: Isotope Utilization, Surveys, Waste Logs and Quarterly Inventories are to be kept together in a single notebook. Duplicate books may be used to hold records more than one year old. All other sections (Violation Notifications, Training, User Permit and the Safety Manual) may be kept in a separate book.

Training and Supervision of Personnel

Training

All permit holders and personnel at Oakland University working with, or in the vicinity of, radioactive materials or radiation-generating machines must receive instructions and training commensurate with their duties before beginning any radiation work. All radiation workers must attend annual radiation safety update training.

I. **Prior Training and Experience.**

Oakland University Permit Holders are responsible for documenting all prior training and experience. For new applicants a Record of Prior Training and Experience must be included with the permit holders "Application to Use Radiation at Oakland University".

II. **Training Provided by the RSO**.

To ensure training requirements are met, the RSO shall provide periodic classes for new laboratory radiation workers, prior to their commencement of radiation activities. At a minimum, individuals who are to handle radioactive materials must receive instructions in the topics listed below prior to the first use of isotopes.

1. Potential risks from radiation.
2. Recognition of radiation warning symbols.
3. Isotope use, storage and security.
4. General radioisotope lab safety.
5. Appropriate emergency response procedures.
6. Basic principles of radiation protection.
7. Contamination control techniques.
8. The rights and responsibilities of radiation workers.
9. The ALARA philosophy.
10. Policies and procedures for radiation safety.
11. Specific precautions and specific license conditions.
12. Proper use of portable radiation survey meters.
13. Proper use of laboratory counting equipment.
14. Proper use of radiation dosimeters.
15. Radiation measurements and calculations.

At a minimum, individuals who are to use radiation-generating machines must receive instruction in the topics listed below prior to the first machine use:

1. Characteristics of x-rays;
2. Units of radiation dose;
3. Biological effects of radiation exposure;
4. Hazards of radiation exposure;

5. Normal radiation levels from radiation-generating machines;
6. Proper use of personal dosimeters;
7. Proper use of radiation monitoring equipment;
8. General laboratory safety procedures;
9. Emergency response procedures;
10. Basic radiation protection;
11. Contamination control for stain and dye work;
12. Rights and responsibilities of radiation workers;
13. The ALARA philosophy;
14. Recognition of radiation warning signs and symbols.

Training of Permit Holders and Radiation Safety Proctors. In addition to the above training sessions, the RSO shall provide the following information specifically to Permit Holders and Radiation Safety Proctors.

1. The responsibilities of the Permit Holder and Radiation Safety Proctor with regard to radiation safety;
2. Radiation measurements, standardization, monitoring techniques, and instrumentation;
3. Laboratory surveys and records that are required for handling, storage and disposal of radioactive materials.

Annual Update Training. Annually the RSO shall conduct training for all radiation workers. The training will emphasize issues or situations at Oakland University requiring attention, and/or changes in federal state local or university rules, policies or procedures, which affect laboratory staff.

Training of Ancillary Personnel. The RSO shall provide periodic classes for new ancillary workers prior to beginning duties in radioisotope areas. At a minimum, all individuals who work in the vicinity of, but do not themselves handle radioisotopes, must receive instructions in the topics listed below prior to beginning duties in radioisotope areas.

1. Potential risks from radiation;
2. Recognition of radiation warning symbols;
3. Areas where radionuclides are used and stored;
4. General radioisotope laboratory safety procedures.

III. Training Provided by Permit Holders

Radioactive material Permit Holders must provide and document instruction to their workers in the use of radioactive materials and protective measures specific to their research projects and radionuclides. Topics should include the following:

1. Radiation safety considerations of the specific radionuclides used in the Permit Holder's laboratories, including physical properties, radiation biology, and health physics.

2. Use of the Radiation Safety Logbook and all required records for each isotope used, including the required daily, weekly, monthly and quarterly surveys.
3. Proper swipe techniques, LSC and/or survey meter use and conversion of counts to disintegrations and disintegrations to activity.
4. Location of all storage areas and any special precautions (including shielding).
5. Location of all work areas and any special precautions (including shielding).
6. Proper waste disposal for isotopes used.
7. Radiation Safety training specific to the protocols being used.
8. Site specific emergency response procedures

Machine Permit Holders shall provide and document instruction to their staff in the use of specific radiation-generating machines and appropriate safety measures. Topics should include the following:

1. Radiation safety considerations for specific equipment in the laboratory;

2. Use and maintenance of the Radiation Safety Logbook and all the required records;

3. Proper survey techniques and documentation requirements;

4. Location of designated dye/stain work and storage areas, and the special safety requirements for those areas;

5. Proper disposal of stain and dye waste,

All use-specific training conducted by the Permit Holder shall be documented on the Record of Research-Specific Training, and a copy maintained in the Permit Holder's Radiation Safety Logbook. This form requires the following information:

1. List of topics covered (including any identified by the RSO);
2. Time spent on each topic;
3. Names and SSN for each student;
4. Date and location of training;
5. Written evaluations of the sessions; and
6. Training aids used.

Supervision. Individuals who work with radiation under authorized Permit Holders are considered to be under the supervision of the Permit Holders. The Permit Holder is responsible for:

1. Ensuring that such individuals receive training as described above.
2. Requiring that supervised individuals follow the instructions of the Permit and the procedures established by the Radiation Safety Committee.
3. Ensuring that personnel are working within the limits of the Permit Holder's authorizations, and are maintaining proper records regarding the use of radiation under the permit.

4. Taking appropriate and timely corrective actions should items of non-compliance occur. Such actions must include steps to prevent reoccurrence.

Permit Holders are reminded that, as supervisors, they are responsible for the actions of the individuals they supervise.

Rights of Radiation Workers at Oakland University

- The University must give you a written report if you receive an exposure in excess of any applicable limit as set forth in Nuclear Regulatory Commission (NRC) regulations or Oakland University's license.

- If you request it, the University must give you a written report of your radiation exposure upon termination of your employment (or work with radioactive material).

- If you request it, the University must advise you annually of your quantitative exposure to radiation.

- If you were provided with personnel monitoring while at Oakland University, the University must provide a written report to you of your personal exposure, or (with your written permission) to your new employer within 30 days after receiving your request for such a report.

- If you have any questions regarding the safe use of radiation or radioactive material at Oakland University, you are encouraged to contact your supervisor and/or the Radiation Safety Officer. Contact these people first, in the interest of obtaining prompt effective resolution of your concerns.

- If you believe that there has been a violation of NRC regulations, or the conditions of the University's radioactive materials license, you may request that the NRC conduct an inspection. Any such request to the NRC must be in writing, must state the specific ground for the request, and must be signed. The NRC will provide a copy of the request to the University. If you request, the NRC will delete your name from any report that it prepares and will respect your request for confidentiality.

- Oakland University may not discharge you or in any manner discriminate against you, because you have filed a complaint with the NRC.

- You may contact a representative of the NRC by telephone to discuss complaints or concerns you have regarding radiological working conditions or other matters regarding compliance with NRC rules and regulations.

- If your work involves radiation or radioactive material regulated by the State of Michigan (versus the NRC), you should be aware that the State has established rules that are essentially identical to those of the NRC.

Procurement and Transfer of Radioisotopes or Radiation Machines

General

No radioactive materials or equipment producing ionizing radiation shall be brought into Oakland University except through the procedures listed below or by special and written arrangements that have received prior approval by the Radiation Safety Committee.

Only an authorized Permit Holder may procure radioactive material. 'Procurement' means purchase, receipt by transfer from another laboratory, receipt from outside the University as a gift or demonstration sample, or any other receipt of radioactive material regardless of whether monetary transaction is involved.

Procurement Procedures

The Radiation Safety Officer must give written approval before shipments of radioactive material or a radiation-generating machine leaves its point of origin.

Faculty members or principal investigators are required to give the Radiation Safety Officer a properly completed Purchase Order Requisition, including the vendor name, catalogue number, radioisotope, chemical form, machine description and operating parameters (if applicable), and activity of material being ordered.

All requisitions must indicate delivery to:

Domenico Luongo, Radiation Safety Officer
30 A SEB
Oakland University
Rochester, MI 48309-4401
ATTN: (*Authorized User/Laboratory Office Phone Number*)

The RSO will check to ensure that the requested materials and quantities are authorized for use by the investigator, and that the possession limits for the investigator and OU are not exceeded. The RSO will maintain written records of this information.

Upon RSO approval, the Oakland University Purchasing Department will assign a Purchase Order Number.

The PI named on the User Permit maintains procurement records. Packages bearing the name of an individual other than the Permit Holder (e.g., a laboratory tech, co-worker, etc.) may encounter significant delays in delivery, because the RSO cannot accurately identify the proper intended recipient.

Receipt of Radioactive Materials

All incoming radioactive materials must be delivered to the Radiation Safety Officer. No materials may be transported by private vehicle. Only authorized commercial transporters may be used.

Upon shipment receipt, and prior to internal swipe testing for contamination, the RSO shall compare the packing slip to the written records described above. If the invoice matches the order, the package will be opened and tested for contamination.

The Permit holder will then be notified to pick up the material. For unusual situations, alternate shipping arrangements may be discussed with the Radiation Safety Officer.

Transfer of Isotopes

Inter-laboratory transfer of radioisotopes at Oakland University is permissible only after approval is obtained from the Radiation Safety Officer.

Inventory of Radioisotopes

Permit Holders are required to maintain accurate and up-to-date inventories of their radioactive materials at all times (including all radioactive material that is being stored for later use or accumulated as waste). Such inventories must include tracking of storage vials and containers to ensure adequate security.

The Radiation Safety Office maintains an inventory of all radioactive materials ordered at Oakland University. Quarterly reports are required from each Permit Holder summarizing the receipt, use, disposal and transfer of radioactive materials. Copies of these reports are maintained in the Radiation Safety Office; originals are kept in the Radiation Safety Logbook.

Instructions for Opening Radioisotope Packages

The procedures detailed in this section are a condition of the U.S. Nuclear Regulatory Commission license issued to Oakland University and as such are to be followed by ALL users of radioactive material for EVERY radioactive package received.

General Procedures

1. Film badges must be worn during all operations involving gamma or energetic beta emitters, and finger rings are required for work with gamma emitters or millicurie quantities of an energetic beta emitter.

2. Disposable gloves and laboratory coats must be worn when opening radioactive packages.

3. Packages containing radioactive material must be opened and inspected as soon as possible after receipt. Improperly packaged materials may gradually leak. Notify the RSO immediately if a vial is leaking or contaminated.

4. Contamination surveys of packages are to be conducted using a liquid scintillation counter.

5. Records of the survey results must be maintained in the Radiation Safety Logbook.

Specific Package Opening/Inspection Procedures

Definitions used in this section: The "**outer container**" means the cardboard box or other shipping container in which the radioactive material is shipped from the manufacturer. The "**source holder**" means the inner package (usually a lead pig, aluminum canister, plastic sleeve, etc.) in which the "**source**" container (the vial or bottle containing the radioactive material) is placed.

A. The RSO or designee shall:

   1. Provide ample workspace with provisions for placing the source holder, such that it will not affect the monitoring instrumentation's background.

   2. Visually inspect the unopened package for evidence of apparent damage or leakage.

   3. Open the outer container and remove the packing slip, check it for contamination and place it in a 'clean area' (if no contamination is found), and check it against the purchase order.

   4. Remove packaging material and immediately check material for contamination.

   5. Remove the source holder from the outer container. Swipe the unopened source container and monitor the swipe for contamination.

Caution: When handling the source container, all operations shall be performed in a containment that will avoid loss of contents in the event the container escapes from fingers, tongs, or other holding devices.

6. Remove the source holder from the package, remove the source container, quickly check the final source container for leakage or breakage of seals, and check the label to verify that the contents agree with the packing slip.

7. Swipe the outside of the source container and monitor the swipe to check for contamination.

8. If contaminated, replace the source container back into the source holder and contact the vendor.

9. Replace the source holder, the packaging and a copy of the packing slip, and notify the Permit Holder to pick up the package from the Radiation Safety Officer or deliver the package directly to the Permit Holder.

B. Immediately after returning to the lab, the Permit Holder shall:

1. Place the final source container in the appropriate storage area.

2. Remove or obliterate all radiation symbols and radioactive material labels from the empty outer container and discard as normal waste,

3. Remove gloves and dispose of them as radioactive waste and then monitor your hands to confirm that they have not been contaminated.

4. Log the contents of the package (date received, nuclide, activity, chemical form, purchase order number, etc.), and the date and time the swipe test was completed into the radionuclide inventory record in the designated section of the Permit Holder's Radiation Safety Logbook.

Security of Radioactive Materials

It is absolutely imperative that radioactive material be used and stored in a manner consistent with all regulations and internal Oakland University procedures, particularly with regard to security against unauthorized access, theft, or malicious use. Malicious use of radioactive material is a Federal crime; suspected criminal activity involving radioactive materials at Oakland University will be fully investigated and perpetrators will be prosecuted.

The following rules apply to any quantity of radioactive material:

1. All containers and/or storage devices used for radioactive material must be labeled with appropriate radiation warning labels.
2. All radioactive material storage devices (refrigerators, freezers, cabinets, etc.) which are in accessible areas (hallways, common equipment rooms, open laboratories, etc.) must be equipped with locks. Further, all such devices must be kept locked at all times when unsupervised by authorized personnel. Control of keys or access to combinations for locks on such devices is limited to authorize Permit Holders or designated Radiation Proctors. Shared storage compartments must have every container clearly labeled with a radioactive material label, name of the principal investigator, phone number, and location of persons having control of the locks.
3. All entrances to rooms where radioactive material is present, and not under the immediate and direct control of authorized persons for any length of time (even a few seconds) must be closed and locked.
4. Authorized personnel present where radioactive materials are being used or stored are expected to take all reasonable steps to ensure that unauthorized personnel do not access radioactive material. This means maintaining adequate vigilance of untrained or unauthorized personnel who enter a radioactive material area, questioning or challenging such persons about their presence, and notifying Oakland University Police or the Radiation Safety Officer if necessary.
5. Any radioactive material found missing for any reason must be immediately reported to the Radiation Safety Officer.
6. Any unsecured radioactive material, storage devices or laboratories are also to be immediately reported to the Radiation Safety Officer.

   Persons trained to handle radioisotopes may remove unsecured radioactive material from accessible areas to secure locations. Untrained personnel should attempt to keep the radioactive material under observation to prevent unauthorized access or removal until trained personnel can respond, but they should not handle the material themselves.
7. Unsecured radioactive material found by Radiation Safety personnel will be confiscated or otherwise immediately secured.

Disposal of Radioactive Waste

Oakland University Permit Holders are allowed to dispose of water soluble/dispersible ^{3}H, ^{14}C and ^{32}P radioactive waste by way of the sewer system, but the amounts are tightly regulated. ^{3}H and ^{14}C must be diluted (1 gallon of water per 185 μCi) to < 0.05 μCi/ml prior to drain disposal. Only very limited amounts of activity may be disposed of in this manner (< 1 Ci per year of all isotopes combined used at Oakland University). Investigators must indicate on their Usage Permit Application the maximum activity of each isotope that will be disposed by drain in their laboratories, both daily and annually. Disposal limits will be determined by the RSC. If a User Permit is issued for such disposal, the Permit Holder must maintain a log of daily drain disposal in the Radiation Safety Logbook.

If drain disposal is not appropriate, isotopes which have half-lives that allow for ten-half-life decay within 3 years will be temporarily stored for decay and then disposed of.

Isotopes with longer half-lives (^{14}C, ^{3}H, ^{45}Ca, ^{22}Na, ^{36}Cl, ^{63}Ni, ^{75}Se) are stored as low-level radioactive waste prior to shipment to a disposal site.
Scintillation cocktail contaminated with ^{3}H and/or ^{14}C at a specific activity of <0.05 μCi/ml and may be disposed of without regard to the radioactive contamination. Washed or rinsed plastic or glass vials are also considered non-radioactive and may be thrown into the regular trash. Investigators are encouraged to dispose of water-soluble scintillation counting media containing only ^{3}H and/or ^{14}C in concentrations of <0.05 μCi/ml down the drain. Investigators may also dispose of animal tissue containing only ^{3}H and ^{14}C in concentrations of <0.05 μCi/g as non-radioactive waste. Animal tissue must be disposed of so that it cannot be used as food for humans or as animal feed. Proper records must be kept showing the receipt, transfer and disposal of these materials on the forms provided in the Radiation Safety Logbook.

Waste must be packaged in a suitable manner to prevent spills and injuries. Syringes, pipette tips, glass, hard plastic and any other sharp capable of puncturing a plastic bag must be packaged in a rigid-walled container. Empty scintillation vials will only be accepted in sealed plastic pails or boxed upright in the original trays. Thin-walled consumer bottles (pop or milk bottles with labels defaced or removed) are excellent for pipette tip disposal, but are not acceptable for liquid waste. Glass bottles are not acceptable for waste disposal. Thick-walled consumer bottles may be used for liquid disposal after the original label has been completely defaced or removed. All items must bear radioactive material labels visible from all sides of the item.

All items of radioactive waste must be clearly labeled with the Permit Holder's name, radioisotope, activity, assay date, and liquid waste chemical composition. Pathogenic material must be deactivated with bleach (non-radioiodine waste) or formalin (radioiodine waste) before delivery to the Radiation Safety Officer.

The Use of Radioactive Materials in Animals

(At this time no experiments are permitted by Oakland University's Materials License that require housing of radioactive animals. See RSO for details.)
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Instructions to Personnel Handling Radioiodine

(At this time no experiments using unbound radioiodine are permitted by Oakland University's Materials License. See RSO for details.)

Emergency Procedures

General.

Where danger of contamination exists, suitable personal protective is mandatory. Workers must be thoroughly familiar with the location of telephones, exits, and all available safety devices.

Injury or Medical Emergency

1. Assist people first in the event of a medical emergency involving radioisotopes, without regard to possible radioactive contamination. The potential harm that may come to a person requiring assistance will certainly far exceed any radiation risk to an emergency responder. Contact the Oakland University Police immediately (911), and request medical attention. The Radiation Safety Officer along with the assistance of the Graham Health Center Clinic will decide if special treatment or hospitalization is required.

   If a person is contaminated and requires emergency medical care or hospitalization, contact William Beaumont hospital emergency room at (248) **551–5000** and tell the dispatcher that the incoming patient is contaminated with radioactivity. Be prepared to provide information about the radionuclide of contamination, approximate activity, and any additional chemical or pathogenic hazards involved.

2. Report all radiation-related incidents (wounds, possible high exposure, ingestion, or inhalation) to the RSO as soon as possible.

3. Strictly control the contaminated area. Take steps to minimize spread of contamination. Post any necessary warning sign or labels. Monitor personnel for contamination and monitor the area to locate the contamination. Lock the room if you must leave the area.

4. No person involved in a radiation incident requiring hospitalization shall be permitted to return to work without the approval of the Radiation Safety Officer and the Graham Health Center physician.

5. Follow procedures below for type of emergency encountered.

6. Prepare a complete history of the accident and response for review by the Radiation Safety Committee.

Spills of radioactive materials

Major spills (> 1 mCi, or any quantity of radioactive vapor, powder or gas):

1. Prevent the spread of contamination.

2. Notify all persons not involved in the spill to vacate the room.

3. Begin minor personnel decontamination techniques. Wait for assistance if major personnel decontamination is required.

4. Discard contaminated clothing by placing in a plastic bag labeled with radioactive stickers.

5. Switch off all fans.

6. Notify the Radiation Safety Officer.

7. Vacate and lock laboratory if significant airborne contamination exists, otherwise stay in the area and wait for the Radiation Safety Officer.

The Radiation Safety Officer is responsible for supervising the remaining steps.

8. Decontamination of personnel involved, as necessary.

9. Decontaminate area until activity does not exceed 1000 dpm/cm^2. It is recommended that decontamination continue until background levels are reached. Personnel involved in decontamination must wear appropriate personal protective equipment.

10. Survey all persons involved in the spill and clean–up to determine adequacy of decontamination.

11. Survey the spill area after clean–up to determine adequacy of decontamination.

12. No person shall be permitted to resume work until a radiation survey has been completed, and the area shown to be free of contamination.

13. Prepare a complete history of the accident and response for review by the Radiation Safety Committee.

Minor spills (< 1 mCi):

1 Prevent the spread of contamination.

2 Notify all persons in the room of the spill.

3 Persons who are not contaminated or assisting with cleanup should leave the spill area.

4 Liquid spills: While wearing protective gloves, drop absorbent paper onto the spill.

5 Dry spills: While wearing protective gloves, pick up contaminated radioactive material.

6 Immediately notify the Radiation Safety Officer if personal contamination has occurred.

The Radiation Safety Officer is responsible for supervising the remaining steps.

7. Decontaminate personnel involved, as necessary.

8. Decontaminate area until activity does not exceed 1000 dpm/cm^2. It is recommended that decontamination continue until background levels are reached. Personnel involved in decontamination must wear appropriate personal protective equipment.

9. Survey all persons involved in the spill and clean–up to determine adequacy of decontamination.

10. Survey the spill area after clean–up to determine adequacy of decontamination.

11. No person shall be permitted to resume work until a radiation survey has been completed, and the area shown to be free of contamination.

12. Prepare a complete history of the accident and response for review by the Radiation Safety Committee.

Personal Decontamination Protocol for energetic emitters.

1. Identify zone of contamination with a survey meter and note the cpm.
2. Decontamination of intact skin
    a. Using a mild soap, (Do not use Rad Con or other decontaminating agents unless specifically designed for use on skin) lather up the contaminated area by gently rubbing the skin. Apply water as needed to maintain the lathering for 3 minutes.
    b. Rinse well with lukewarm water, collecting contaminated rinse in a container.
    c. Repeat steps a. and b. above along with a soft scrub brush if necessary. Be

careful not to abrade the skin.
   d. Discontinue decontamination procedures when no contamination is detected.
   e. Contact the RSO to report the skin contamination and request assistance if decontamination procedures are unsuccessful.
3. Decontamination of wounds should be supervised by a physician.

Fires or explosions involving radioactive materials

The first priorities in fires or explosion are to rescue people; prevent and/or treat injuries; and extinguish fires. Immediate radiological hazards are of secondary importance.

1. Alert all personnel in immediate danger.

2. Report fire immediately regardless of size:

   a) Activate the nearest fire alarm.

   b) Contact the University Police by dialing 911 on any campus business phone. Cell phones or pay phones must dial (248) 370-3331 to reach the police dispatcher. Inform the dispatcher of the building involved, the floor, the room, the kind (or source) of fire, and the caller's name and phone number.

3. Extinguish manageable fires, if possible, otherwise leave the area immediately, close the door and wait for assistance. A typical Oakland University fire extinguisher contains approximately 30 seconds of charge. Only use a fire extinguisher when the fire is small in size; otherwise vacate the area immediately.

4. Notify the Radiation Safety Officer at once.

5. Subsequent fire fighting or other emergency activities shall be governed by the instructions of the Radiation Safety Officer.

The Radiation Safety Officer is responsible for supervising the remaining steps.

6. Following the emergency, monitor the area to determine what protective devices shall be necessary for safe decontamination.

7. Decontaminate area until activity does not exceed 1000 dpm/cm^2. It is recommended that decontamination continue until background levels are reached. Personnel involved in decontamination must wear appropriate personal protective equipment.

8. Permit no persons to resume work until a radiation survey has been completed, and the area shown to be free of contamination.

9. Survey all persons involved in combating the emergency for contamination, and decontaminate as necessary.

10. Prepare a complete history of the accident and response for review by the Radiation

Safety Committee.

After Hours Emergencies

For any emergency situation involving radiation, Radiation Safety personnel may be reached by contacting Oakland University Police at 911.

Survey Meters

Requirements for Appropriate Survey meters

Survey meters must be available to personnel in any area where unsealed radioisotopes other than ^{3}H and ^{14}C are used. Pancake-type Geiger-Mueller detectors are recommended for all energetic emitters other than radioiodine. Low energy gamma scintillator detectors are required for radioiodine surveys. In some cases, multiple interchangeable probes or more than one meter may be required. In all cases, the meter must be calibrated with the probes that will be used and functioning properly.

Appropriate Calibration Procedures

The conditions of Oakland University's Radioactive Materials License require that all survey meters be calibrated annually, or whenever they are serviced or modified. Responsibility for ensuring that meters are calibrated rests with the Permit Holder, but the RSO can assist with shipment of meters to an authorized vendor. The current authorized vender for calibration of survey meters is NDL Organization, Inc.; 1000 Lower South Street; Peekskill, NY 10566; New York State Radioactive Materials License No. 1959-1422.

Geiger-Mueller and scintillation detectors must be specially calibrated against the radionuclide of interest to be accurately used as a dose-rate meter. Standard calibration will ensure the meter will reliably detect contamination, but the mR/hr scale will not be accurate unless the instrument has been specifically calibrated for dose measurements.

Requirements for Instrument Use

1. All personnel who work with energetic radioisotopes must know how to properly handle a survey meter, and when/where the use of a survey meter is appropriate.

2. When conducting an instrument survey, the operator must:

    a. Check the batteries.

    b. Check the instrument response to a known source of radiation.

    c. Remove dust cover from probe window.

    d. Determine background count rate.

    e. Hold the probe close to, but not touching, survey surface.

    f. Move the probe slowly over survey area.

    g. Watch the needle and listen to the audio response to detect contaminated areas.

    h. Record the survey results in the Logbook, even if no contamination is found.

Radioisotope Laboratory Monitoring

Oakland University's licensing agencies require that radiation monitoring be performed in all areas where radioactive substances are used or stored, and written records of these results must be carefully maintained.

The ultimate responsibility for the safe use of radioisotopes rests with the Permit Holder. The task of performing the actual monitoring operations may be delegated to any qualified individual; however, the customary designee would be the Radiation Proctor.

For common use laboratories or temporary storage areas, responsibility for conducting contamination surveys rests with the Research Unit Department Chair or Director.

Radiation monitoring is to be performed in all areas and on all laboratory equipment where radioisotopes or radioactive wastes are used or stored. This includes cabinets, refrigerators, freezers, workbenches, centrifuges cold rooms, etc., as well as the floors in the areas of interest. Each Permit Holder must include laboratory floor plans in the Radiation Logbook. Survey records must be labeled in such a manner as to specify the area each survey reading represents. Surveys must follow the monitoring frequency stated below and must be conducted for all areas identified on the swipe map submitted to the RSO.

Always assume the area being monitored is contaminated. Appropriate personal protective equipment must be worn while performing contamination surveys. The use of a double layer of gloves is recommended when performing swipe surveys.

Monitoring Frequency

Monitoring is to be performed as follows:

1. **Immediate monitoring is required** whenever radioactive contamination is suspected.

2. **Daily Surveys/End of Day (EOD)** are required to check for contamination in days in which licensed radioactive materials are handled and/or manipulated. Monitoring will follow the complete swipe/survey map that is part of the user's permit and documented promptly in the user's logbook. Surveys must be conducted as soon as possible after the conclusion of the experiment, use, or handling of radioactive materials. Any additional use of radioactive materials on the same day will require an additional EOD survey. In the event that more than one experiment/use are done simultaneously at the same laboratory, and one has concluded earlier, that worker will survey the specific work areas that he/she have used, and will leave the EOD survey to be performed by the individual who's experiment/use is still ongoing. In experiments that continue more than a day (by means of, e.g., overnight incubation of western blots) the EOD survey will be performed after the overnight incubation has been set.

3. **Weekly monitoring is** required for areas in which large quantities (>200 μCi at any one time) are used.

4. **Monthly monitoring** is required for areas in which only small quantities (<200 μCi at any one time) are used.

5. **"No Radioactive Material Use"** must be written in the survey log during weeks when licensed radioactive material has not been used. **No survey is required.** A survey will be required at the end of the month if any licensed radioactive materials are **stored** in the lab, including waste containers or stock vials.

6. **Radioactive Material Storage Areas** (Freezer, Refrigerator, Waste containers or Locker) containing radioactive stock vials or radioactive waste must be surveyed once a month.

7. **Immediate Monitoring** whenever contamination or a spill has occurred.

Survey Techniques

1. Surveys are conducted using an appropriate survey meter for energetic emitters or liquid scintillation counting (swipe, wipe or smear survey) for low-energy beta emitters. While a Geiger-Mueller detector is capable of detecting ^{35}S and ^{33}P, the use of swipe surveys for these radionuclides is recommended.

2. If contamination is found while performing an instrument survey, use the instrument to find the boundary of the contaminated area, and perform a swipe survey to determine if the contamination is fixed or removable. If the contamination is removable, decontaminate as appropriate. If the contamination is fixed, contact the Radiation Safety Officer for assistance.

3. Swipe tests are the best survey method for low-energy beta emitters, and the only way to detect ^{3}H or determine if a contamination is fixed or removable.

    a. The swipe media may be cloth, paper or cotton swab. Moisten the swipe with water or a mild solvent to facilitate removal of contamination.

    b. Thoroughly rub the area of interest with the swipe media. Large surfaces, such as bench tops, should be subdivided into smaller survey areas. Swipe at least 100 cm^2 of surface.

    c. Place each swipe in a separate liquid scintillation vial. Label each vial to show which survey area the swipe represents. Avoid cross-contamination of swipes.

    d. Count the swipes in an appropriate counting device. The counting system must be capable of detecting 200 dpm/100 cm^2. You must know the counting efficiency of your detection system for the isotope(s) in use.

    e. Record results in the Permit Holder's Radiation Safety Logbook, even if no contamination is found.

    f. All results must be recorded in microcuries (μCi) or disintegrations per minute (dpm).

4. All areas with removable contamination must be decontaminated to <1000 dpm/100 cm^2 as soon as possible after discovery.

5. All areas of contamination >10,000 dpm/cm^2 must be reported as soon as possible to the Radiation Safety Officer.

6. Records of surveys must be maintained in the Radiation Safety Logbook, to include the information listed in the following table.

1. Location, date, identification of equipment used including the serial number and pertinent counting efficiencies.

2. Name of person conducting the survey.

3. Drawing of area surveyed identifying relevant features, such as active waste and storage areas.

4. Measured activity keyed to locations on the drawing. Surveys requiring corrective action must be identified.

5. Corrective action taken in the case of contamination.

6. Measured activity levels after corrective action and any appropriate comments.

Personal Dosimeters

The following are Oakland University's procedures for evaluating external radiation exposures of individuals working with radioactive materials. The principal means of evaluating such exposures is the personal radiation dosimeter. Personal dosimeters do not serve as warning devices to indicate when one is being exposed, nor do they provide protection against radiation. The sole function of a radiation dosimeter is to document the exposure the wearer receives from work with radioactive materials. There are two types of radiation dosimeter used for exposure monitoring at Oakland University:

- **Body Badge** — Used to monitor energetic beta, gamma, x-ray and neutron exposures to the whole body.
- **Extremity (Ring) Badges** — Used to monitor gamma, x-ray and energetic beta exposures to the hands.

General Rules

1. Body badges are required for all persons working with gamma emitting nuclides or energetic beta emitters.
2. Ring badges are required for all persons handling gamma emitters or millicurie quantities of energetic beta emitters.
3. Dosimeters are to be stored, when not being worn, in areas where radioactive contamination or exposure is unlikely. Dosimeters should not be stored in areas where they will be exposed to excessive heat or sunlight.
4. Dosimeters are to be worn only by the person to which they are assigned.
5. Individuals must make certain that their names are visible through the open window of the badge holder. Any other orientation will result in an erroneous dose assessment.
6. Dosimeters are designed to monitor radiation exposures for the wearing period that begins with the date shown on the badge. All badges must be returned to the Radiation Safety Officer for processing promptly at the end of each wearing cycle, even if the badges were not worn during that cycle. Permit Holders who fail to return dosimeters by the return date will be required to pay a late fee to cover additional handling and processing charges.
7. Dosimeters provide a legal record of occupational radiation exposure that is reportable to regulatory agencies. Dosimeters must not to be worn for any reason outside of work. Report accidental non-occupational exposure of a dosimeter (such as a medical or dental x-ray) to the RSO immediately. Intentional overexposure, contamination, or non-occupational exposure of a radiation dosimeter will result in serious consequences to the individuals involved.
8. Dosimeters that have been lost, damaged, or accidentally contaminated with radioactive material should be reported to the Radiation Safety Officer immediately. Failure to receive a new dosimeter should also be reported to the RSO.
9. It is the right and responsibility of monitored radiation workers to track their

exposure history in order to keep exposure ALARA. Dosimetry records are kept in the office of the Radiation Safety Officer. Any employee whose measured occupational exposure exceeds 10% of an applicable regulatory limit (i.e., 500 mRem for the badge and 5,000 mRem for the ring) will be notified in writing, with a copy to the permit holder (P.I.). The P.I with the RSO will then look into the possible causes for the exposure and determine whether there is a need to modify existing practices. The P.I. will submit a written response including the results of the investigation to the RSO within two weeks of the RSO's notice.

Unsafe Laboratory Practices and Radiation Safety Violations

The Radiation Safety Program at Oakland University is responsible for the health and safety of all persons using radiation at our institution and is the authority on campus for setting guidelines and dealing with infractions and violations. Excellent communication between Permit Holders and the Committee, principally through the Radiation Safety Officer, is essential for success. To this end, the guidance below has been developed by the Committee, acknowledging user concerns expressed in a series of open meetings. The Committee's goal has been to develop an explicit hierarchy of risk-levels associated with radiation laboratory practice, while permitting flexible and timely responses to incidents which may arise.

The Radiation Safety Committee has the responsibility to verify that all regulations concerning use of radioactive materials at Oakland University are followed. This policy provides guidance to the Radiation Safety Officer when dealing with situations where violations of NRC, State or University regulations occur and/or health hazards are presented. This policy also serves to notify Permit Holders of required actions when unsafe laboratory practices or radiation safety violations occur. The violations levels designated below will be assigned a point system to assist in determining the appropriate action to be followed by the RSO, RSC chair and the RSC. Violations are classified into five levels of severity, from light to heavy as follows:

1. ***Level 1*** violations are bookkeeping or documentation errors or other minor infractions that do not pose a potential health hazard or violation of university's licenses or registrations to use radiation. When Level 1 violations are identified, the following action will be initiated:

    a. RSO will inform the Permit Holder of the Violation.

    b. RSO will document the violation in a logbook.

    c. The Permit Holder is expected to take corrective action

    d. Violations will not be carried over to the next calendar year.

    Examples of Level 1 violations include the following:

    i. Incomplete documentation of contamination or direct radiation surveys.

    ii. Failure to perform one contamination survey at the required frequency.

iii. Single incident of inadequate or improper records.

iv. Single incident of failure to maintain posted documents up-to-date, e.g., radiation precaution signs, lab diagrams, etc.

v. Poor laboratory housekeeping practices.

vi. Failure to return film badges/finger rings on a timely basis.

vii. Loss of film badges/finger rings and/or reporting same to RSO

2. ***Level 2*** violations are laboratory practices that pose minor health risks or deviations from radiation safety program requirements. When Level 2 violations are identified, the following action will be initiated:

   a. Written notice of violation will be issued by the RSO to the permit holder with a copy sent to the RSC chair. The RSO will include the incident in his/her quarterly report to the RSC.

   b. Permit Holder must respond to the written notice within ***one week***.

   c. Increased surveillance

   d. Eight (8) points will be assessed for each Level 2 violation.

   e. The points are kept for a rolling calendar year- 12 month after the date of the violation. Afterwards, 50% of the points are carried over to the next rolling year.

   f. Examples of Level 2 violations include the following:

      i. Repeated violations at level 1 in one rolling calendar year.

      ii. Multiple violations at level 1, indicating lack of due diligence.

      iii. Failure to employ radiation safety procedures approved by the RSC and specified in the Permit Holder Application to use Radiation (e.g., utilization of protective clothing, equipment etc).

      iv. Transfer of radioactive material between Permit Holders without proper authorization of the RSO.

      v. Failure to label radioactive waste containers or equipment and/or improper storage of radioactive waste.

3. ***Level 3*** violations are laboratory practices which pose potential health hazards. The actions described below for Level 3 violations will also be enforced for repeated violations at Level 2 that result in a point total greater than or equal to

20 points. When Level 3 violations are identified, the following action will be initiated:

a. Written notice of violation will be issued by the RSO to the permit holder with a copy sent to the RSC chair, and the department chair. The RSO will include the incident in his/her quarterly report to the RSC.

b. Permit Holder must respond to the written notice within ***one week***.

c. Additional training

d. Increased surveillance

e. Repeated violations at level 3 can lead to suspension of the permit to use radiation.

f. Twenty (20) points will be assessed for each Level 3 violation. The points are kept for a rolling calendar year- 12 month after the date of the violation. Afterwards, 50% of the points are carried over to the next rolling year

g. Examples of Level 3 violations include the following:

i. Eating, drinking, smoking, the application of cosmetics, and/or the storage of consumable items in areas designated for radionuclide use.

ii. Incidental utilization of radionuclides in laboratory facilities that have not been approved by the RSO/RSC.

iii. Failure to provide adequate security measures designed to prevent unauthorized removal of radioactive materials.

iv. Failure to utilize required personnel monitoring devices or failure to comply with bioassay requirements.

v. Repeated negligence of personal protective equipment.

vi. Failure to transfer radionuclide waste from generating laboratory to the central storage area in a timely manner.

vii. Failure to notify RSO of contaminated film badges/finger rings.

4. ***Level 4*** violations are laboratory practices involving radiation, which pose an immediate risk to health, safety or the environment, but are not reportable to regulatory agencies. Level 4 violations also include any violation that could jeopardize the university's materials license. The actions described below for Level 4 violations will also be enforced for repeated violations at Level 2 – 3 that result in a point total greater than or equal to 50 points. When Level 4 violations are identified, the following action will be initiated:

a. The RSO will deliver a written notice of temporary suspension to the permit holder within 24 hours of identifying the violation with a copy to the RSC chair and the department chair. Upon receipt of the suspension notice, the P.I. will not initiate any new radiation experiments. Barring any health, safety or regulatory concerns, the P.I. may request a stay in the suspension from the RSO so that ongoing experiments can be concluded at a time that will not jeopardize research or radiation safety. The RSO will include the incident in his/her quarterly report to the RSC.

b. Permit Holder must respond to the written notice within one week.

c. Temporary suspension will be in effect pending review by RSC chair, RSO and permit holder. There is no specific time limit for this review but the parties will make an effort to make a recommendation as soon as possible. The review could result in extended suspension until full review by the RSC. In any case members of the RSC will be notified by the RSO that radioactive work by the P.I. in question has been temporarily suspended.

d. Additional training. Increased surveillance

e. Fifty (50) points will be assessed for each Level 4 violation. The points are kept for a rolling calendar year- 12 month after the date of the violation. Afterwards, 50% of the points are carried over to the next.

Examples are:

i. Utilization of radioactive materials by unauthorized individuals.

ii. Failure to initiate decontamination procedures when contamination levels greater than 1,000dpm/100cm2 are detected.

iii. Contamination levels in several areas in excess of acceptable levels as measured by the RSO. Note: This does not include contamination discovered in labeled bench areas while radioactive work is in progress, but will be included if the radioactive work has ended and surveys have been entered in the labs radiation log book.

iv. Failure to report Major Spills>1mCi, personal contamination or accidental X-ray machine exposures to the RSO.

v. Non-incidental utilization of radionuclides in laboratory facilities that have not been approved by the RSO/RSC.

vi. Contamination of public areas outside the laboratory at a level that is not reportable to the NRC

5. ***Level 5*** violations are the most severe. These violations pose an immediate risk to health, safety or the environment and must be reported to a regulatory agency (NRC or the State of Michigan). The actions described below for Level 5 violations will also be enforced for repeated violations at Level 2 – 4 that result

in a point total greater than or equal to 100 points. When Level 5 violations are identified, the following action will be initiated:

a. The RSO will immediately suspend all radioactive work pending RSC review.

b. A letter will be delivered to the P.I by the RSO describing the violation and actions with a copy to the RSC Chair, and the department Chair. Members of the RSC will be notified that radioactive work by the P.I. in question has been temporarily suspended.

c. All communications with the media will be through Oakland University Communication and Marketing department. When specific information is requested, the RSC Chair will prepare a factual written report for use of the Communication and Marketing department.

d. The P.I. will respond in writing within one week.

e. The P.I. will appear at an RSC meeting as part of an in-depth investigation of the violation(s). The RSC will deliberate the facts and decide on corrective action(s). The RSC may uphold the suspension, revoke the suspension or modify the point total according to the committee's findings. The RSO will include the incident in his/her quarterly report to the RSC.

f. One Hundred (100) points will be assessed for Level 5 violations. As long as there are 100 points the operations cannot resume. When the RSC approves resumption of operation the points can be reduced at the discretion of the RSC, for example a reduction to 50 for 12 months and then reduced to 50% of 50 points for the next rolling year.

g. Examples

    i. Exposure above the occupational limit

    ii. The release of a reportable quantity radioactive material, inside or outside of a restricted area

    iii. Serious deceptive practices which attempt to mislead or hide from the RSO and RSC actions involving radionuclides.

    iv. Multiple violations at lower levels accumulating 100 points or more.

Sources of Additional Information

- Your supervisor

- Oakland University Radiation Safety Officer — 370-4314

- Chair of the Radiation Safety Committee — 370-3555

- U.S. Nuclear Regulatory Commission (www.nrc.gov)
  U.S. NRC Region III
  2443 Warrenville Road
  Suite 210
  Lisle, Illinois 60532-4352
  Phone:(630) 829-9500
  Phone:(800) 522-3025

- Office of the Director
  Bureau of Radiological Health (HFX-1)
  Department of Health and Human Services
  5600 Fishers Lane
  Rockville, MD 20857
  Phone: (301) 443-4690

- Office of Radiation Programs (www.epa.gov)
  U.S. Environmental Protection Agency
  401 M Street, SW
  Washington, DC 20460
  Phone:(703) 557-9710

- Radiation Safety Section
  Michigan Department of Community Health
  P.O. Box 30664
  Lansing, Michigan 48909
  Phone: (517) 241-1989
  Fax: (517) 241-1981

Appendix A: NRC Instruction Concerning Risks From Occupational Radiation Exposure

NRC Regulatory Guide 8.29

Appendix B: NRC Instruction Concerning Prenatal Radiation Exposure

NRC Regulatory Guide 8.13