



**Santa Clara
University**

Ionizing Radiation Safety Program

**Santa Clara University (SCU)
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Program Approval Record

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Program Approval

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Original	September 2005	New manual submitted with 2005 CDPH renewal application
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Ionizing Radiation Safety Program

1. Purpose

The purpose of Santa Clara University's Radiation Safety program is to ensure that work with radioactive materials and radiation producing equipment is conducted in such a manner as to protect the health and safety of personnel, minimize environmental and facility impacts, and comply with the University's Radioactive Materials License and relevant regulations.

This program also incorporates the regulatory philosophy that seeks to keep all personnel radiation exposures "As Low As Reasonably Achievable," (i.e., ALARA) given available social and economic resources. Fulfillment of the ALARA philosophy shall be, to the greatest extent practicable, consistent with the education and research mission of the University.

2. Applicability

This program applies to all users of ionizing radiation at the university.

3. Definitions

NOTE: The most pertinent definitions for all users are contained in Attachment 1. Review and use as necessary.

4. Roles and Responsibilities

The following are the SCU Roles and Responsibilities in regards to Radiation Safety:

Group	Responsibilities
Associate Provost for Research Initiatives	<ul style="list-style-type: none">▪ Appoint the members of the Radiation Safety Committee.
Radiation Safety Committee (RSC)	<ul style="list-style-type: none">▪ Provide oversight of the ionizing radiation safety program.▪ Review and approve with the RSO applications for the possession and/or use of radioactive materials and X-ray machines.▪ Suspend or terminate the possession or use of radioactive materials or radiation-emitting equipment where the committee finds noncompliance or that such use or possession poses a threat to the health and safety of the community or jeopardize SCU's license▪ Participate in periodic reviews of the use of ionizing radiation and X-ray machines at SCU.
Radiation Safety Officer (RSO)	<ul style="list-style-type: none">▪ Administer the day-to-day operation of the Ionizing Radiation Safety Program.

(Environment Health and Safety)	<ul style="list-style-type: none"> ▪ Maintain the State of California Radioactive Material License and Radiation Machine Registrations and pay associated fees. ▪ Review and approve with the RSC applications for the possession and/or use of radioactive materials and radiation machines (X-ray machines). ▪ Maintain a current inventory of radioactive materials and radiation-producing machines. ▪ Manage the personal dosimeter and bioassay programs and provide oversight to the radiation survey program. ▪ Provide technical support in regard to ionizing radiation safety hazards, controls, and procedures to the RSC, PIs, staff, and others as needed. ▪ Provide warnings signs, labels, and postings. ▪ Inspect and test received packages of radioactive materials as required. Designate an alternate for inspection and testing of packages when RSO or ARSO is not on-site. ▪ Manage a program for conducting periodic audits of ionizing radiation safety facilities, controls, and procedures. ▪ Manage a program for investigating ionizing radiation safety related incidents. ▪ Report findings and recommendations from audits and incident investigations to the RSC and, where appropriate, to the relevant department chair or other supervisor. ▪ Ensure that each laboratory with radioactive materials and X-ray machines has operational Standard Operating Procedures (SOPs), appropriate controls, and emergency plans for dealing with fires and injuries. ▪ Conduct or otherwise support ionizing radiation safety training. ▪ Ensure that this Ionizing Radiation Safety Program is kept up-to-date with regulatory requirements and applicable best practices. ▪ Maintain radiation safety program records and ensure that they are in compliance. ▪ The authority to immediately stop a procedure it determines presents a serious risk to the health and safety of others or the environment.
Alternate RSO (ARSO)	<ul style="list-style-type: none"> ▪ Serve as the RSO if the RSO is unavailable or designates responsibilities to the ARSO.
Primary Investigator or Primary Instructor (PI) or Department Manager	<ul style="list-style-type: none"> ▪ Identify the ionizing safety hazards associated with proposed equipment, research, or teaching exercise; the appropriate level of containment; the laboratory practices and techniques required to perform the experiments safely; and emergency procedures. ▪ Submit an application for the possession and/or use of radioactive materials and radiation-emitting equipment to the

	<p>RSC before procuring radioactive materials or initiating activities involving radioactive materials</p> <ul style="list-style-type: none"> ▪ Implement the approved level of containment, laboratory practices and techniques, and emergency procedures. ▪ Comply with applicable regulatory requirements and requirements approved through the University application process. ▪ Post door signs and regulatory posters and use radiation labels as required. ▪ Ensure that staff and students receive training in, know, and follow the specific ionizing radiation laboratory practices applicable to their work. ▪ Ensure that dosimeters are worn and survey meters used as required. ▪ Notify the committee in writing and in advance if any changes in laboratory practice or emergency procedures are planned. ▪ Ensure the safe and responsible disposition of their unneeded radioactive materials and radiation-emitting equipment. ▪ Maintain records as required.
Authorized Users	<ul style="list-style-type: none"> ▪ Know the hazards and the precautionary procedures for the radioactive materials and X-ray machines in the work area ▪ Attend required training(s) before using radioactive materials and X-ray machines. ▪ Plan and conduct operations in accordance with approved SOPs and good safety practices. ▪ Use personal protective equipment (PPE) in accordance with prescribed training and SOPs. ▪ Notify the PI and EHS of all accidents, failure of control devices and procedures, and possible exposure to ionizing radiation. ▪ Notify the PI if intending to get pregnant, and act to minimize potential exposure to radiation. Notify the RSO if pregnant.

5. Requirements

Program Administration

The Ionizing Radiation Safety program will be managed by the Santa Clara University Radiation Safety Committee (RSC) and the Radiation Safety Officer (RSO) in accordance with the responsibilities listed in Section 4 of this program.

State License and Radiation Machine Registration

State of California Radioactive Material license

The RSO will maintain the State of California Radioactive Material License and associated applications and applications for amendment. Copies of the state license,

operating and emergency procedures, and regulations are available from the RSO upon request.

If an amendment to the license is required, the RSO will send a signed letter to the California Department of Health, Radiologic Health Branch describing the requested changes. If the change involves changing the RSO, the letter must be signed by a responsible official other than the RSO.

The RSO will request license renewal not less than 60 days before expiration of the existing license. Proposed changes to the program will be approval by the RSO and the RSC

All permit documentation, including applications, amendments and renewals, will be maintained on file by the RSO.

Radiation Machine Registration, Changes and Disposal

The RSO will submit a Radiation Machine Registration form (RH 2261) to the California Department of Public Health, Radiologic Health Branch for each individual X-ray machine within 30 days of acquiring the machine (for machines of operating at a potential in excess of 500 kVp notification must occur at least 60 days prior to possession of the machine or at least 60 days prior to the commencement of construction or reconstruction of the room which will house the machine, whichever occurs first). A copy of the Radiation Safety Program is required for all radiation machines capable of operating above 500kVp.

This form must also be completed and submitted to California Department of Public Health Radiologic Health Branch within 30 days of any change in registrant's name, address, location of the installation or receipt, sale, transfer, disposal or discontinuance of use of a radiation machine.

Pre-Use Application and Approval, Review, Transfer and Termination Processes

Prior to purchasing, installing, or using radioactive materials for purposes not previously approved by the RSC or a new X-ray machine, the PI must complete following steps:

- Submit a completed *APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES* to the RSO. This document is presented in Attachment 2.
- *Submit Statements of Training and Experience* for anyone who will perform work with radioactive materials and/or a radiation machine but has not previously submitted this form.
- Respond to requests for additional information or modifications.
- Receive written approval of the application.

Upon receipt of the completed application, the Office of Research Compliance & Integrity office (ORCI) will send the form to the RSO and the Chair of the RSC. They will review the application for completeness and will request modification of the form if needed. The RSO will also determine whether the type or quantity of the radioisotope

would require an amendment to the state license or if the material requested is covered under the existing license.

Following this initial review, the RSO and Chair of the RSC will distribute the completed application to members of the RSC with their recommendation. The RSC will take appropriate and timely steps to review the application by e-mail, phone, or in-person meeting and review concerns or questions with the PI.

The decision to approve or deny the application will be communicated by the RSO or the Chair of the RSC by issuing an Ionizing Radiation Authorization Permit (permit) to the PI and a copy to the Office of Research Compliance & Integrity.

Research permits are generally approved for one year. Permits for academic instruction are generally approved for a single quarter, but may be approved for longer at the discretion of the RSC if the same course will be taught for multiple quarters.

If an amendment is required, the RSO will follow the amendment procedures listed in the "State License and Radiation Machine Registration" section above to request the required approval of new radioisotopes, quantities, or other needed changes.

Other Reviews

PI's must also comply with the application processes associated with the following programs if applicable to the work described in the *APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES*.

- Work with biohazardous materials is subject to the requirements of the Biosafety Program.

Further information on each is available on the websites of the Office of Research Compliance & Integrity and Environmental, Health and Safety.

Modification and Transfers

An *APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES* must be re-submitted when significant modifications are made to the original protocol, such as moving from one lab to another, modifications impacting radiation controls, or transfer from one PI to another.

Permit Inactive Status and Termination

A PI may voluntarily convert an active permit to inactive status or terminated status by submitting written notification to the RSO.

In the case of inactive status requests, the RSO will work with the PI to transfer or remove radioactive materials from the laboratory and will update the inventory. Equipment and facilities will be decommissioned as needed. Records will indicate the permit is inactive.

In the case of termination requests, the RSO will work with the PI to transfer or remove radioactive materials from the laboratory and will update the inventory. Equipment and facilities will be decommissioned and the license updated as needed

The RSC will review instances of non-compliance including but not limited to the following:

- Willful violation of SCU's policies or state regulations regarding the use of radioactive materials.
- Loss or inability to account for radioactive material.
- Repeated mid- or high-level removable surface contamination.
- Use of radioactive materials not authorized by the permit.

The RSO will inform the RSC on actions it has taken to stop/suspend radiation use activities due to non-compliance or immediate threats to health and safety or the environment. The researcher can request the RSC reconsider the actions taken by the RSO. Based on the results of its investigation, the RSC will take appropriate action which can include written warnings for minor infractions and suspension or termination of the use permit for serious infractions. Serious infractions include those that jeopardize the health and safety of others or the environment and/or those that could jeopardize SCU's radioactive materials license or subject SCU to citations and fines. The RSC is guided by the University's policy to comply with Federal, State and Local regulations.

Inventories and Program Reviews

Biannual Inventory

The RSO will ensure that a physical inventory is conducted every six months to account for all sealed sources and devices.

Annual Review

Project Review

Each year the RSO conducts a review of active permits with the responsible PI. Permits may be automatically renewed by the RSO and Radiation Safety Committee Chair if use quantities and conditions have not changed. Alternatively the same review and approval process as used for new applications will be followed for annual project reviews requiring a more extensive review.

Program Review

The RSO will arrange for a third party audit of the Radiation Safety program and compliance with its requirements at least annually. The RSO will review the audit findings and conduct root cause analysis as appropriate. The results of this review will be communicated in writing to the RSC for review and corrective and preventive action (CAPA) as required. The RSO will maintain a tracking log to track CAPAs to completion.

Qualification

PIs, authorized users and ancillary personnel must complete the training presented in Section 6 of this program prior to working with radioactive materials, sealed sources or radiation machines.

Declared Pregnant Woman Status

SCU policy regarding the exposure of expectant women to ionizing radiation is to minimize the specific hazards which ionizing radiation may present to the human fetus or embryo.

A declared pregnant woman is limited to a Dose Equivalent to the embryo/fetus of 500 millirems (0.5 rem) during her pregnancy, delivered at a recommended rate of approximately 50 millirems per month or less. If a pregnant woman at SCU chooses not to become a declared pregnant woman, the standard occupational dose limits apply as described in the section on Radiation Exposure Limits and Monitoring below.

Users of radioactive materials actively trying to become pregnant should arrange with their supervisors to limit work around radioactive materials until pregnancy is confirmed and then through the third month. Upon confirmation of pregnancy, the user must submit the Radioactive Materials User Pregnancy Form to the RSO in writing as soon as possible to document her decision concerning "declared pregnant woman" status. This form is presented in Attachment 3.

For any questions or further information regarding pregnancy and radiation, the RSO should be contacted.

Personnel Under 18 Years of Age

No personnel under the age of 18 shall be authorized to handle radioactive material or equipment. In case of access to laboratories by such individuals (e.g., visiting students, Bring Your Children to Work Day, etc.), the following requirements must be met:

- The minor will not directly handle radioactive materials.
- The minor must receive a safety briefing regarding laboratory radiation hazards.
- The student must be supervised by the PI or other authorized user while in areas of radioisotope usage.

Radiation Exposure Limits and Monitoring

The occupational dose to individual adults must be controlled to the following dose limits.

- Any individual 18 years of age or over must not receive an occupational dose in excess of the limits specified in the following table.
- Any individual under 18 years of age must not receive an occupational dose in excess of 10% of the limits specified in the following table.
- An embryo/fetus must not receive a dose in excess of 500 millirems (0.5 rem) during the entire pregnancy, due to the occupational exposure of a declared pregnant woman.

Occupational Dose Limits

Description	Dose Limit (rems/calendar year)
Whole body	5
The sum of the deep dose equivalent and the committed dose equivalent to any individual organ or	50

tissue other than the lens of the eye	
Lens dose equivalent	15
Shallow-dose equivalent to the skin of the whole body or to the skin of any extremity	50

A radiation monitoring badge (personal dosimeter) must be worn at all times while working with milliCurie amounts of ^{32}P or ^{125}I or certain X-ray machines at SCU. (Note: dosimeters cannot measure the dose from ^3H , ^{14}C , ^{33}P , or ^{35}S). No one may use radioactive materials or radiation machines under a permit requiring a personal dosimeter until the badge has been provided by the RSO. Badges must be worn as follows:

- Assigned badges must be worn as specified in the permit;
- Users must wear only their personally assigned badge(s), and never share their badge(s) with another individual; and
- Users must promptly return badges at the end of the monitoring period. Failure to return badges in a timely manner will necessitate corrective action. Initial action will include written notice to the supervisor and retraining. Subsequent actions will increase in severity with continuing failure to provide badges including potential loss of status as a PI or authorized user.

Individuals who have lost or damaged their badges must complete and submit to the RSO a "Lost, Missing or Discontinued Radiation Badge" form. This form is presented in Attachment 4. The RSO will use this form to assess and document exposure during the monitoring period covered by the missing badge. This form must also be submitted when personnel no longer require monitoring.

The need for bioassays will be determined as part of the authorization process. The RSO will arrange with the PI for bioassays as required by the permit.

Personnel radiation dosimetry records must be maintained as permanent records by the RSO. Upon written request, the RSO will advise individuals of their recorded annual exposure to radiation. Upon leaving the University, an individual may request a copy of their exposure record or that the RSO forward a copy to another institution. In addition, in any case where an individual's radiation exposure must be reported to the California Department of Health Services, that individual will be notified in writing of the nature and extent of their exposure.

Procurement, Custody, Transfer / Shipment of Radioactive Materials

Procurement Policy

Procurement of all radioactive materials, whether by purchase, gift, or loan, must be reviewed and approved by the RSO prior to receiving them on-site.

Requisition

Information for the purchase or receipt of radioactive materials, including sealed sources, must include the following information:

- The radioisotope, activity, and chemical form of material;
- The authorization permit number;
- Any special instructions for shipping and handling.

Delivery

All shipments of radioactive materials to the campus must be addressed and delivered directly to the “RSO, Santa Clara University, Building 604, 500 El Camino Real, Santa Clara, CA 95053.” The RSO or ARSO will inspect the radioactive material as follows:

- Check for damage or contamination of shipping containers.
- Read supplier’s instructions for special operating procedures (if any).
- Verify the type(s) and quantities of radioisotopes.
- Perform wipe test of package to check for contamination. Decontamination procedures will be initiated when contamination is found in excess of twice background levels.
- Check radiation levels external to the package.
- Check radiation level for each internal package or container.
- Unless the shipment is leaking, it may then be delivered to the Authorized User by the RSO or ARSO.
- If the package is leaking, he/she will immediately notify the supplier of the material and the transportation company for determination of next steps, e.g. return, disposal or decay.

Prior to disposal of an empty radioactive material shipping box or container, all radioactive material labeling must be removed or defaced.

Custody of Radioactive Material

PIs are responsible for the custody of all radioactive materials in their possession. PIs must also ensure that all licensed materials in their possession are secure from unauthorized removal by implementing appropriate security measures.

Acceptable methods of securing unattended radioactive materials are:

- Locking or otherwise controlling access to the laboratory or storage room, and/or
- Locking refrigerators or cabinets where these materials are stored.

Alternative methods of securing unattended materials may be implemented if approved by the RSO. The RSO must immediately be notified of lost or missing radioactive materials.

Transfer / Shipment of Radioactive Materials

All transfers of radioactive materials must be reviewed and approved by the RSO prior to any transfer or shipment.

Transfers Within the Campus

A completed “Record of Radioactive Material Transfer” form must accompany all transfers and a copy sent to the RSO for review and approval. This form is presented in [Attachment 6](#). Once approved, the RSO will transfer the material and update inventory and other records as necessary. The unauthorized transfer of radioactive materials

may result in the suspension of the Ionizing Radiation Authorization and impoundment of the materials.

Off-Campus Shipments

Shipments of radioactive materials to another licensee must have the prior approval of the RSO. A copy of the recipient institution's radioactive material license must be on file at EHS prior to shipment. Off-campus shipments of radioactive materials must comply with the requirements of the U.S. Department of Transportation regulations. Packaging, monitoring, and labeling must be performed or inspected by the RSO. Once the shipment has been completed, the RSO will update inventory and other records as necessary.

Radioactive Material Usage

The PI and authorized users must conduct experiments in compliance with the state license and regulations, permit conditions approved by the RSC and the safety procedures communicated in this program and radiation safety training.

Authorized and Restricted Locations

Radioactive materials must only be used at locations specifically authorized in the permit. In addition, the permit may place restrictions on the specific radionuclide, chemical and physical forms, quantities, and operations that may be performed at a particular authorized location.

The permit may also restrict access to certain laboratories and other locations to specifically authorized personnel who have received appropriate training and any necessary protective equipment. Access restrictions will be communicated through signage, Standard Operating Procedures (SOPs), training, and other methods as needed.

Postings

All locations where radioactive materials are used or stored must be posted as follows:

- A sign must be displayed on each entry door with the standard warning symbol (trefoil) and the words "CAUTION – Radioactive material." Alternatively locations containing X-ray equipment as the only source of radiation must be posted with a sign or signs that read "CAUTION X-RAY".
- A current copy of the permit and the RH-2364 (Notice to Employees) must be posted at a location which is accessible to that permit's authorized users. Alternatively the Notice may be posted on the main floor bulletin board in buildings where radioactive materials are used or stored.

Labeling of Containers, Areas, Equipment

Primary Radioactive Material Containers

Each container containing radioactive materials must be marked with the standard warning symbol (trefoil) and the statement "Caution – Radioactive Material." As an alternative to the labeling of primary



containers, they may be placed within a larger, outer container (e.g., lead pig, tray, Plexiglas box, refrigerator shelf), provided that:

- The outer container bears the standard warning symbol and statement; and
- Written records which identify the radionuclide and activities in individual containers are readily available.

Contaminated Areas and Equipment

All potentially contaminated equipment (e.g., pipettes, centrifuges, trays) must be labeled with the standard warning symbol and statement, or placed within equivalently marked containers, or placed within an established “exclusive use area” (see the “Labeling of Containers, Areas, Equipment” section).

All equipment, containers, areas or items which were formerly used for radioactive materials work or storage, and which are therefore potentially contaminated, shall be surveyed, decontaminated if necessary, and have all warning labels removed or defaced before being released to uncontrolled (non-radioactive) use.

Protective Clothing

Lab coats, safety glasses, and closed-toe shoes must be worn upon entry to radiation labs. Lab coats, gloves, and safety glasses are always required for all handling of unsealed radioisotopes. It is recommended that personnel also wear clothing that completely covers their legs (e.g., long pants; long hem skirts). Enough gloves for frequent changes and clean lab coats must be available. Additional personal protective equipment and/or garments must also be used if required by the permit.

Contamination Control

Counter tops, walls, and floors in areas where unsealed radioactive materials are used must have smooth, impermeable surfaces (e.g., unfinished concrete and grouted, unglazed tile are generally not acceptable).

Work with unsealed radioactive materials must be performed over adsorbent paper and/or trays, or other suitable covering, to help contain radioactive spills. Absorbent paper should be changed when torn, frayed, or contaminated. Trays should be cleaned when dust or dirt becomes apparent or contamination is detected.

All experiments using radioactive materials under conditions where a radioactive material(s) can become airborne as an aerosol, vapor, gas, or particulate must be carried out under a properly ventilated fume hood or hard-ducted biological safety cabinet with a minimum face velocity of 100 linear feet per minute. Heating of a container that holds radioactive material must be done above a pan or tray to catch the material if spilled and must be done in a fume hood even if the material is considered non-volatile.

Radioactive liquids, powders, and other readily dispersible forms of radioactive material shall not be transported into uncontrolled areas (e.g., hallways, elevators, between buildings) unless in a closed container which is impermeable and shatterproof.

Personal Hygiene

Personnel shall not eat, drink, smoke, or apply cosmetics in areas where radioactive materials are used, or otherwise make possible the ingestion of radioactive materials. After radioisotopes have been used, hands and shoes must be monitored before leaving the radiation area. If contamination is detected, decontamination must be performed prior to leaving the radiation area. After monitoring but before leaving the radiation area, hands must always be washed.

Cleanup/Decontamination

A good-faith effort must be made by research personnel to decontaminate areas and equipment to the lowest level feasible. Contamination is generally considered present when the count rate is three times above the background count rate using the devices and procedures described in the “Radiation Surveys and Sealed Source Monitoring” section below. The RSO will perform a follow-up confirmation survey to ensure residual activity is below release levels.

The following contamination limits apply to areas and equipment that are not for the exclusive use of radioactive materials and designated multiple use areas:

Contamination Limits – Multiple-Use Work Areas

Type of Contamination	Removable Contamination (dpm / 100 cm ²)
³ H	≤ 400
¹⁴ C / ³⁵ S	≤ 250
Other beta emitters	≤ 100
Gamma emitters	≤ 100
Alpha	≤ 20

For properly labeled areas and equipment (e.g., fume hoods, centrifuges) used exclusively with radioactive materials, the contamination limits are ten times the limits specified for multiple use work areas and equipment. PIs remain responsible for controlling radiation dose rates resulting from surface contamination. A good faith effort should be made to reduce contamination in all areas to a level As Low As Reasonably Achievable (ALARA).

Cleaning of Contaminated Equipment

The cleaning of contaminated glassware and other equipment must be performed in radioactive material work areas or other restricted areas. If radioactive solutions are produced, cleaning should be performed in buckets or trays labeled with radioactive warning labels.

Cleaning solutions and rinses from contaminated items shall be sampled for radioactivity prior to disposal. Rinses that are less than three times the background count rate, as measured in a liquid scintillation counter, can be considered “non-radioactive” and, provided no other hazardous chemicals are present, may be released into the sanitary sewerage system.

Decommissioning of Equipment and Areas

Laboratory equipment that has been used with radioactive materials, or that may be reasonably suspected of being contaminated must not be decommissioned (e.g., no longer used incidental to radioactive material work or removed from a radioisotope lab) without first being surveyed and decontaminated to the lowest level practical or to the Multiple-Use limit in the “Standards for Contamination and Release of Equipment – Contamination Limits – Multiple-Use Work Areas” Section, whichever is lower. Decommissioned equipment shall have all radioactive materials warning statements and symbols removed.

MARSSIM methodology will be followed for all decontamination and decommissioning for free release of previously restricted areas.

Potentially contaminated laboratory equipment that is being transferred to organizations outside the University (e.g., manufacturers, repair shops, calibration laboratories) shall be surveyed to ensure compliance with the receiver’s own contamination standards, or the University’s, whichever is lowest.

Radiation Surveys and Sealed Source Monitoring

Radiation Surveys

Permit holders and users of unsealed radioactive materials must monitor for potential contamination whenever such materials are used. At the conclusion of each laboratory work session with unsealed radioactive materials, personnel must monitor their hands, clothing, bench top, and equipment using the proper survey method per the following table. Areas are considered contaminated if the radioactivity levels are greater than three times the background level.

Appropriate corrective actions, such as shielding or decontamination, must be implemented in response to findings of contamination during these radiation surveys.

Radiation Survey Methods

Isotope	Emission	Survey Method	Meter Probe	Comments
³ H	Beta	Wipe test	None	Liquid scintillation counting (LSC)
¹⁴ C	Beta	Wipe test, meter	Thin window GM	Pancake Geiger-Mueller (GM) recommended or LSC
³² P	Beta	Wipe test, meter	Thin window GM	Pancake GM recommended or LSC
³⁵ S	Beta	Wipe test, meter	Thin window GM	Pancake GM recommended or LSC
¹²⁵ I	Gamma	Wipe test, meter	Sodium-iodide (Thallium doped) NaI (TI)	Crystal scintillation probe

The PI must ensure that laboratory and portable radiological survey instruments are functional and within calibration. A calibration label, indicating the date of the last calibration and its effective duration, must be affixed to all portable instruments.

Survey instruments that are not fully functional and within calibration must not be used until they have been repaired and/or calibrated. Such instruments should be clearly marked as “inoperative”. In case of questions about equipment repairs, calibration, or loaner instruments, contact the RSO.

The results of formal surveys, any corrective actions (e.g., shielding, decontamination), and confirmatory follow-up surveys must be recorded and maintained by laboratory personnel for periodic inspection. Additional records and/or more frequent surveys may be required and listed on the permit.

Leak-Testing of Sealed Radioactive Sources

Sealed sources containing in excess of 100 mCi of beta/gamma, or 10 mCi of alpha, emitting radionuclide shall be tested semi-annually for leakage. The RSO will perform, or contract, the leak-testing. Leak testing must be performed using methods and equipment approved by California Department of Health Services; leak-testing must be documented. PIs must provide Radiation Safety personnel with timely access to such sources. The RSO will remove from service, as required by the California Department of Health Services, sources leaking greater than 0.005 uCi. The RSO may also require procedural or engineering controls for those sources that are found to be leaking at levels less than 0.005 uCi.

Radioactive Waste Disposal

Waste Containers and Disposal

Radioactive waste containers must be of the type supplied or approved by the RSO. The minimum criteria are that waste should have at least two separate layers of unbreakable containment and be clearly marked as to its radioactive contents. Examples would be a plastic carboy or jug and spill/drip containment for liquid waste (that can contain 110% of the total volume of the primary liquid container) and a heavy-

duty plastic bag and cardboard box for solid waste etc. Labeling must also include the isotope, activity, waste generation date, and generator's name/initials. Disposal guidance is presented in the following table. Contact the RSO for assistance with waste containers and disposal.



Radiation Disposal Instructions

Description of Waste	Disposal Instructions
<p>Solid waste - dry, radioactive contaminated materials such as paper, plastics, glassware, and gloves. Note: Do not put any liquids or capped vials into solid waste containers (but may contain droplets retained in containers by surface tension or capillary action). Solid waste must not contain hazardous chemicals/solvents and materials such as lead pigs, stock vials with remaining liquids/powders, or sealed radioactive sources</p>	<p>Place in appropriate waste containers, which are clearly marked with the radioactive warning symbol and contents. Solid waste contaminated with radioactive materials (³²P, ³⁵S, etc.) with half lives less than 120 days must be segregated from those contaminated with radioactive materials with half lives greater than 120 days and may be held for decay per the procedures in the "Disposal of Accumulated Waste" section below. Solid waste contaminated with radioactive materials (³H and ¹⁴C) with half lives greater than 120 days must be added to the appropriate radioactive waste disposal container and held for off-site disposal.</p>
<p>Liquid wastes Note: Although small amounts of non-soluble materials may be present, liquid waste should generally not contain solid materials, especially plastic laboratory equipment such as pipette tips, micro-centrifuge tubes. Avoid the generation of mixed wastes, which consist of radioactive waste and hazardous waste (e.g. waste radioisotopes in isopropanol or ethanol)</p>	<p>The transfer of radioactive liquids to laboratory sink drains is strictly prohibited with the following exception: Rinses that are less than three times the background count rate, as measured in a liquid scintillation counter, can be considered "non-radioactive" and, provided no other hazardous chemicals are present and the liquid meets pH and other sanitary district requirements, may be released down the drain. Liquid waste must be placed in appropriate waste containers, which are clearly marked with the radioactive warning symbol and contents. Disinfect biohazardous liquids before placing in waste containers in accordance with the practices in the Biosafety Program. Liquid waste contaminated with radioactive materials with half lives less than 120 days may be held for decay. When radiation has decayed to no more than three times background, aqueous liquid wastes may be disposed of down the drain provided no other hazardous chemicals are present and the liquid meets pH and other sanitary district requirements. Liquid waste contaminated with radioactive materials with half</p>

	lives greater than 120 days must be added to the appropriate radioactive waste disposal container and held for off-site disposal.
Contaminated Sharps - sharp items, such as Pasteur transfer pipettes, syringes and needles, broken glass, razor blades and scalpel blades	Place sharps that are contaminated with radioactive materials with half lives less than 120 days into specially identified sharps containers, bearing the radiation warning symbol. Hold for ten half-lives, than dispose of as biohazardous waste. Sharps contaminated with radioactive materials with half lives greater than 120 days must be added to the appropriate radioactive waste disposal container and held for off-site disposal.
Scintillation Waste - liquid scintillation cocktails (including dissolved or suspended samples), autoradiography enhancement solutions, and associated containers such as used counting vials	Accumulate all scintillation waste as radioactive liquid waste, regardless of the non-detectability of radioactivity. Exception: 0.05 microcurie or less of ^3H or ^{14}C per gram of medium used for liquid scintillation counting may be disposed of as if not radioactive. Package for pickup as either vials in the original holding trays, bulk vials in plastic-lined fiberboard boxes or bulk liquids in original containers or carboys approved by the RSO.
Large non-compactable items such as contaminated motors, lab equipment and centrifuges	Contact the RSO for disposal or decontamination procedures.

Disposal of Accumulated Waste

Dispose of solid wastes and liquid waste that does not meet drain disposal criteria as follows:

- Radioactive materials with a half life of less than 120 days may be held for decay in storage for at least ten half-lives in designated radiation storage areas. Dose rates in adjacent areas must be maintained below 0.05 mrem/hr at all times.
- Decay in storage waste shall be segregated by half-life group and type of emitted radiation.
- Before disposal as normal waste, the waste must be surveyed by the RSO in accordance with the following procedure in a low background area.
 - Scan the outside of the storage container within 1 inch of the surface at a scan rate of no more than 1 inch per second.
 - If less than background, open the container and scan the inside of the container.
 - If the reading is indistinguishable from background, remove or obliterate all radiation labels, and the waste is then disposed of as non-radioactive waste.
- If the reading is greater than background, the waste is repacked and allowed to continue to decay. Long lived radioactive materials (^3H , ^{14}C) must completely separate from decayable waste and be packed into containers located in the Alumni Science waste area. Package all unusable material in clear plastic bags with the radioactive label. When full, place the bag in the appropriate radioactive disposal container. The RSO will periodically arrange for long lived radioactive waste to be sent off-site for disposal at an authorized burial site.

Contact the RSO for detailed instructions concerning the disposal of radioactive materials that do not fall within the definitions of solid, liquid or scintillation media.

X-Ray Machines Use Requirements

Prior to ordering an X-ray machine, a completed *APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES* must be submitted to the RSO in accordance with the Pre-Use Review and Approval Process. Examples of X-ray machines include X-ray fluorescence, X-ray diffraction, cabinet radiography, accelerators, field radiography machines, medical radiography machines, and electron microscopes. If an Ionizing Radiation Authorization Permit (permit) is issued as a result of the review and approval process, the X-ray radiation machine must be used in accordance with the requirements of the permit and this section.

Operator Safety

PIs responsible for an X-ray machine must maintain an operational guide specifically designed for their particular machine. Each authorized user of the radiation machine must be thoroughly familiar with the operational guide prior to assuming duties as an

operator. The operation guide and safety instructions for each machine shall be posted nearby or made readily available for review. In order to prevent operation of an x-ray machine by unauthorized personnel, positive controls of the machine must be maintained at all times. This may be in the form of a key or computer password which is required to energize the machine.

A use log for each machine must be maintained and made readily available for review. The use log includes information regarding the machine operator, date of operation, tube current, and voltage. Additionally, a current list of users authorized to operate the machine must be posted near the machine or readily available.

When working with an accessible beam, machine adjustments should be made, whenever possible, with the beam off or shutters closed. No modifications in the operational safety features may be made unless these have received prior approval of the RSO. No part of the body should be within 3 inches of the main beam or high-level scatter. Shielding the beam with an interlocked enclosure is strongly recommended. Fail-safe warning lights, which warn of the production of X-rays, must also be clearly visible and installed near the beam shutter and the control console. Personnel not involved in machine operation should not be in close proximity to the machine. If required by the permit, operators must wear radiation-monitoring badges during machine operation.

Out-of-service X-ray machines must be made inoperable, e.g. by locking it in the off position and tagging it "out of service" or other equally effective method.

Posting/Labeling

A current copy of the permit must be visibly posted near the X-ray machine. The State of California Department of Health Services "Notice to Employees" must be displayed in a conspicuous location where machine users may observe it on their way to or from work. EHS approved "Caution: X-ray" stickers or signs must be posted on all entrances to the room (s), near the machine key switch, and near the tube head or shutter(s).

Radiation Surveys

Prior to use, newly acquired X-ray machines must be surveyed by the RSO in order to determine the effectiveness of shielding and other engineering and procedural controls. EHS will also conduct an annual radiation survey and inspection of machines. Radiation survey measurements of machines should also be conducted whenever major repairs or tube replacements have been made. It is recommended that a radiation survey meter be kept nearby to survey for scatter radiation and to verify that X-rays are being generated.

Disposal or Transfer of X-Ray Machines

EHS must be notified prior to disposition, transfer of ownership, or change in X-ray machine location in order to ensure proper disposal and notification to the State of California Department of Health Services within 30 days of changes in machine status.

X-ray machines should be disposed of in accordance with the disposal instructions provided by the manufacturer in the product manual, and/or contact the manufacturer for information and guidance. When manufacturer guidance is not available:

- The X-ray machine components may be returned to a commercial X-ray machine assembler or vendor; or
- The X-ray machine may be totally disabled and the components sold as scrap metal or disposed of according to environmental requirements; or
- The X-ray machine may be rendered non-functional by disassembly and/or component removal such that repair and use may not be readily affected.

Emergency Procedures

In the event of an incident involving radioactive materials (e.g., spills, personnel exposure, loss or theft, transportation incidents, etc.), follow the procedures in the Radiation Emergency Response Chart below.

Radiation Emergency Response Chart

<p>Personnel Exposure and Contamination</p>	<ol style="list-style-type: none"> 1. Inform all personnel in the laboratory that an exposure has occurred. 2. Evacuate personnel to nearby safe areas. Monitor all potentially contaminated personnel. Do not allow potentially contaminated personnel to leave the area. 3. Call x4444 to report the exposure and request the assistance of EHS. 4. Retain the radiation-monitoring badge of the individual for immediate processing. 5. Untrained persons must not examine or decontaminate personnel in the area. 6. For skin contamination: <ol style="list-style-type: none"> a. Flush thoroughly with soap and water. Skin decontamination should be performed inside of a radiation laboratory. To minimize the spread of contamination, avoid using public restrooms. b. Monitor the skin to determine levels and location of contamination. Use a portable radiation survey meter for most radionuclides; take wipe samples and count them in a liquid scintillation counter for 3H and 125I contamination. c. If contamination persists, repeat the washing and monitoring procedures several times, being careful to not damage the skin. 7. If the spill is on clothing, discard outer or protective clothing at once, including shoes. Collect any contaminated clothing or personal possessions in plastic bags for later monitoring. 8. If inhalation or ingestion is suspected, wait for the RSO before taking any additional steps.
<p>Spills of Radioactive Materials</p>	<ol style="list-style-type: none"> 1. Inform all personnel in the laboratory that a spill has occurred. 2. Evacuate personnel to nearby safe areas. Monitor all potentially contaminated personnel. Do not allow potentially contaminated personnel to leave the area. 3. EHS should be contacted by calling x4444 to advise on decontamination techniques, determine the necessity of reporting and/or calling in outside resources and to determine the effectiveness of decontamination. 4. Don appropriate Personal Protective Equipment (PPE) (e.g., laboratory coats and leg coverings, gloves and shoe covers, safety glasses or face

	<p>shields, etc.).</p> <ol style="list-style-type: none"> 5. Limit and contain the spill by: 6. Liquid Spills: Place absorbent paper or paper towels on the spill. 7. Solid Spills: Cover completely with damp absorbent paper, taking care not to spread contamination. 8. Monitor to determine locations and levels of contaminated areas. Mark the boundaries of contaminated areas with "Caution – Radioactive Material" tape. Keep non-essential personnel away from these areas. 9. Formulate a decontamination plan and assemble necessary supplies such as additional gloves, soap, and brushes, absorbent paper, and radioactive waste containers. 10. Generally, decontaminate the least contaminated areas first. Avoid using large amounts of water since this may spread contamination. Document results of decontamination for inclusion into your laboratory survey records.
Loss or Theft of Radioactive Materials	<p>Upon becoming aware of the loss or theft of radioactive materials, the PI must report to the RSO immediately by telephone and confirm in an e-mail message.</p> <p>The RSO will conduct an investigation in collaboration with the PI. The incident investigation will be documented.</p>
Transportation Spills	<p>Notify the RSO or ARSO immediately by calling Campus Safety Services at x4444.</p>

Internal Incident Reporting and Investigation

A Radiation Survey Form must be completed and submitted to the RSO. The PI must investigate the incident and submit the results, including recommended corrective and preventive actions, in writing to the RSO and the Chair of the RSC.

External Notification Procedures

The RSO or ARSO must notify the State of California Department of Health Service:

- As soon as possible but not later than four hours after the discovery of an event that prevents immediate protective actions necessary to avoid exposures to radiation or radioactive materials that could exceed regulatory limits.
- Within 24 hours after the discovery of any of the following events involving radiation or radioactive materials:
 - An unplanned contamination event involving licensed radioactive material that:
 - Requires access to the contaminated area by workers or the public to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area;
 - Involves a quantity of material greater than five times the lowest annual limit on intake specified in Appendix B of Title 10, Code of Federal Regulations, part 20 for the material; and

- Has access to the area restricted for a reason other than to allow isotopes with a half-life of less than 24 hours to decay prior to decontamination.
- An event in which equipment is disabled or fails to function as designed when:
 - The equipment is required by regulation or license condition to prevent releases exceeding regulatory limits, to prevent exposures to radiation and radioactive materials exceeding regulatory limits, or to mitigate the consequences of an accident;
 - The equipment is required to be available and operable when it is disabled or fails to function; and
 - No redundant equipment is available and operable to perform the required safety function.
- An event that requires unplanned medical treatment at a medical facility of an individual with spreadable radioactive contamination on the individual's clothing or body.
- An unplanned fire or explosion damaging any licensed material or any device, container, or equipment containing licensed material when:
 - The quantity of material involved is greater than five times the lowest annual limit on intake specified in Appendix B of Title 10, Code of Federal Regulations, part 20; and
 - The damage affects the integrity of the licensed material or its container.

The reporting procedures outlined in 17 CCR, Section 30295 will be followed. The Department's address and telephone number are California Department of Health Services, 1501 Capitol Ave., Suite 2101, P.O. Box 942732 Sacramento, CA 94234-7320; telephone (916) 327-5106.

6. Training

- Before working with radioactive materials, PI's and authorized users are required to receive radiation safety training. Required training includes the following:
 - Radiation safety course designed for users of radioactive materials.
 - Annual refresher training
- Training will cover at a minimum, the following topics:
 - Annual dose limits
 - Identification of use areas
 - Potential hazards
 - Pregnancy policy

- Regulations and license conditions
- Duty to report unsafe conditions
- Before working with radiation machines, PI's and authorized users must complete the following training
 - Radiation safety course designed for users of X-ray machines.
 - For each specific X-ray machine used, radiation producing machine operators must be trained and familiar with the machine's engineering controls, administrative procedures and policies related to machine safety. This training must be completed within 30 days of the beginning of work with x-ray machines

All training, including specific X-ray machine training, must be documented on the standard EHS training documentation form in use at the time the training is performed.

Training of Students Working Near or With Radiation Sources

Students working near or with radiation sources must be instructed in the proper techniques and procedures associated with ionizing radiation use. This includes classroom use and lab use by students and graduate students. This instruction is the primary responsibility of the PI. The PI must submit the following information to the RSO:

1. Names of students attending the radiation safety instruction;
2. Date(s) of instruction;
3. Outline of radiation safety topics covered during instruction.

If the course instructor prefers, the RSO may be contacted to arrange a presentation on Radiation Safety to the students.

Training of Ancillary Personnel

Ancillary personnel such as those in Shipping and Receiving and Facilities will receive basic radiation safety awareness training.

7. Reporting

The RSO will arrange for a third party review of the Radiation Safety program for compliance and refer any issues to the Chair of the Radiation Safety Committee. If the program is found to be non-compliant, the Radiation Safety Committee will take appropriate actions, including root cause analysis, to ensure that the issues are corrected going forward.

8. Document Retention

The following documents are retained at these locations for three years, unless otherwise indicated:

Record	Location	Duration	Responsible Party
<i>APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES</i>	EHS Files	Until superseded	RSO
<i>Radiation Machine Registration form</i>	EHS Files	3 years after decommissioning/disposal	RSO
<i>Statements of Training and Experience</i>	EHS Files	3 years after decommissioning/disposal	RSO
SCU Ionizing Radiation Authorization Permit	Room of use/PI files	Current	PI
Surveys and Calibration Records	EHS Files	3 years after the record was created	RSO
Dosimeter, Air Monitoring, Bioassays and other Exposure Related Records	EHS Files	Indefinitely	RSO
Incident Investigation Record	EHS Files	3 Years after the incident	EHS Manager
Annual Radiation Program Audits	EHS Files	3 Years after the audit	RSO
CAPA Tracking Log	EHS Files	3 Years after the audit	RSO
Personnel Training	TBD	3 Years after termination of employment	TBD
Waste Disposal Records	EHS Files	Indefinitely	EHS Manager

9. Key References and Resources

- California Code of Regulations (CCR), Title 17, Div. 1, Chapter. 5, Subchapters 4 and 4.5. 17 CCR 30253 incorporates by reference the federal regulations specified in Title 10, Code of Federal Regulations (CFR), Part 20.

Attachment 1 - Definitions

Declared Pregnant Woman: An employee, student, or other affiliated person who has voluntarily informed Santa Clara University, in writing, of her pregnancy and the estimated delivery date.

Half-life: The amount of time it takes for half of the atoms of an isotope to decay into a more stable form.

Primary Investigator or Primary Instructor (PI): The Santa Clara University employee bearing primary responsibility for all essential aspects of the work being carried out, including technical, budgetary and administrative compliance.

X-ray Machine: Any device capable of producing X-rays when its associated control devices are operated, e.g. X-ray fluorescence, X-ray diffraction, cabinet radiography, accelerators, field radiography machines, medical radiography machines, and electron microscopes.

Restricted Areas: Areas to which access is restricted to authorized, trained and equipped personnel for the purpose of protecting against undue risks from exposure to radiation.

Sealed Source: Radioactive material that is permanently encapsulated in a manner that prevents the material from being released under the most severe conditions likely to be encountered in transportation, use, or storage of the source.

Mixed Waste: Waste that contains both hazardous waste and radioactive waste.

Attachment 2 - Application For Research Project Involving Radioactive Materials, Sealed Sources Or X-Ray Machines

Log Number:

APPLICATION FOR RESEARCH PROJECT INVOLVING RADIOACTIVE MATERIALS, SEALED SOURCES OR X-RAY MACHINES
SANTA CLARA UNIVERSITY RADIOACTIVE SAFETY COMMITTEE

It is the investigator's responsibility to provide complete information about research procedures involving radioactive materials. The Santa Clara University Radiation Safety Committee (RSC) reviews all requests to conduct research involving radioactive materials and sealed sources. Please electronically submit a copy of your complete application to the RSC as well as any other material or background information as noted below that will assist the Radiation Safety Committee in its review.

New Application Annual Renewal Date:

Principal Investigator//Licensed User	Department	Phone Number: E-mail:
Authorized Investigators	Phone Number: E-mail:	
Other Authorized Investigators and or /Staff (List all)	Phone Number: E-mail:	
<p>Type of Radioactivity <input type="checkbox"/> Radioisotope Complete Section II and III <input type="checkbox"/> Sealed Source and/or X-Ray Machines Complete Section I and III</p> <p>Project Title:</p>		

As principal investigator for research using radioisotope sealed sources and/or X-ray machine, I certify that I am familiar with the regulations for use and agree to abide by the Santa Clara University Policy and Procedures applicable to their use. The information in the attached application is accurate and complete.

Signature, Principal Investigator

Date

Section I
Sealed Source and/or Radiation Producing Equipment

Type:

Sealed Source Specify type of source:

Radiation Producing Equipment Specify type of equipment: X-ray fluorescence X-ray diffraction electron microscope Other (describe)

Manufacturer	Model Number/Serial Number	
Projected Date of Receipt/Installation	Building/Room Number	Power Output (max) if applicable

PROTOCOL

Describe the methods you will use when working with the source/equipment (you may attach a copy of your standard area protocol):

SAFETY FEATURES AND SECURITY MEASURES

Describe safety features and security measures:

Section II
Radioactive Materials Experimental Protocol

LABORATORY LOCATION Please indicate building(s) and room(s)

Activity	Building/Room Number	Location in room (e.g. benchtop, hood)
Storage		
Experiments		
Scintillation counting		
Gamma counting		
Waste storage		
Other (describe)		

RADIOISOTOPE(S) MATERIAL LIMITS

Radioisotope	Maximum Quantities (mCi)		
	Total Possession	Purchase Per Order	Use Per Experiment
<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S			
<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S			

Date experimentation is scheduled to begin _____ end _____ No end planned

PHYSICAL PROPERTIES

Chemical	Form	Radioisotope	Total activity (mCi)
	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Volatile	<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S	
	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Volatile	<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S	
	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Volatile	<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S	
	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Volatile	<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S	
	<input type="checkbox"/> Solid <input type="checkbox"/> Liquid <input type="checkbox"/> Volatile	<input type="checkbox"/> ³ H <input type="checkbox"/> ¹⁴ C <input type="checkbox"/> ³² P <input type="checkbox"/> ¹²⁵ I <input type="checkbox"/> ³⁵ S	

Do you need a radioisotope that is not on the above list? If so, which one (note pre-approval required by California Department of Radiologic Health)?

Are there support personnel not designated as an Authorized User? Yes No If yes, please describe:

PROTOCOL

This form must be completed prior to receipt of radioisotope for each new investigation to record the users, chemical and physical properties. Reference may be made to previous protocols only for similar experimentation and amounts of isotope.

Description of the materials and methods you will use when working with the nuclide including sample preparation (you may attach a copy of your standard area protocol)

What other chemicals will be present in this experiment that may prevent decay of short term isotopes and/or require other hazardous waste consideration (particularly the formation of a mixed hazardous/radioactive waste stream):

State any unusual hazards that may be associated with the performance of this experiment and methods to minimize these hazards

Approximate frequency of experimentation (per day, week of month)

Estimate the total amount of isotope used per experiment in μCi (a range is acceptable)

Radioactive waste disposal:

Expected Disposal per experimental session (in percentage)

Solid waste:

Liquid waste:

Biological waste:

Sewer waste

- No Waste Allowed Into Sewer
- Liquid waste <3X background (describe)

Section III

PRECAUTIONARY MEASURES

Protective Clothing	Protective Equipment	Personnel Monitoring	Engineering Controls
<input type="checkbox"/> Disposable Gloves <input type="checkbox"/> Lab Coat <input type="checkbox"/> Safety Glasses <input type="checkbox"/> Lead Aprons <input type="checkbox"/> Shoe Covers <input type="checkbox"/> Disposable Coveralls <input type="checkbox"/> Hair Covers	<input type="checkbox"/> Work Tray/Absorbent Paper <input type="checkbox"/> Tongs for Stock Solutions <input type="checkbox"/> Lucite/Plexiglas Shielding <input type="checkbox"/> Lead Gamma Shield <input type="checkbox"/> Survey Instrument <input type="checkbox"/> Respiratory Protection	<input type="checkbox"/> Film badge (personal dosimeter) <input type="checkbox"/> Ring Badge for P-32 <input type="checkbox"/> Extremity Badge <input type="checkbox"/> Urine Analysis <input type="checkbox"/> Thyroid Count <input type="checkbox"/> Hand/Foot Monitoring <input type="checkbox"/> Air Monitoring	<input type="checkbox"/> Fume Hood > 100 lfm <input type="checkbox"/> Fume Hood with Charcoal Filter <input type="checkbox"/> Glove Box with HEPA Filter <input type="checkbox"/> Interlocked Access <input type="checkbox"/> Flashing Light at Access <input type="checkbox"/> Room Security Required <input type="checkbox"/> Stock monitoring

OTHER REQUIRED MEASURES:

Initial/Annual Training Completion Date/Anticipated Completion Date:

Application Reviewed and Approved by the Radiation Safety Officer (RSO)

(Signature of RSO)

(Date)

Application Reviewed and Approved by RSC

(Signature of Chair)

(Date)

Attachment 3 – Ionizing Radiation/ Sealed Source Authorization Permits

Permit User Name: Phone:	Department	Permit Number (Application Log Number)	Expiration Date					
Description								
Radioactive Materials Limits								
Radioisotope	Maximum Quantities (mCi)			Experimental Protocol #	Authorized Radiation Worker	Locations		
	Total Possession	Purchase Per Order	Use Per Experiment			Use Bldg/Room	Lab Class.	Counting Storage
Precautions Required								
Protective Clothing	Protective Equipment	Personnel Monitoring	Engineering Controls					
<input type="checkbox"/> Disposable Gloves	<input type="checkbox"/> Work Tray/Absorbent Paper	<input type="checkbox"/> Body Badge for P-32	<input type="checkbox"/> Fume Hood > 100 lfm					
<input type="checkbox"/> Lab Coat	<input type="checkbox"/> Tongs for Stock Solutions	<input type="checkbox"/> Ring Badge for P-32	<input type="checkbox"/> Fume Hood with Charcoal Filter					
<input type="checkbox"/> Safety Glasses	<input type="checkbox"/> Lucite/Plexiglas Shielding	<input type="checkbox"/> Extremity Badge	<input type="checkbox"/> Glove Box with HEPA Filter					
<input type="checkbox"/> Lead Aprons	<input type="checkbox"/> Lead Gamma Shield	<input type="checkbox"/> Urine Analysis	<input type="checkbox"/> Interlocked Access					
<input type="checkbox"/> Shoe Covers	<input type="checkbox"/> Survey Instrument	<input type="checkbox"/> Thyroid Count	<input type="checkbox"/> Flashing Light at Access					
<input type="checkbox"/> Disposable Coveralls	<input type="checkbox"/> Respiratory Protection	<input type="checkbox"/> Hand/Foot Monitoring	<input type="checkbox"/> Room Security Required					
<input type="checkbox"/> Hair Covers		<input type="checkbox"/> Air Monitoring	<input type="checkbox"/> Stock monitoring					
Other Requirements								
<ol style="list-style-type: none"> 1. A copy of this authorization shall be posted in each ionizing radiation work area. 2. All applicable provisions of the following documents shall be observed: <ol style="list-style-type: none"> a. The Radioactive Material License (0585-43) is maintained by the Radiation Safety Officer (RSO). b. California Radiation Regulations and Federal Regulations are maintained by the Radiation Safety Officer. c. Santa Clara University Ionizing Radiation Safety Program. 3. The following records shall be maintained: <ol style="list-style-type: none"> a. Use logs and waste logs. b. Contamination survey currently required weekly. 								

4. Special Instructions:	Copy of package opening will be forwarded to the RSO. One hour refresher training required annually. Documentation sent to the RSO. Ring Badges required for P-32 in amounts above 100uCi per experiment.
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Approval and Certification

We approve this ionizing radiation use as described and is subject to the precautions listed	We certify that all work will be as described and will be performed in accordance with the precautions listed
Radiation Safety Officer	Primary Investigator/Instructor
Date	
Chairman, Radiation Safety Committee	Department Chair
Date	Date

Attachment 5 - Lost, Missing or Discontinued Radiation Badge



Loss of Personal Dosimeter Report

Date:

From: Radiation Safety Officer

By law, SCU must ask those who lose their radiation dosimetry badges/rings to help retrieve information. Please complete the following information to the best of your ability. Sign, date and return this form as soon as possible.

I lost my dosimeter number _____. Here is my best understanding of how this occurred:

These dosimeter(s) were for the exposure period from _____ to _____. During this period I:

1. did did not conduct work with radioactive materials.
2. have reason no reason to believe I might have received radiation doses in excess of the permissible exposure levels. If yes, please explain.

Employee Signature

Date

Supervisor Signature

Date

Radiation Safety Officer Use

Date Received: _____ Evaluation Date: _____

Evaluation Performed By: _____ Result/Conclusion: _____

Attachment 6 – Radioactive Material Transfer



Record of Radioactive Material Transfer

Transferred From:	
Authorized User Name _____	
Phone Number: _____	SCU Permit Number: _____
Building: _____	Room Number: _____
Radionuclide: _____	Activity : _____ mCi
Manufacturer: _____	
Stock Number or Other Identification Number _____	

Authorized User Signature	Date

Transferred To:	
Authorized User Name _____	
Phone Number: _____	SCU Permit Number: _____
Building: _____	Room Number: _____

Authorized User Signature	Date

I confirm the recipient is authorized to receive this material.

Radiation Safety Officer's Signature Date