

**California Polytechnic State University
San Luis Obispo**

Radiation Safety Manual

Reviewed, revised November 2018
Original: November 2016

1. ADMINISTRATIVE PROCEDURES AND RESPONSIBILITIES

The purpose of the Radiation Safety Program is to assure the safe use of ionizing radiation through training, consultation, and surveillance consistent with government regulations. The Radiation Safety Program will be reviewed for effectiveness on an annual basis. Records of audits, self-assessments, peer assessments, or similar review processes can be used singly or in combination to satisfy the annual review requirement.

Sources of radiation shall be secured from unauthorized removal or use through the use of locked storage. Locked storage includes safes, locking cabinets, or locked rooms or enclosures. Access to keys to radioactive materials storage is strictly controlled by the Radiation Safety Officer (RSO) or designated Authorized Users (see Section 2.2)

The California Polytechnic State University, San Luis Obispo, (hereinafter referred to as “CPSU”) Radiation Safety Manual sets the standards of operations for the Radiation Safety Program. This guide is prepared for Authorized Users as an aid in complying with the University’s License for use of radioactive materials.

Requests for records should be directed to:

California Polytechnic State University
Office of Environmental Health & Safety
Building 80
San Luis Obispo, CA 93407

2. DEFINITIONS

2.1. Radiation Safety Officer (RSO)

The Radiation Safety Officer (RSO) is responsible for the review of campus performance with respect to University and campus policies on radiation and radiation protection, and for informing management of program issues. The RSO is assigned the responsibility for surveillance of departmental activities and for providing services in radiation safety in conformity with policies and standards set forth in this manual. The RSO is part of the Department of Environmental Health and Safety. The RSO is responsible for all aspects of radiation control on the campus. Each application for use of radiation is reviewed and approved by the RSO. See Appendix A for the full duties of the RSO.

Radiation Safety Officer, Vivian Longacre, 805-756-6628 appointed 12/7/2016

2.2. Authorized User

The Authorized User is personally responsible for compliance with campus and governmental regulations as they pertain to the authorized use of ionizing radiation for the authorization they are issued. The Authorized User must be qualified by training and experience, as determined by the RSO. The Authorized User shall provide a copy of their Radiation Use Authorization (RUA) to each coworker and ensure that each person has received training appropriate to the level of operations carried out prior to the first use of radioactive materials or entry into areas restricted by the licensee to protect individuals from exposure to ionizing radiation. The Authorized Users must ensure that each individual on that RUA has read the appropriate sections of the Radiation

Safety Manual and their respective RUA.

Specific responsibilities include:

- A. Instructing all personnel listed on the Radiation Use Authorization (RUA), in good radiation safety practices prior to their entry into restricted areas including:
- B. Control and measurement of contamination.
- C. Proper use of protective clothing and equipment.
- D. Operating and emergency procedures specific to their tasks.
- E. Proper maintenance of records on receipt, use, transfer, and disposal.
- F. ALARA (as low as reasonably achievable) considerations and goals.
- G. Ensuring that only work authorized by the approved RUA is carried out.
- H. Ensuring that operations involving radioisotopes or radiation producing machines are performed by properly trained and authorized personnel.
- I. Maintaining records of receipt, transfer current inventory, and disposal of all radioactive materials.
- J. Maintaining records of radiation fields and contamination monitoring.
- K. Posting warning labels, guidelines, and other appropriate postings as requested by the Environmental Health and Safety Office.
- L. Notifying the Environmental Health and Safety Office of all changes in the RUA such as changes in location, personnel, experiments, etc.
- M. Notifying the Environmental Health and Safety Office immediately in the case of an accident involving radiation or potential excessive exposure.
- N. Ensuring the use of personnel dosimetry and survey instruments as applicable.

2.3. Audits or Reviews

Reviews of radioactive material use areas (e.g. laboratories, storage areas) should be performed at least annually by the RSO.

Radioactive material use areas that are considered part of a field study or a temporary work area should be assessed at least once while work is in progress.

2.4. Records

The records maintained by the Environmental Health and Safety Office are classified as First Class Records and are considered vital as stated in the CPSU Vital Records Protection Plan.

3. LICENSE REQUIREMENTS

3.1. University Broad Scope License

The University possesses a specific license of broad scope issued by the State of California, Department of Health Services in agreement with the U.S. Nuclear Regulatory Commission, which authorizes the use of radionuclides for education and research. The License can be reviewed at the Environmental Health and Safety Office. The License describes the possession limits for each radionuclide and location for use, and provides for the internal issuance of Radiation Use Authorizations (RUAs). The Environmental Health & Safety Office shall make requests for amendments to the License. Authorized activities, unless expressly noted otherwise, shall take place in facilities or on property owned or otherwise controlled by CPSU. Activities, such as field studies, shall be clearly identified so that additional, special controls can be specified.

3.2 RUA for Research Use

Application for RUA and a Statement of Training and Experience (RH 2050 A) are required. All completed applications and forms are to be submitted to the RSO. The application must include the following:

- A. All locations of use
- B. Names of individuals who will use the material
- C. Isotopes, activity per use, per order, possession limit for each
- D. Description of use
- E. Special hazards (ex. volatile or dispersible)
- F. Availability of safety equipment, such as shielding, ventilation equipment, survey meters etc.

3.3 RUAs for Classroom Use

RUAs are issued for the use of radioactive materials for teaching or demonstration in academic courses. Such applications shall be submitted for review and approval to the RSO at least two weeks prior to the commencement of the quarter in which radionuclide use is desired. An RUA must be renewed by the RSO if there is any change in the isotope, quantity, or procedures. The following information is required to supplement the standard RUA:

- A. Laboratory personnel in charge of the course/lab.
- B. Availability of safety equipment, such as shielding, ventilation equipment, survey meters etc.
- C. Number and type of monitoring instruments needed for routine use in the Laboratory.
- D. Descriptions of Proposed use and procedures for each isotope stated on the application, including:
- E. Radiation Safety instruction for students; and
- F. Extent to which students will be handling isotopes.

3.4 Submission of RUA Applications for Approval

The completed application shall be sent to the RSO who will evaluate the Statement of Training and Experience, hazards of the work, and safety protocols (see Section 3.6).

3.5 RSO Review

The RSO reviews the completed application form and conducts a detailed review of the proposed project. Normally this review includes a personal interview with the applicant and an inspection of the proposed workplace(s). Where applicable, the following specific factors are evaluated and recorded in a project analysis:

- Training and experience of the applicant and assistants.
- The radioisotope, its activity, and its chemical and physical form.
- Experimental protocol and specific methods for conducting the phase of the experiment involving radioactive materials or ionizing radiation.

Safety requirements for the RUA are set by the RSO, based on the evaluation (use of fume hoods or other effluent containment, use of shielding, dosimetry requirements, and special procedures). The workplace is evaluated with respect to:

- A. Storage facilities, security
- B. Hoods, glove boxes, other special equipment
- C. Effect of radiation use on surrounding areas
- D. Housekeeping levels in proposed areas
- E. Waste disposal
- F. Storage and labeling
- G. Environmental control:
- H. Monitoring methods, frequency, and records
- I. Radiation detection equipment
- J. ALARA: Appropriate quantities and procedures to keep occupational and public radiation doses as low as reasonably achievable

As part of the review, the RSO discusses campus radioactive waste-minimization methods and makes suggestions for waste reduction under the RUA. The user is provided information on the segregation, labeling, packaging, and pickup of radioactive wastes.

3.6 Approval of RUA

Prior to use of radionuclides all applications must be approved by the RSO. Hazard rating categories are based on the criteria listed below. All radiation safety costs shall be borne by the researcher. Such costs shall include:

- A. New construction or major alterations;
- B. Acquisition of special monitoring equipment;
- C. Off-campus waste disposal as determined by the Environmental Health and Safety Office.

RUAs are approved for 3 years.

3.7 Renewal of RUAs

The RUA will be renewed if work on the project is to be continued. A re-evaluation of the project will be performed by the RSO, with respect to the items listed in the initial evaluation and the compliance record.

3.8 Amendments to the RUA

All amendment requests must be submitted in writing to the RSO. Any change in personnel, protocols, locations, isotopes, or activities of the radionuclides used will require an amendment. An evaluation will be made per Section 3.5 and an amended RUA will be issued.

3.9 Termination of RUA

Any applicant found to be willfully or negligently violating any of the CPSU, State, or 10CFR30.10 of the NRC regulations governing the use of radionuclides may have their RUA suspended or revoked by the RSO, and any radionuclides in their possession will be transferred to the possession of the Radiation Safety Officer. The applicant has the right to appeal this decision. RUAs will ordinarily be terminated upon:

- A. completion of project;
- B. expiration of RUA without renewal.

Upon termination of an RUA, all radionuclides must be accounted for. Unused amounts must be transferred to another active RUA or disposed of as Radioactive Waste.

4. ACQUISITION, TRANSFERS, AND DISPOSAL

4.1 Procurement Policy

All purchases of radioactive materials shall be accomplished through established campus purchasing channels and with the approval of the Radiation Safety Officer and by the RSO.

4.2 Purchasing Procedure

Purchases shall only be initiated by the RSO. An email will be sent by the requestor at least 30 days of when the material is required to the Radiation Safety Officer. The email will include the following information:

- A. Indicate the identity, part number, vendor and amount of radioactive material desired.
- B. A copy of the RUA.
- C. Indicate any special instructions for shipping and handling.
- D. Indicate the account that the purchase will be charged to after it is received by Environmental Health and Safety (RSO).

Purchase endorsements will not be approved if the requested radionuclides and amounts are not identified on the RUA or if purchase of the requested radionuclide would exceed license-based possession limits as determined by the Radiation Safety Officer.

4.3 Delivery of Radionuclides

Receiving Procedures are as follows:

- A. Radioactive Materials are received at the CPSU warehouse and at the CPSU Corporation Receiving Department.
- B. Upon receipt of any radioactive materials bearing the U.S. Department of Transportation labels (White I or Yellow II or Yellow III) and, for Yellow 2 or Yellow 3 packages, a corresponding Transport Index (1 to 10), the RSO is notified.
- C. Within 3 hours of receipt during normal business hours or within 3 hours of the start of business when a package is received after normal working hours the Radiation Safety personnel perform a visual inspection of any labeled package to evaluate the condition of the shipping container and perform a radiation survey (reference 10CFR20.1906).
- D. Shipping receipts or bills of lading are checked to verify contents.
- E. The package is opened and the radioactive material is surveyed to determine radiation levels. The source is leak-tested if required and added to the campus inventory. The package is then delivered by the Radiation Safety Personnel to the user lab.
- F. Upon completion of checking the package containing radioactive material, the material then becomes the responsibility of the Authorized User. The Authorized User is responsible for the safe use and storage as required.
- G. Should any radioactive material arrive over the weekend or at night, the University Police are instructed to receive it unopened and place it in the Environmental Health and Safety Office until the RSO is notified.

4.4 Custody of Radioactive Materials

The users named on the RUA shall be continuously responsible for the custody of any radioactive material acquired under the RUA. They shall be responsible for the proper storage, labeling, inventory, accounting, use, and disposal of the material. The licensee shall also be responsible for documenting spills or mishaps that may be important in the formulation of

decommissioning plans.

4.5 All Shipments of Radioactive Material Must Be Specifically Approved by the RSO

All packaging and labeling of shipping containers must conform to the Department of Transportation regulations contained in 49CFR173 and any other appropriate regulations. The Environmental Health and Safety Office must be consulted for the appropriate regulations prior to shipping. After proper packaging and approval, shipments shall be made through the State Warehouse or the Foundation Warehouse Shipping and Receiving. Special arrangements may be made with the RSO where applicable control shipments are made by outside professional agencies or Institutes. Improper packaging, labeling, and certification can result in a monetary fine from the Department of Transportation as well as a citation from the State Department of Health Services.

4.6 Transfer of Radioactive Materials

Radioactive materials shall not be transferred from any person, department, or project to another without specific, prior approval of the RSO. This includes transfers to other licensees. A copy of the receiver's license to which transfer is being made must be reviewed prior to completing such a transaction. The shipping procedures shall comply with the Department of Transportation regulations.

4.7 Radioisotope Inventory

Inventory shall be determined once per year. For RUAs receiving material, the RSO will update the campus inventory before delivery. All RUA holders must keep proper inventory of radioactive material in their possession and report any change in inventory to the RSO.

4.8 Radioactive Waste Disposal Policy

All potentially contaminated material must be disposed of as radioactive waste.

Radioactive waste must be stored in approved containers and sealed prior to pickup by the Radiation Safety Staff. The following labeling will be used to comply with campus regulations:

- A. All containers must be labeled with a "Caution (or Danger)-Radioactive Materials" label indicating the isotope(s), amount (activity), and date of assay.
- B. Liquid waste containers shall additionally identify the chemical composition present.

The Authorized User is responsible for verifying the chemical compatibility of all solutions placed in the liquid waste container.

No Authorized User will be authorized by the RSO to generate radioactive waste unless provisions are in the research grant or department funding to pay for off campus waste disposal. See Section 4.11 on how to deal with off campus waste disposal.

4.9 Radioactive Waste Containers

ALL radioactive waste material shall be contained as follows:

- A. Dry Waste:
 1. All dry waste must be deposited in a two-cubic foot box or another container approved by the Environmental Health and Safety Office
 2. Each box must be lined with a clear plastic bag.
 3. Vials containing liquid are not to be discarded into the dry waste.
 4. Needles must be placed in an impermeable, approved sharps container prior to being

- placed into dry waste.
5. Short radiological half-life radionuclides (half-life of less than 90 days) shall be segregated.
 6. Radioactive labels shall be defaced prior to putting them in the dry waste.
- B. Aqueous Liquid Waste Only:** Absorbed liquid waste shall be put into 1 gallon jugs or other suitable intermediate containers approved by the Environmental Health and Safety Office. Short-life radionuclides with a physical half-life of less than 90 days shall be segregated.
- C. Scintillation Vials:** Full vials are to be placed in the original honeycomb containers in which they were received.
- D. Animal Carcasses:** Individual researchers shall have access to freezer storage for animal carcasses with the scheduled waste collection date. Notify the Environmental Health and Safety Office when you have animal carcasses for disposal. Special arrangements for disposal of large animal carcasses must be made with the Environmental Health and Safety Office prior to administering radioactive materials.

4.10 Disposition of Radioactive Waste

The Environmental Health and Safety personnel will pick up all waste. The containers must be properly labeled and sealed. Twenty-four (24) to forty-eight (48) hour notification should be given to allow time for pickup of containers. Modes of disposal may include:

- A. Disposal through the Sanitary Sewer:** Disposal of liquid radioactive waste through the sanitary sewer system is prohibited unless specifically approved by the RSO. If approved, the Authorized User shall limit the concentration of any radionuclide released to sewers to those values tabled in 10CFR20 Appendix B, Table 3. Releases will be intermittent batch releases and not continuous releases. Therefore, monthly averaging provisions are satisfied by assuming a default 5 gallons (18,926.5 ml) of dilution flush water is used per occasion. The activity of a radioactive waste approved for disposed by release to sewers shall be limited such that the following expression is satisfied:

10CFR20 App B, Table 3 value \geq μCi for release / 18926 ml

Example:

Phosphorus-32 Table 3 value = $9 \text{ E-}5 \mu\text{Ci/ml}$

Dilution flush water = 18926 ml

$X \mu\text{Ci} / 18926 = 9 \text{ E-}5 \mu\text{Ci/ml}$

Max activity = $9 \text{ E-}5 \mu\text{Ci/ml} * 18926 \text{ ml}$

Max activity = $1.7 \mu\text{Ci}$

Other dilution flush volumes may be prescribed at the discretion of the RSO.

- B. Disposal by Burial:** Disposal by burial on site is prohibited.
- C. Unusual Radioactive Waste Disposal Problems.** The RSO will assist in the development of disposal for unusual wastes or wastes with off-normal composition or configuration. The method must be developed and defined on the RUA.

4.11 Off Campus Waste Disposal

The Environmental Health & Safety Office will collect all radioactive waste from individual laboratories where waste is generated by the RUAs. These wastes shall be stored in the central Radioactive Waste Storage facility located at the Radiation Safety laboratory. The Radioactive Waste Storage Building is locked and only authorized personnel are allowed access. When stored radioactive waste accumulates enough to warrant off campus disposal, Environmental Health and Safety or an authorized Radioactive Waste contractor shall do the packaging and shipping.

Personnel involved in the packaging and transport of radioactive materials shall be trained in accordance with 49CFR – Subpart H -172.702. Training topics include the general provisions of the transportation regulations, identification of hazardous materials, specific requirements for radioactive material transport, emergency response information, self-protection measures and accident prevention methods.

If approved by the Radiation Safety Officer, byproduct material with a physical half-life of less than 120 days may be held for decay-in-storage before disposal without regard to its radioactivity if:

- A. Byproduct material is monitored at the surface before disposal and it is determined that the radioactivity cannot be distinguished from the background radiation level with an appropriate radiation detection survey meter set on its most sensitive scale and with no interposed shielding; and
- B. All radiation labels are obliterated or removed, except for radiation labels on materials that are within containers and that will be managed as biomedical waste after they have been released from the licensee.

A licensee shall retain a record of each disposal permitted under paragraph (A) of this section in accordance with 10 CFR35.2092.

The above specified determination and subsequent release of material from decay in storage will not be approved by the Radiation Safety Officer until a period equal to 10 times the longest radiological half-life of radioactive materials contained in the mixture has elapsed.

No RUA will be authorized by the RSO to generate radioactive waste unless provisions are in the research grant or department funding to pay for off campus waste disposal.

5. EXPOSURE STANDARDS AND DOSIMETRY

5.1 Radiation Exposure Goals

The California Polytechnic State University goal is to maintain human radiation exposure levels to as low as reasonably achievable (ALARA). The annual exposure limits for personnel over the age of 18 years are shown in table 5.1. Minors are not allowed to work with radioactive material unless special permission is given by the RSO (projected dose within limits for the general public)

Table 5.1 - Annual Limits

Total Effective Dose Equivalent (TEDE)	5 rem (0.05 Sv)
Sum of the Deep Dose (H_d) and Committed Dose Equivalent (CDE, H_{T-50}) to any Individual Organ or Tissue (except the lens of the eye)	50 rem (0.5 Sv)
Lens of the Eye (LDE)	15 rem (0.15 Sv)
Skin (Shallow Dose, H_s)	50 rem (0.5 Sv)
Extremities	50 rem (0.5 Sv)

The administrative goals for annual exposure are shown in table 5.2.

Table 5.2 - Administrative Goals for Annual Exposure

Total Effective Dose Equivalent (TEDE)	3 rem (0.03 Sv)
Sum of the Deep Dose (H_d) and Committed Dose Equivalent (CDE, H_{T-50}) to any Individual Organ or Tissue (except the lens of the eye)	10 rem (0.1 Sv)
Lens of the Eye (LDE)	5 rem (0.05 Sv)
Skin (Shallow Dose, H_s)	10 rem (0.1 Sv)
Extremities	10 rem (0.1 Sv)

The exposure limit for an embryo / fetus, due to tasks or activities performed by a declared pregnant woman shall not exceed 0.5 rem (500 milli-rem) during the entire pregnancy. The Radiation Safety Officer or Authorized User shall make efforts to avoid substantial variation above a uniform monthly exposure rate to a declared pregnant woman so as to satisfy the limit of 500 milli-rem.

The dose to an embryo/fetus shall be taken as the sum of:

- A. The deep-dose equivalent to the declared pregnant woman; and
- B. The dose to the embryo/fetus from radionuclides in the embryo/fetus and radionuclides in the declared pregnant woman.

If the dose to the embryo/fetus is found to have exceeded 0.5 rem (5 mSv), or is within 0.05 rem (0.5 mSv) of this dose, by the time the woman declares the pregnancy to the licensee, the licensee shall be deemed to be in compliance with paragraph (a) of this section if the additional dose to the embryo/fetus does not exceed 0.05 rem (0.5 mSv) during the remainder of the pregnancy. *The declaration of pregnancy by a female employee to the radiation safety officer is an individual choice of the employee.*

5.7 Dosimetry and Bioassay

Bioassay and other internal dose assessment techniques should be initiated in all cases where it is known or suspected that an individual has received an uptake of radioactive material in excess of 10% of the applicable Annual Limit on Intake (ALI) for any single radionuclide or mixture of radionuclides.

Likewise dosimetry will be issued if it is known or suspected that an individual will receive exposure in excess of 10 per cent of any limit. Typically dosimetry is issued for routine use of millicurie amounts of high-energy beta-gamma emitters, material or sealed sources. Any radiation worker may request dosimetry.

5.4 Personnel Exposure Records

Personnel exposure data shall be part of the permanent records of Environmental Health and Safety Office including Radiation Exposure Record (Form 10, 10A and/or 10B), TLD Ring Exposure Record (Form 11), and any related documents furnished by outside contractors for film badges and TLD rings. Upon written request by any employee or student, Environmental Health and Safety will provide a copy of the individual's exposure history. In addition, in any case where exposures of an individual to radiation must be reported to the NRC and/or the State Department of Health Services pursuant to regulations, such individuals will be notified in writing of the nature and extent of their exposure. Previous exposure history requirements and personnel notification of routine exposure will be followed according to State regulations.

5.5 Exposures

The RSO must be notified immediately if any person is known or suspected of receiving internal or external exposure to radiation in excess of the limits specified in table 5.1.

6. RADIATION PROTECTION REQUIREMENTS

6.1 Inventory of Radioactive Materials/Leak Tests

A central inventory of radioactive material on campus is maintained by the RSO. Each user must keep reasonable records of the amounts and kinds of radioactivity under his supervision so that the central inventory may be updated. The RSO or designee, in accordance with 17 CCR 30275, twice yearly on sources other than those listed in table 6.1, shall do leak tests of sealed sources.

Table 6.1 Sources Exempted From Twice Yearly Leak Testing

Tritium (H-3)
Krypton-85 (Kr-85)
Source Material
Sources containing radioactive material with a half life of 30 days or less
Sources of beta and/or gamma emitting radioactive material with an activity of 100 micro-curies or less
Sources of alpha and/or neutron emitting radioactive material with an activity of 10 micro-curies or less
Sources of beta and/or gamma emitting radioactive material which are not in use and which are securely stored and labeled as not to be used. These sources shall be leak tested prior to returning to service.

No source will be put into use unless it has been certified by the manufacturer as having passed a leak test or the Radiation Safety Officer has confirmed a leak test.

Contamination and leak tests shall be capable of determining the presence of 0.005 micro-curies of removable contamination.

6.2 Storage of Radioactive Materials

Radioactive materials shall be stored so as to prevent unauthorized access or removal from their place of storage. The Storage shall not create a “radiation area”(see below) and will be shielded or sealed to keep exposures as low as reasonably achievable.

6.3 Posting and Labeling

Rooms in which radioactive materials are used or stored shall be posted with a sign bearing the radiation symbol and “*caution (or danger)- radioactive material*”.

- A. **Areas** in which there exists a radiation level in excess of 5 milli-rem per hour shall be posted with a sign bearing the radiation symbol and “*caution (or danger)- radiation area*”.
- B. **Areas** in which there exists a radiation level in excess of 100 milli-rem in 1 hour at 30 centimeters (1 foot) shall be posted with a sign bearing the radiation symbol and “*caution (or danger)-high radiation area*”.
- C. **Containers** holding radioactive materials for storage or during processing and use shall be clearly labeled with a sign bearing the radiation symbol and “*caution (or danger)- radioactive material*”, and shall state the quantities and identify the isotope and the date.
- D. “Notice to Employees” State of California Form RH-2364 shall be posted permanently

and conspicuously in all areas where work with radioactive materials or radiation producing machines is being carried out.

6.4 Protective Clothing

Personnel working with open sources of radioisotopes must wear protective garments. Open-toed shoes and sandals are not permitted. The usual laboratory coat and disposal gloves are considered minimum fulfillment of this requirement. Persons working with greater than 1 mCi of an open source of radioactivity must cover their legs with pants or garment to protect them against absorption of radioactivity in the case spill. Additional protective garments may be required by the RSO. The RSO may grant exceptions.

6.5 Storage and Consumption of Food and Smoking

The storage and consumption of food and smoking are prohibited in locations authorized for the storage and use of radioactive materials except in designated “clean areas.” Upon the request of the Authorized User, clean areas will be posted by the Environmental Health and Safety Office after a critical evaluation of the potential for maintaining the area free of radioactive contamination.

Approval of the “clean area” will depend in part on the radioisotopes, amounts, physical forms as well as the types of operations being conducted.

Refrigerators used for storage of radioactive materials shall not be used for storage of food and beverages.

6.6 Personal Hygiene

Mouth pipetting is not permitted while working with radioactive materials. Personnel completing the manipulation of radioactive materials shall wash their hands thoroughly before leaving the laboratory.

6.7 General Monitoring

Immediately following the use of unsealed radioactive materials, personnel directly involved with the project shall monitor the work area and equipment for contamination and radiation fields. At minimum, wipe tests must be done once every month if work with unsealed radioactive material has been carried out. Clean up criteria (clean and retest) is 200 dpm/100 square centimeters. The results of radiological monitoring must be kept for subsequent review by the Radiation Safety Office and/or by the State Department of Health Services. Documented monitoring results may be required more frequently at the discretion of the RSO.

Some RUAs require the use of survey instruments. These instruments shall be continuously available for routine monitoring and for hazard surveys following a radiation incident. These instruments shall be calibrated at least annually or following repair by an accredited calibration service.

6.8 Monitoring by Radiation Safety

Radiation Safety shall conduct periodic surveys of all areas in which significant quantities of radioactive materials may be present, and institute or recommend appropriate corrective measures in cases where contamination, dose rates or other sources of potential hazards are detected.

6.9 Animal Use

A. Caging and Labeling:

Small animals given radioactive materials shall be caged separately from non-radioactive animals. Cages shall be labeled with appropriate radiation warning signs. Information on the label shall include the name of the Authorized User responsible for the experiment, the radioisotope, quantity, and date of administration. Special arrangements through Environmental Health & Safety will be required prior to relocation of any such animals.

B. Contamination Control:

Radioactive excreta, animal carcasses and tissue, contaminated cage bedding, etc., must be handled in accordance with radioactive waste disposal procedures. Projects likely to produce large quantities of waste or involving unusual contamination potentials will be reviewed by the RSO prior to the start of work to assure that facilities are adequate.

C. Instruction of Caretakers:

Authorized Users are responsible for assuring that animal caretakers and custodians are aware of potential hazards and are adequately trained and supervised in the observance of necessary precautions.

6.10 Safe Work Practices

The following rules of good radiation protection practice should be scrupulously observed by all radiation workers to prevent unnecessary radiation exposure and minimize contamination.

1. Wear lab coats and impermeable gloves when working with unsealed radioactive material.
2. Work with radioactive material in an exhaust-ventilated enclosure when required.
3. Store and transport containers of radioactive solutions in closed containers on trays or tubs that will hold the contents of the primary container in the event of breakage.
4. Line trays and working surfaces with absorbent paper with an impermeable backing.
5. Clearly label all containers of radioactive material and post all radiation and storage areas with the standard radiation warning symbol. Labels on containers should bear the legend, "**Caution - Radioactive Materials**", preferably with an indication of the nuclide and quantity of radioactive material. Placards for posting of radiation and storage areas should bear the legend, "Caution- Radioactive Materials". Areas with a radiation level exceeding 5 mR/hr at 1 foot must have appropriate labeling. Contact the RSO for assistance.
6. Use remote handling tools when needed to reduce hand exposure (P-32, gamma emitters).
7. Shield stored P-32 and gamma emitters appropriately.

8. Always use assigned dosimeters when handling material requiring them.
9. Conduct work with radioactive material in accordance with written radiation safety and operating procedures.
10. Monitor work areas, hands and clothing during procedures and at the end of the day. Perform required periodic documented wipe and meter surveys.
11. Report and/or clean spills and contamination promptly.
12. Do not eat, drink, smoke or apply cosmetics in areas where unsealed radioactive materials are used.
13. Do not pipette by mouth.

7. TRAINING

Title 17, California Code of Regulations, Section 30280, requires that a Licensee instruct his personnel regarding health and safety rules and problems applicable to the use of sources of radiation. Where re-training (refresher training) is specified and appropriate, the frequency will be annual unless otherwise specified.

7.1 Formal Training of new radiation users

Training materials with tests and formal instruction by the RSO are required. The following topics are covered:

- A. Specific requirements under Cal Poly's License
- B. Annual dose limits.
- C. Radioactive material use area identification.
- D. Policy for exposure control for pregnant radioactive material users.
- E. Current applicable laws and regulations.
- F. Standards set by regulations and license conditions.
- G. Operating and emergency procedures.
- H. Current issues and experience relevant to a research or University setting.
- I. Applicable audit or corrective action items.
- J. The duty to report unsafe conditions.
- K. Topics considered timely and relevant by the RSO
- L. Radiations Basics

7.2 Refresher training

Annual refresher training, when appropriate, should be presented by Authorized User (or RSO) and would include instruction in:

- A. Changes in regulations, State license conditions, RUA conditions and their consequences to the operations.
- B. Changes in operating procedures.
- C. Emergency procedures and problems.
- D. Lessons learned and corrective actions.

7.3 CPSU Employees

The campus Injury and Illness Prevention Program (IIPP) assigns responsibility for safety training of campus faculty and staff to department chairs / heads and to Deans. Custodial or service personnel are provided training by the Authorized User or the RSO and are instructed on appropriate procedures for working in authorized areas.

8. RADIATION ACCIDENT PROCEDURE

For campus emergencies involving radioactive materials, the following is required.

8.1 For any spill or contamination detected outside the papered work area:

- A. Stop work, cover the area with paper or plastic to prevent spread. Use moist material for dry contamination.
- B. Warn others in the area and restrict movement.
- C. The RSO must be notified at ex 66628 immediately, during normal working hours. Call Ext. 62281 during other hours and have the police contact the RSO.
- D. Start monitoring personnel and have them remain in the area until the RSO arrives.
- E. If there is a potential inhalation hazard assemble in a safe area until the RSO arrives. Turn off the room ventilation, if possible, and close the windows and doors.

8.2 For fires and/or injuries involving radioactive materials:

- A. Call 911. Advise the Dispatcher of the involvement of radiation. Ask the Dispatcher to contact the RSO.
- B. It is the responsibility of the Dispatcher to notify the responding agency (Fire Department and/or ambulance) of the involvement of radioactive materials, however the person reporting the accident should remain near the scene and advise these agencies of any pertinent information concerning this involvement.

8.3 For minor spills of radioactive materials with no significant skin contamination or physical injuries (contamination only in the controlled, papered work area), the following procedures should be used to decontaminate experimental equipment and facilities:

- A. Monitor to determine the level and location of contamination.
- B. Mark off contaminated areas with radioactive caution tape.
- C. Dispose of anything that does not need to be reused into the radioactive waste. Clean items to be reused with appropriate decon material.
- D. Dispose of cleaning all material into the radioactive waste.
- E. Wipe items and release only if <200 dpm per 100 sq. cm. and non-detect with a meter.

For assistance in monitoring, contact the RSO.

The Regulatory Agency numbers are 916-327-5106 (State RHB Office) and 800-852-7550 (24-hour radiological emergency number)

APPENDIX A: RSO Duties and Responsibilities

The RSO's duties and responsibilities include ensuring radiological safety and compliance with California and Federal NRC regulations and the conditions of the license. These duties and responsibilities include ensuring the following:

- Activities involving licensed material that the RSO considers unsafe are stopped
- Radiation exposures to personnel are ALARA
- Follows all applicable parts of 10 CFR Part 20 and dose investigational levels
- Up-to-date radiation protection procedures in the daily operation of the licensee's radioactive material program are developed, distributed, and implemented
- Possession, use, and storage of licensed material is consistent with the limitations in the license and the regulations
- Individuals installing, relocating, maintaining, or repairing devices containing sealed sources are trained and authorized by an NRC or Agreement State license
- Personnel training is conducted and is commensurate with the individual's duties regarding licensed radioactive material (initial and refresher training)
- Documentation is maintained to demonstrate that individuals are not likely to receive, in one year, a radiation dose in excess of 10% of the allowable limits or that personnel monitoring devices are provided
- When necessary, personnel monitoring devices are used and exchanged at the proper intervals, and records of the results of such monitoring are maintained. The results are given the employee at least annually.
- Licensed material is properly secured
- Documentation is maintained to demonstrate, by measurement or calculation, that the total effective dose equivalent to the individual likely to receive the highest dose from the licensed operation does not exceed the annual limit for members of the public
- Proper authorities are notified of incidents such as loss or theft of licensed material, damage to or malfunction of sealed sources, or fire (emergency phone numbers are kept current)
- Audits of the radiation protection program are performed at least annually and documented
- If violations of regulations, license conditions or program weaknesses are identified, effective corrective actions are developed, implemented, and documented
- Licensed material is transported in accordance with all applicable DOT requirements
- Licensed material is disposed of properly
- Appropriate records are maintained
- Up-to-date license is maintained, amendment and renewal requests are submitted in a timely manner
- Provide periodic on-site direct supervision over the implementation of the Radiation Safety Program in technical and administrative issues
- Dose records and surveys are reviewed quarterly to ensure safe operations, adequate staff training and engineering controls and to look for trends
- ALARA practices are being followed
- Ensure new users and uses of radioactive material are reviewed prior to first use

