University of California, Merced
Environment, Health and Safety

Radiation Safety Manual

Approved by:

Signature:_____

Title:

Date:

TABLE OF CONTENTS

APPENDICES TO RADIATION SAFETY MANUAL

Appendix A - Emergencies Telephone Numbers

Appendix B - UC Merced Radioactive Materials License

Appendix C - Information Relating to Commonly Used Radioisotopes

Appendix D - Units and Conversion Factors

Appendix E - Instrument Efficiencies

Appendix F - Occupational Dose Limits

Appendix G - Training

G.1 New User Training Checklist
G.2 Safe Use of Radioisotopes
G.3 Prenatal Radiation Exposure
G.4 Risks from Occupational Radiation Exposure

1. Organization and Responsibilities

1.1 POLICY

The radiation safety program was established to assure that work with radioactive material is conducted in a safe manner, so as to protect health and minimize danger to property and the environment. Activities involving the use of radioactive material at the University of California Merced (UC Merced) shall be consistent with this policy.

This Radiation Safety Manual (RSM) sets forth UC Merced policy, organization, operating procedures and standards of conduct for the use of radioactive material such that compliance with regulations and procedures is ensured. All personnel using radioactive material are required to be familiar with and comply with the provisions of this document.

1.2 RADIATION SAFETY OFFICER

The UC Merced Radiation Safety Officer (RSO) is responsible for the radiation safety program; for assuring that the use of radioactive material is in conformity with UC Merced policies and with applicable governmental regulations.

The RSO is responsible for the maintenance of records pertinent to the UC Merced radiation safety program. These records are necessary to show compliance with government rules and regulations as well as UC Merced policies and include:

- Training held and attendance
- Radioactive package receipt and package surveys
- Site radioactive material inventory
- Radioactive material use and storage area surveys
- Radioactive waste disposal
- Instrument calibration
- Dosimetry and bioassay results

1.3 ALTERNATE RADIATION SAFETY OFFICER

The Alternate Radiation Safety Officer's appointment is based on experience in the use of radioactive material and knowledge of state and federal rules and regulations concerning the use of radioactive material. The Alternate RSO assumes the responsibilities of the RSO during the RSO's absence.

1.5 PRINCIPAL INVESTIGATORS

The Principal Investigators and other personnel authorized by the UC Merced Radioactive Material License are responsible for training personnel reporting to them and for ensuring that the UC Merced radiation safety policies and procedures are adhered to.

1.6 RADIATION USERS

Each person using radioactive material is responsible for following established radiation safety procedures, keeping their radiation exposures As Low As Reasonably Achievable (ALARA), and reporting any spill or suspected internal deposition to the RSO or the Alternate RSO.

2. LICENSES AND REGULATIONS

2.1 POLICY

UC Merced will obtain and maintain all necessary licenses and other required permits needed to fulfill its research goals.

2.2 LICENSES AND REGULATIONS

UC Merced has obtained a radioactive material license from the State of California Department of Health Services. This license describes radioactive material possession limits, use locations, authorized users, and other specifics pertaining to the use of radioactive material. Copies of the license, as well as state and federal regulations, may be obtained from the RSO or the Alternate RSO.

2.3 LICENSE AMENDMENTS

Amendments to the license must be obtained prior to the implementation of any of the following changes:

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- Use of radioisotopes not specified in the license.
- Need to exceed authorized possession limits.
- Use for purposes other than those authorized.

- Use at locations other than those authorized.

- Change in the RSO or Alternate RSO.

The license amendment must be obtained prior to the anticipated changes.

2.4 LICENSE TERMINATION

The license will be terminated if all work with radioactive material is stopped or if a site changes ownership.

The State of California Department of Health Services must be notified 30 days prior to termination of use together with a plan specifying and describing the termination survey of the site in question.

A report must be submitted to the licensing agency indicating that all radioactive material has been properly disposed of and that the site is free of fixed and/or removable radioactive contamination or decontaminated to the limits specified by the State Radiological Health Branch of the Department of Health Services.

3. TRAINING

3.1 POLICY

No individual may work with radioactive material, or frequent places where it is used or stored, until the individual has received appropriate radiation safety training. Training received must be commensurate with the degree of potential hazards to be encountered. Retraining will be provided annually.

3.2 TRAINING BY RSO

New personnel and personnel starting work with radioactive material at UC Merced must receive basic radiation safety orientation from the RSO or other qualified personnel approved by the RSO. This training must be documented.

The RSO is responsible for scheduling annual refresher training and documenting attendance. The RSO may present other training whenever warranted.

3.3 TRAINING BY PRINCIPAL INVESTIGATORS

The Principal Investigators are responsible for ensuring that each individual whom they supervise receives adequate initial training as well as additional training needed to safely perform the specific tasks assigned.

3.4 RADIATION USERS

Each individual working with radioactive materials is responsible for working within the limits of the training received.

It is the responsibility of each individual to seek additional information and training as warranted and as job assignments change.

4. ACQUISITION AND TRANSFER OF RADIOACTIVE MATERIAL

4.1 POLICY

Radioactive material must be acquired, transferred and disposed of in ways which ensure compliance with federal, state and local laws and regulations and UC Merced policies, while minimizing impedance of legitimate use.

4.2 ACQUISITION

Acquisition of any radioactive material must be approved by the RSO, the Alternate RSO or the Office of Environmental Health and Safety (EH&S).

Each package must be inspected to ensure that the material received is authorized in form and amount, has been properly contained, and is not contaminated by removable radioactivity. Results of this inspection are summarized on the Radioactive Material Receipt form. A copy of the completed form must be sent to the Office of EH&S.

4.3 INVENTORY

Each acquisition must be added to the radioactive material inventory maintained by each Principal Investigator.

The Office of EH&S will review and maintain an inventory for the entire site to ensure that the license possession limits are not exceeded

4.4 ON SITE TRANSFER

Unbreakable secondary containers must be used for transfer of labeled material within the facility.

4.5 OFF-SITE TRANSFER

A copy of the consignee's radioactive materials license must be on file with the Office of EH&S prior to any off-site shipment.

The Shipper's Certificate for Radioactive Material form must be completed and signed to ensure compliance with Department of Transportation (DOT) and/or International Air Transport Association (IATA) rules pertaining to packaging, labeling and contamination limits.

5. USE OF RADIOACTIVE MATERIAL

5.1 POLICY

Personnel using radioactive materials are responsible for handling them in such manner as to keep radiation exposure ALARA.

Handling procedures should minimize the potential for area contamination and environmental release.

5.2 AUTHORIZATION OF USE

The RSO or the Alternate RSO must be informed of all new studies involving the use of radioactive material.

The RSO or the Alternate RSO will review the proposed use with respect to safety, and the RSO will notify the Principal Investigator of the completion of the review and specify any additional safety requirements found to be necessary.

5.3 POSTING

Notice to Employees posters issued by the State of California Department of Health Services will be conspicuously posted in all buildings where radioactive materials are used of stored.

Each entryway to locations where radioactive material is used or stored must be posted with a Caution Radioactive Material sign.

5.4 LABELING

Each hood where radioactive material is used or stored must be labeled with a Caution Radioactive Material sign.

Each refrigerator and/or freezer where radioactive material is stored must be labeled with a Caution Radioactive Material sign.

Other equipment where radioactive material is used or stored must be labeled with a Caution Radioactive Material sign.

Any container holding, or contaminated with, radioactive material must be labeled with a Caution Radioactive Material sign.

Each transport container holding radioactive material for shipment must be labeled in accordance with DOT and/or IATA regulations.

5.5 SECURITY

Radioactive material must be stored in a secure manner minimizing the possibility of unauthorized removal.

5.6 SURVEY METERS

Functional portable survey meters with appropriate detectors must be present whenever more than 10 µCi of any radioisotope, except H-3, is used.

Each radiation survey meter must be calibrated at least annually and after undergoing repairs.

5.7 SURVEYS-MONITORING RECORDS

Facilities and equipment where more than 1 mCi is used per week must undergo a routine survey at least once each week. Laboratories using lesser amounts must be surveyed monthly.

A survey includes both swipes to detect removable contamination and direct readings via survey meter, where appropriate.

The RSO, the alternate RSO or the Office of EH&S must be notified if swipe readings exceed 200 DPM/100 cm^2.

A copy of the survey results must be forwarded to the Office of EH&S .

Special surveys may be required and/or performed by the RSO when conditions so warrant. These surveys must be documented and kept on file in the same manner as routine surveys.

5.8 HANDLING AND STORAGE

The following general guidelines must be observed for the handling and/or storage of radioactive material in laboratories:

- Eating, drinking, smoking, or application of cosmetics is not permitted.
- Edibles shall not be used or stored in posted refrigerators, freezers or areas where radioactive material is present.
- Containers or utensils previously used to store food or beverages shall not be used for storing radioactive materials.
- Protective gloves, lab coats, shoes and appropriate eye protection shall be worn while working with radioactive material.
- Radioactive material shall be used in areas covered with absorbent paper having an impervious backing or on trays.
- Liquids, including wastes, shall be stored in screw capped containers, placed in a secondary container capable of preventing contamination spread should the primary container leak or break.
- Work and storage areas as well as contaminated items shall be marked with "Caution Radioactive Material" labels.
- Appropriate portable survey instruments shall be on hand and operable when radioactive material is being used.
- Prior to leaving an area after the use of radioactive material, personnel shall survey themselves as well as the use area.
- Transfer of radioactive material between workstations shall be in leak proof unbreakable containers.
- A legible, accessible and up-to-date inventory shall be maintained by each laboratory.
- Use and storage areas as well as all containers used to store radioactive material will be labeled according to 10 CFR 20, Subpart J.
- All gamma emitters and high energy beta emitters will be stored in properly shielded containers.
- Remote handling tools will be used when appropriate to minimize extremity exposures.

- Appropriate dosimetry will be worn to monitor exposure to radiation when required by the guidelines specified in this Manual, see Section 7.3

- Mouth pipetting is prohibited

- Good housekeeping shall be practiced.

- Work with radioactive material will be in accordance with radiation safety operating and emergency procedures.

- Spills will be promptly cleaned according to emergency response procedures

- The Office of EH&S shall be notified immediately in case of a spill or personnel contamination exceeding 200 DPM/100 cm^2.

6. WASTE DISPOSAL

6.1 POLICY

Radioactive waste generated by UC Merced shall be disposed of according to license specifications, appropriate regulations and disposal site requirements. Waste minimization shall be practiced by all users of radioactive material.

6.2 STORAGE LOCATIONS

All radioactive waste shall be taken to the designated waste storage areas for disposal via a licensed radioactive waste vendor.

6.3 WASTE CATEGORIES

6.3.1 LSC VIALS

- LSC vials must be segregated by radioisotope and activity. Two containers are provided and labeled as follows: **H-3, C-14, P-32 and I-125 ONLY** and **S-35 and Ca-45 ONLY**.

- Only vials are placed in the container. **No plastic bags or cardboard trays are to be placed into the container.**

- Enter date, name, radioisotope and amount **in uCi** on the LSC vial waste log which is located by the container.

6.3.2 AQUEOUS LIQUIDS

- **No aqueous liquids may be disposed of via the sanitary sewer**

  - Aqueous liquids must be placed in unbreakable screw capped containers

  - The containers must be labeled and an appropriate entry must be placed in the aqueous waste log

6.3.3 MIXED WASTE

- Mixed waste is liquid waste that contains a radioactive compound plus a non-radioactive “hazardous” component such as an organic solvent.

- Contact the Office of EH&S for the disposal of mixed waste.

6.3.4 SHORT HALF-LIFE SOLIDS

- Short half-life radioisotopes have a half-life of less than 90 days .

- **Make sure each radioisotope is placed in a separate box.**

- Make sure there are no radiation warning signs or other hazard signs, such as “Biohazard”, on or in the waste.

- Make appropriate entry in the short half-life waste log.

6.3.5 LONG HALF-LIFE SOLIDS

- Long half-life solids have a half life in excess of 90 days

- Long half-life solids do need to be segregated by isotope

- Make appropriate entry in the long half-life radioactive waste log

6.3.6 CONTAMINATED OIL

- Contaminated pump oil must be disposed of as radioactive waste.
- Contact the Office of EH&S for disposal instructions.

6.3.7 BIOLOGICAL WASTE

- Biological waste consists of animals, tissue, blood, excreta and bedding.
- Contact the Office of EH&S for proper disposal of biological waste.

7. DOSIMETRY

7.1 POLICY

To maintain its commitment to ALARA, the radiation exposure of personnel working with radioactive material shall be monitored and appropriate actions initiated to minimize the potential for occupational exposure.

7.2 PREVIOUS DOSE ASSESSMENT

An assessment of radiation exposure received within the last three months will be made for all personnel starting work with radioactive materials.

7.3 EXTERNAL DOSIMETRY

A body badge as well as a finger ring shall be issued to personnel using high energy beta or gamma emitters if quantities in excess of 1 mCi are handled.

Dosimetry shall be exchanged on a quarterly basis.

7.4 BIOASSAY

Routine thyroid counting is required if an individual has handled more than 0.1 mCi of I-125 in a calendar quarter. Thyroid counting is performed every three months.

Special bioassays may be required and shall be prescribed by the RSO on a case-by-case basis.

Any person working with radioactive material may request a bioassay by contacting the Office of EH&S.

7.5 ACTION LEVELS

The RSO will investigate any radiation exposure exceeding 10% of the annual occupation dose limit. Any positive results will be transmitted to the individual involved.

The Office of EH&S will maintain records for external as well as internal exposure. These records may be sent to another licensee at the written request of the person to whom the dosimetry was assigned or who was on the bioassay program.

8. RADIATION INCIDENTS

8.1 POLICY

Radiation incidents and other abnormal situations involving radioactive material shall be handled so as to minimize actual, potential or perceived harm to personnel, equipment, facilities, research activities and the environment; to provide proper notification of authorities and to provide proper information to interested parties.

8.2 CLASSIFICATION

A reportable radiation incident is any situation requiring the notification of State or Federal agencies pursuant to Title 17 California Code of Regulations (CCR) paragraph 30295 or Title 10 of Code of Federal Regulations (CFR) 20.2201, 20.2202 and 20.2203.

There are three levels of incident severity requiring different notification schedules:

- Immediate notification is required under 10 CFR 20.201 (i) 20.2021 (ii) and 17 CCR 30295 (a).

- Twenty-four hour notification is required under 10 CFR 20.2202 (b) and 17 CCR 30295 (b).

- Thirty-day notification is required under 10 CFR 20.2203.

An event not requiring regulatory agency reporting is considered a non reportable radiation incident.

Classification of an event as a non-reportable radiation incident is at the discretion of the RSO. In general, non-reportable radiation incidents include:

- Abnormal bioassay or dosimetry results,

- Personnel contamination,

- Significant area contamination,

- Fires or other similar events in radiation use areas.

8.3 INCIDENT MANAGEMENT

8.3.1 Responsibilities of Involved Personnel:

In case of a spill or high-level contamination, the first individual recognizing the situation shall:

- Alert persons in the vicinity and keep people out of the affected area.

- Take steps to contain the contamination.

- Notify the PI and the Office of EH&S immediately.

- Attempt decontamination as directed by the Office of EH&S.

- Request that others possibly involved remain in the general area until released by the Office of EH&S.

- Resume work in the area after authorization by the Office of EH&S.

In case of internal or external contamination of an individual the first person recognizing the situation shall:

- Keep unnecessary personnel out of the affected area.

- Remove the individual from the contaminated location to a nearby clean area, if possible.

- If the individual is externally contaminated, remove any contaminated clothing and wash area with water. Do not use harsh chemical or physical agents.

- Notify the PI and the Office of EH&S immediately.

In the event of lost or stolen radioactive material, the first person recognizing the situation shall notify the Office of EH&S immediately.

In case of personnel injury, fire, flood or similar problems, notify the Office of EH&S immediately.

8.3.2 Responsibilities of the Office of EH&S:
Upon being notified of a suspected or verified radiation incident, or similar situation, the RSO or a qualified member of the Office of EH&S shall take charge of the radiological aspects of the situation and shall:

- Ensure that medical assistance is obtained without delay, if necessary.

- Arrange for a bioassay and/or send in dosimeters for processing, if necessary.

- Ensure that the Principal Investigator the RSO and the Vice Chancellor **of Research** are notified, if necessary.

- Perform necessary release surveys of persons and equipment from the affected area.

- Supervise the decontamination process and provide advice and assistance when necessary.

- Notify regulatory agencies, if necessary.

- Conduct an investigation, documenting findings and recommendations.

- Assure that required reports are prepared and arrange for their proper and timely distribution.

- Ensure that corrective and preventive plans are set forth and implemented.

8.3.3 Responsibilities of Principal Investigators:

Arrange for provision of personnel and equipment to decontaminate facilities and equipment under the supervision of a qualified member of the Office of EH&S.

Ensure repair, replacement or modification of equipment and facilities to prevent a recurrence of the incident.

Provide personnel training to prevent a recurrence of the incident.