

UNIVERSITY of  
**HOUSTON**

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DEPARTMENT of PUBLIC SAFETY  
Environmental Health & Life Safety

**Radiation Safety Manual**



## **Preface**

Radiation Safety is the responsibility of all persons at the University of Houston (UH)-faculty, staff, students, researchers, etc. Consistent with the broad radioactive material license issued to UH by the Department of State Health Services (DSHS), the University has established a radiation safety program. The program assigns responsibilities at all levels to promote a safety culture, ensure compliance with license conditions and address adequate protection for members of the university community and community at large.

The use of radioactive materials at UH, where a large number of people may be unaware of their exposure to radiation hazards, makes strict adherence to federal, state regulations, and university policies very important.

The Radiation Safety Committee, under the functional authority of the Vice President of Research & Technology Transfer, is responsible for the Radiation Safety Program outlined in this manual. The objective of the Radiation Safety Program is to assist all levels of management in fulfilling the commitment at the University of Houston (UH) to provide a place of employment and learning which is as free as possible from recognized radiation hazards.

The purpose of the Radiation Safety Manual is to assist personnel, students, and management in complying with the state radiation regulations and the Radiation Safety Program.

This Radiation Safety Manual is not intended to be an exhaustive or fully comprehensive reference. Further advice concerning hazards associated with specific radioactive material, radiation producing devices, and/or the development of new and unfamiliar procedures should be obtained through consultation with the Radiation Safety Officer (RSO).

The Radiation Safety Manual is an enforceable component of the Radioactive Material Broad Scope License and Radiation Producing Devices Registrations under which the UH is authorized.

## **Notice**

*Where existing or future federal, state, or local regulations are found to differ from the requirements contained in this manual, those legally accepted regulations shall supersede this document.*

*This document has been approved by the Texas Department of State Health Services (DSHS) during the renewal of the University's radioactive materials license and replaces all such previous documents.*

*Whereas this manual shall form part of the licensee's operating conditions, the format and administrative content of the forms in the Operational Radiation Safety Manual shall, as deemed necessary, undergo revisions pending the approval of the Radiation Safety Committee.*

*New forms may also be added as deemed necessary. However, no changes which would result in any condition of non-compliance with applicable regulations or license conditions shall be approved.*

*The Radiation Safety Officer will, within 30 days of Committee's approval, submit to the DSHS Radiation Control Program copies of revised manual and forms with substantial changes.*

## Helpful Telephone Numbers and Information

Environmental Health and Life Safety-Main Office	(713) 743-5858
Environmental Health and Life Safety (Fax)	(713) 743-8035
Radiation Safety Officer	(713) 743-5867
Assistant Radiation Safety Officer	(713) 743-5870
Safety Specialist	(713) 743-5860
University Health Center	(713) 743-5151
UH Police Department (Emergency)	(713) 743-3333
UH Police Department (Non-Emergency)	(713) 743-0600
Medical Emergencies	911

Environmental Health & Life Safety (EHLS) office hours are Mondays -Fridays, 8:00 a.m.-5:00 p.m.

For assistance with a radiation incident during normal office hours, contact the EHLS main office phone line. If you call after normal office hours about a non-emergency incident, you may leave pertinent information on the voicemail system and your call will be returned next business day.

EHLS maintains an emergency mechanism to provide expertise in the event of an after-hours situation requiring assistance. In the event of after-hours radiation incident, contact the UH Police Department at 713-743-3333 and the responsible persons at EHLS will be contacted.

Handling of radioactive material spills and other emergency information are available in the Spill and Emergency section of this manual.

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## **Radiation Safety Program Administration**

University of Houston is authorized by the Texas Department of State Health Services (DSHS) to receive, acquire, possess, and transfer certain radioactive materials and sources of radiation; and to use at designated locations, to further its mission of research and education. The License and Registration conditions require strict control of the use of radioactive materials and radiation producing devices to ensure that radiation exposures to all Authorized Users, UH personnel and members of the public are maintained As Low As Reasonably Achievable (ALARA).

The Radiation Safety Program is designed to provide adequate safeguards to the health and well-being of the UH community and the community-at-large from the potentially harmful effects of radiation. This is accomplished by maintaining compliance with applicable Federal and State regulations, University policies, and through the establishment of good health physics work practices.

The Radiation Safety Program applies to all persons who purchase, possess, transfer, store, use, or handle radioactive materials in any amount, licensed or license exempt, and/or radiation producing devices, registered or unregistered, at UH.

The University of Houston requires that all users of radioactive material or radiation producing devices on the campus receive appropriate radiation safety training, be approved by the Radiation Safety Officer (RSO) & Laser Safety Officer (LSO) and authorized by the Radiation Safety Committee (RSC), and comply with applicable regulatory requirements to ensure that radiation exposure levels are maintained ALARA.

Responsibility for implementing the Radiation Safety Program to maintain compliance with the license and registrations is delegated appropriately within the campus. The organization of the UH Radiation Safety Program includes the Radiation Safety Committee, Radiation Safety Manager/RSO & LSO, Radiation Safety Staff, Principal Investigators, and Authorized Users.

### **Radiation Safety Committee (RSC)**

The Radiation Safety Committee (RSC) at the University of Houston shall be composed of a Chair and other members as appointed by the Vice President/Vice Chancellor of Research & Technology Transfer who is a designee of the licensee- University President/Chancellor. The Committee shall include at a minimum a representative from Executive Management with signature authority to commit university resources, faculty representation from University Colleges and Departments–user community at the University, and such other members as deemed appropriate. Proposed members of the Radiation Safety Committee shall be submitted to the Texas Department of State Health Services as stipulated in 25 TAC §289.252(h)(1)(c).

## **Meeting Frequency & Quorum**

The Committee shall meet to conduct official business at a minimum four times per calendar year, i.e. once every calendar quarter. The Committee may meet at other times on request of the Chair, the representative from Executive Management, or the RSO. A simple majority of members shall constitute a quorum; however, a quorum may not be declared without the presence of the Committee Chair or delegate, the representative from Executive Management or delegate, and the Radiation Safety Officer.

## **Committee Charge**

The RSC is charged with ensuring that the UH's Radiation Safety Program remains in compliance with the State Radiation Regulations in Title 25 of the Texas Administrative Code, Chapter 289 as well as other applicable regulations and university policies. The RSC advises UH administration including the President, the Executive Vice President for Administration and Finance, the Senior Vice President for Academic Affairs and Provost, and the Vice President/Vice Chancellor for Research & Technology Transfer about radiation hazards at UH. The RSC operates under the functional authority of the Vice President/Vice Chancellor for Research & Technology Transfer.

Specifically, the RSC works with the RSO/LSO to:

- Review and grant permission for, or disapproval of, the use of radioactive material and/or radiation producing devices including lasers and x-ray machines at UH.
- Review and prescribe special conditions, requirements and restrictions as may be necessary to protect faculty, staff, students, and the general public from health hazards associated with radioactive material and radiation producing devices at UH.
- Prepare and disseminate information on radiation safety and provide safety training in the use of, and requirements pertaining to radioactive material and radiation producing devices at UH for the instruction and guidance of the faculty, staff, and students.
- Approve in advance, all structures and laboratories in which the uses of radioactive materials or radiation producing devices are planned, including new construction and modifications to existing facilities.
- Provide additional technical expertise to the Radiation Safety Program. Review and support the Radiation Safety Program and assist with solutions to issues arising from the use of radioactive materials and radiation producing devices.
- Shutdown or order the immediate termination of work in any facility where it is evident that health hazards exist and/or operations are in violation of existing federal, state, UH, and other applicable regulations.
- Investigate any possible misuse, apply and enforce any necessary disciplinary action, and notify the DSHS of any reportable incidents.

## **Radiation Safety Officer**

Radiation Safety Officer (RSO) acts as the operational functionary for the RSC and the University community. The RSO is charged with directing Radiation Safety Staff within Environmental Health & Life Safety Department to implement the University's Radiation Safety Program, maintain regulatory compliance, and establish good health physics work practices at UH. The RSO reports directly to the Director of Environmental Health and Life Safety. The EHLS Director reports indirectly to the Executive Vice Chancellor/ Vice President, Administration & Finance through the Assistant Vice Chancellor /Vice President for Public Safety & Security.

The RSO/LSO has authority, delegated by the licensee through the Vice President/ Vice Chancellor for Research & Technology Transfer through the Radiation Safety Committee, to take such actions as needed, including, but not limited to the cessation of the use of radioactive material and radiation producing devices, to safeguard the public welfare with regard to radiation producing devices and radioactive materials and necessary actions to enforce administrative requirements of the radiation safety program.

Specifically, the RSO will:

- Work with the RSC to develop and enforce policies and procedures for the protection of all individuals from the potential hazards related to radiation emitting materials, machines, or wastes.
- Advise the RSC about radiation hazards, make recommendations for the approval or disapproval of new facilities and/or PIs, and provide the appropriate signage and postings for radiation use locations.
- Disseminate information on radiation safety protection and provide specific radiation safety training courses.
- Administer UH's broad radioactive material license, x-ray and laser registrations with the DSHS.
- Inspect all UH's laboratory facilities using radioactive material or radiation producing devices to ensure safe use and compliance with the State Radiation Regulations.
- Provide a current and comprehensive Radiation Safety Program for UH and maintain all required records.
- Provide health physics services and consultative technical support to faculty, staff, and students.
- Perform investigations and report incidents to the DSHS.

## **Principal Investigators**

Principal Investigators (PIs) are specifically authorized by the RSC to obtain and use radioactive materials and/or radiation producing devices at specified locations within the University. PIs are responsible for all terms and conditions of their sublicenses or subregistrations, the training, and safety of their Authorized Users (AUs), and compliance with all applicable regulations.

University of Houston specifies no minimum training and experience for PIs. However, only faculty members with prior experience with radioisotopes, x-ray machines and lasers, presented to the RSC are approved. As part of the sublicensing process, the Radiation Safety Officer may obtain informal reference on prior documented experience of applicants and advise the Radiation Safety Committee. New PIs without adequate prior experience may be approved to work under supervision/ mentorship of another experienced PI with close supervision of the RSO and staff until competence is demonstrated. All intended PIs must undergo orientation to UH Radiation Safety Program prior to authorization.

## **Authorized Users**

AUs are specifically approved to work with radioactive material and/or radiation producing devices under the sublicenses and/or subregistrations of their PIs. AUs are responsible for working safely with radioactive materials and/or radiation producing devices which they are approved for, and for complying with all applicable regulations.

To be approved as an Authorized User, individuals are required to complete the applicable university safety training course and also receive specific training from their Principal Investigator or designee on the radiation specific procedures and hazards in their laboratories. The Radiation Safety Officer or Radiation Safety Committee may recommend additional training where documented training and experience is deemed inadequate.

## **General Laboratory Workers (Ancillary Personnel)**

General laboratory workers who are not authorized to work with radiation, visitors, and maintenance personnel and non-radiation workers in radiation use laboratories will be provided with radiation awareness training. In addition, they should be properly educated by the PIs and/or the Laboratory Managers on radiation safety hazards in the laboratories.

## **Enforcement Procedures for Non-Compliance**

The Radiation Safety Officer has regulatory and delegated authority to enforce program non-compliance up to and including shut down of activities deemed unsafe or during emergencies. The RSO also makes referral to the Radiation Safety Committee, senior university administrators up to the Associate Deans of Research of Colleges and the Vice Chancellor/Vice President of Research & Technology Transfer for assistance on procedural matters for actions to enforce administrative program requirements, when there is no immediate hazard.

## **Radiation Safety Training Requirements**

Training and education is a primary means of achieving a safe and healthy working environment. The mandatory radiation safety training provides fundamental principles of radiation protection and safety guidelines to all AUs of radioactive materials and radiation producing devices.

### **Initial Training**

The RSC requires all users of radioactive material, Class 3b and 4 lasers, X-ray machines, and other ionizing radiation producing devices requiring registration to complete the applicable radiation safety course. This includes all AUs and PIs.

The Radioactive Material, X-ray, and Laser Safety courses are currently offered with an exam requiring a passing score of at least 70%. An email will be sent to all who attend to indicate a pass or fail grade. The electronic mail indicating a passing grade should be maintained as a record of completion of the course. Failure to pass the course will require that a participant review the handout material and the Online Radiation Safety Manual and then retest within one month. Where interim authorization was granted, failure to pass the course will lead to suspension from working with any source of radiation. The three courses are provided at least once a semester. Other interested faculty, staff, and students are welcome to attend. Class registration is available on EHLS website at <http://www.uh.edu/ehls>.

**Note:** Completion of a radiation safety course does not automatically qualify someone as an Authorized User (AU). To receive authorization to work with specific radioactive material and/or radiation producing devices, you must be added to a PI's sublicense or subregistration through an amendment application.

### **Refresher Training**

Annual Radiation Safety Refresher Training courses must be completed by all persons authorized to work with radioactive materials, x-ray machines and Class 3b and 4 Lasers. PIs and AUs will receive notification of required refresher training. There is an exam with the refresher training with a required passing grade of 80% and participants will be notified by email of either passing or failing the exam. Failure to pass the refresher training will require that a participant review the training presentation and then retest within one month. The participant may also review the Radiation Safety Manual and Radiation Safety Officer may be contacted for assistance. Multiple attempts are permissible. Non-completion of the refresher training, either by not completing or passing the required exam will lead to suspension from working with any source of radiation.

### **Exemption from Refresher Training**

Inactive PIs and their authorized users will be exempted from annual refresher training requirements. However, completion of appropriate training will be required prior to

reinstatement from inactivity. The RSO/LSO will recommend the applicable training when request is received.

### **Interim Authorization/ Alternative Trainings**

Conditional approval as an AU may be granted by the RSO to an applicant, prior to completing the full course due to working demands, if they:

- Provide documentation of prior radiation safety training and experience.
- Successfully complete the applicable University radiation safety refresher training course.

Conditional approval is temporary until the full course is completed. Approval will be revoked if the full course is not completed as scheduled. Adherence to all Radiation Safety Manual procedures is required.

In addition, a person who plans to become an AU will only be required to complete the applicable radiation safety refresher training course if the person can provide documentation of adequate radiation safety training and experience from previous work within a year, subject to the RSO's approval.

In addition to the required trainings, all PIs are required to review and consent to the "Radiation Use Authorization- Terms and Conditions", signifying their intent to operate in compliance with University Policies.

PIs are also required to provide protocol specific, on-the-job training to their AUs regarding the safe use of radioisotopes and/or radiation equipment in their laboratories. Radiation workers who do not receive the required training should contact the RSO at 713-743-5867 for assistance.

## **Radioactive Materials**

The University of Houston was granted a license to possess and use certain radioactive materials per Title 25 Texas Administrative Code §289 (25 TAC 289). License # L01886, a specific license with broad authorization, issued by the Texas Department of State Health Services requires the university to develop and implement a program to control licensed material usage.

The License grants authorized use at the following sites:

<b>SITE</b>	<b>LOCATION</b>
001	University of Houston School of Pharmacy, 1441 Moursund
002	University of Houston Central Campus, 4513 Cullen Blvd.

A copy of the License and program records is available for inspection by contacting the Radiation Safety Officer, at Environmental Health and Life Safety Office, 4513 Cullen Blvd, Houston, TX.

Radioactive materials may be used as Sealed and Open sources. Authorization is not granted for the use of radioactive gases and aerosols. Sealed sources shall conform to applicable regulations of the U.S. Nuclear Regulatory Commission or Agreement States. Open form radioactive materials may be in liquid or solid form. To ensure personnel safety and compliance with 25 TAC §289, and University of Houston Radioactive Material License, prior to commencement of activities, intended Principal Investigators must receive prior approval before initial purchase or use of radioactive material, or changes to existing authorization.

The Principal Investigator who has been extended a Sub-License by the University of Houston Radiation Safety Committee to use radioactive materials shall:

- a. Establish safety procedures to ensure safe use of radioactive materials under the sublicense
- b. Ensure proper training of personnel under the sublicense
- c. Supervise all operations performed under the sublicense
- d. Maintain records of receipt, use, transfer, storage and disposal of radioactive materials as well as record of surveys
- e. Immediately notify the Radiation Safety Officer prior to addition of personnel, use location, isotope, new procedure, and in the event of spill, incident or accident in his/her laboratory
- f. Ensure radiation exposure is maintained as low as reasonably achievable and contamination levels below acceptable limits.
- g. Immediately notify the Radiation Safety Officer if any unexpected difficulties arise which affect the safety of personnel, lead to violation of procedures set forth, present health hazards, or danger to the university community as a result of the material use.

## **Radioactive Material Sublicense Application**

All radioactive material use at the UH must be approved by the RSO and authorized by the RSC.

New PIs must submit an Application for Radioactive Material Sublicense to EHLS-1005, for review by the RSO. This sublicense application must include all radioisotopes, radioactive material users, locations and procedures. Anyone not listed on the sublicense **must not** be allowed to work with radioactive material for any reason.

The use of radioactive material often requires specialized safeguards. Investigative procedures vary widely as do applicable safety techniques. The information provided on the application will enable the RSO to formulate necessary safety measures and assist the PI in implementing these measures. It is important that all requested information is included and the application completed. A compliance inspection will be performed prior to allowing radioactive material use.

PIs also planning to use radioactive material in animals must complete an Application for Use of Radioactive Material in Animals and submit it with the sublicense application. See section on Radiation Safety Procedures for the Use of Radioactive Material in Animals. Application forms can be found in the forms section of EHLS website <http://www.uh.edu/ehls>.

## **Radioactive Material Sublicense Amendment Guidelines**

Authorized PIs planning to make a change to their sublicense must complete and submit a Radioactive Material Sublicense Amendment Form at <http://www.uh.edu/ehls> and submit to the RSO for review. This includes additions and/or deletions of material, location, personnel and procedure.

The RSO will present all applications and amendments to the RSC for approval. The RSO may grant interim approval to PIs until the next RSC meeting. A temporary sublicense permit with a 90 day expiration date will be issued until the RSC approval is granted. When the RSO finds reason to grant interim authorization to a new PI prior to RSC approval, the authorization will be limited to 90 days to allow sufficient time for the RSC meeting (with quorum) to discuss and then approve, deny, or issue additional sublicense conditions to the PI. A new permit will then be issued after the RSC has approved the application.

Approved PIs will receive an Authorization Permit (Sublicense) to work with radioactive material, which is proof of radiation authorization at UH and may be submitted with Grant Proposals. Once authorized, the PI will remain authorized until sublicense termination by the PI or the sublicense is revoked by the RSC for noncompliance.

# **Radioactive Material Receipt, Package Check-In, Inventory Number, Record of Use, Transfer, and Lab Storage Procedures**

## **Package Receipt**

All radioactive material packages must be delivered to the Environmental Health and Life Safety Department (EHLS). The EHLS Department is located at 4513 Cullen Boulevard, Second Floor (Building 106 at Entrance 8) Houston, Texas 77204-1005. The EHLS office is open Mondays through Friday for business from 8:00 am to 5:00 pm. Radioactive material packages cannot be accepted outside normal business hours or on weekends or holidays unless previously arranged with the RSO.

## **Package Check-In**

All radioactive material shipments are checked in and inspected within 3 hours of delivery by trained and authorized radiation safety personnel. Packages with evidence of degradation of package integrity, such as a package that is crushed, wet, or damaged, shall be surveyed immediately. After checking in, packages will be delivered to the laboratories using approved university vehicles. This service is provided to ensure package contents are intact, accurate, and do not pose exposure or contamination hazards to lab personnel or the public. Precautions shall be taken to prevent the spread of radioactive contamination. Packages with unacceptable levels of contamination or with external radiation levels exceeding applicable limits will be investigated and the final delivery carrier immediately notified. The RSO or designee shall notify the Texas Department of State Health Services by telephone or facsimile when required.

## **Inventory Number**

Each radioisotope is assigned a unique inventory number. This is recorded on the vial, any vial container, and the Radioisotope Tracking Form. A Radioisotope Logbook is maintained as part of the Radiation Safety Records and inventory of all radioisotopes is electronically maintained. A physical review of all inventoried radioactive material stock vials will be performed during the lab audits.

## **Record of Use**

The Radioisotope Tracking Form (to be delivered with package) must be kept up to date and filled out completely at each time of use. The form must be returned to the RSO upon completion of the original stock vial, either through waste pick up or during inspections. The form must indicate that the radioisotope is decayed to background levels, used up with zero activity or retained for radioactive waste disposal, in which case a radioactive waste request should be submitted and the activity documented on the Radioactive Waste Disposal Form (see EHLS website). Upon receipt of the completed forms, the radioisotope will be removed from the respective PI's radioactive material inventory. Failure to return the forms in a timely manner may cause the PI to exceed maximum possession limits and could prevent or delay approval of new radioisotope orders.

### **Transfer of Radioactive Material**

All transfer of radioactive material between PIs within the University must be documented and approved by the RSO prior to the transfer. The Transfer of Radioisotope Form available at <http://www.uh.edu/ehls> must be used for all transfers. A new Radioisotope Tracking Form and inventory number will be issued for the transferred radioisotope.

PIs leaving the university and transferring their radioactive material to another institution must arrange to properly ship their material in consultation with the RSO. A 30-day prior notification should be provided.

### **Lab Receipt and Storage of Radioactive Material**

Radioactive material packages will only be delivered to approved laboratories and AUs. All radioactive materials shall be stored in a locked cabinet, refrigerator, freezer, or room, and when not in a locked device or room (such as during use), the material shall be accompanied by trained and authorized personnel at all times. Upon receipt, all radioactive materials must be stored in secure areas to prevent unauthorized removal. When necessary, radioisotopes must also be stored behind sufficient shielding to reduce radiation exposure. Radiation Safety personnel will inspect all radioactive material laboratories to ensure that appropriate safety measures are in place and proper safety procedures and controls are being followed prior to work with radioisotopes.

## Radioactive Material Procurement Procedures

Radioactive Material must only be ordered using a Purchase Requisition through the Purchasing Department per the UH Manual of Policies and Procedures (MAPP) 04.01.01. All Purchase Requisitions for radioactive material must be approved in advance by the RSO or designee.

**It is a violation of University policies to purchase radioactive material using a P-Card.**

**Note:** University policies also require that chemical compounds containing uranium or thorium be purchased as radioactive material, because these compounds may be subject to radioactive waste disposal requirements.

Free shipments, samples and/or replacements of radioactive material must also be pre-approved. Pre-approval will ensure that PIs are authorized for the requested radioisotopes and will not exceed approved maximum possession limits.

Completed purchase requisitions with Addendum B accessible at (<http://www.uh.edu/purchasing/>) should be sent to the EHLS Department for approval either by fax to 713-743-8035, email to [ehs@uh.edu](mailto:ehs@uh.edu), or by inter-campus mail to EHLS-1005. Orders will be promptly approved unless there are questions to be addressed. Purchase requisitions lacking the required information, improperly filled out, or outside the PI's authorization will be delayed. The Purchasing Department will reject orders that do not have EHLS pre-approval.

EHLS is generally responsible for pre-approvals, package surveys upon receipt, and deliveries to laboratories. Problems with orders after EHLS approval should be addressed directly with UH Purchasing department or the vendors. It is important that PIs provide a valid purchase order number to vendors with each order.

Purchase Order information must include:

- ❑ Radioisotope, e.g. P-32, C-14, etc.
- ❑ Maximum activity per vial, e.g. 500 microcuries ( $\mu\text{Ci}$ ), 0.5 mCi, etc.  
(**Not specific activity, e.g. Ci/ml**)
- ❑ Compound(s), e.g. DCTP, Thymidine, etc.
- ❑ Total number of vials
- ❑ Name of the PI authorized for the order.
- ❑ Deliver all shipments to:

*Environmental Health and Life Safety  
4513 Cullen Boulevard, Second Floor  
(Building 106 @ Entrance 8)  
Houston, Texas 77204-1005*

# **Radioactive Materials Laboratory Setup Guidelines**

## **General**

Radioactive material shall only be used at locations approved on the sublicense by RSC. A PI wanting to add a radioactive material use location must submit a completed sublicense amendment request to the RSO. The amendment application should provide details of the area and the proposed uses and receive approval by the RSC. The adequate setup of the radioactive material work area will be assessed prior to RSC approval.

## **Signage**

All radioactive material labs must be properly posted with “Caution Radioactive Materials”, “No Smoking, Eating, or Drinking in the Laboratory” signs, and other such hazard warning signage at each entrance. This signage will be provided and posted by Radiation Safety in EHLS Department and shall be visible at all times. Laboratory personnel should contact the RSO for a replacement sign if the one provided has been removed, defaced or damaged.

## **Postings**

Radioactive material labs must be posted with copies of the “Notice to Employees” from the Texas Department of State Health Services Radiation Control Program, the Notice of Document Location, and the Radiation Emergency Procedures. These will be provided and posted by EHLS Department. They shall be visible at all times. Lab personnel should contact EHLS for replacement postings if the ones provided have been removed or damaged.

## **Restricted Access**

Access to all radioactive material laboratories shall be restricted to authorized personnel only. Housekeeping or maintenance personnel may be allowed into these areas to perform their functions as scheduled or at other times under the direct supervision of laboratory personnel who can assure their safety. Personnel monitoring badges are not assigned to housekeeping or maintenance personnel, but could be provided if necessary. The RSO must be notified of non-routine maintenance at authorized locations to ensure proper monitoring. Doors to all radioactive material laboratories must be securely closed and locked when no one is present. Radioactive material must remain secure at all times from unauthorized use and/or removal.

## **Survey and Analytical Instrumentation**

A survey meter which is appropriate to the type, energy and levels of ionizing radiation must be made available by the PI for users of high energy beta and/or gamma emitting radioisotopes. Laboratories using low energy beta emitters such as H-3, C-14, and S-35 are not required to have survey meters. Liquid scintillation or Gamma counters must be available and in calibration for PIs and their AUs to perform their required wipe test analysis. Please consult with the RSO prior to the purchase of a new survey meter. New

meters (purchased or donated) to be used at UH must be registered with the RSO and will be added to the annual calibration schedule.

### **Shielding**

Shielding materials appropriate to the type, energy and levels of radiation in all laboratories shall be made available. High energy beta emitters shall be shielded with at least 3/8 inches of Plexiglas to minimize the radiation exposure. Work and storage areas must be shielded such that the dose rates are within required limits. In general, exposures shall always be maintained "As Low As Reasonably Achievable" (ALARA). The ALARA program is set to keep occupational exposures under 1/10 of the allowable maximum permissible exposure limits. Shielding evaluations and design requires the RSO's pre-approval.

### **Material Handling**

Containers with more than 100  $\mu\text{Ci}$  of gamma or high energy beta emitting radioisotope should not be hand-held for prolonged periods of time to minimize radiation exposure. Tongs, forceps, or other remote handling tools are recommended. Liquid or loose radioactive material should be contained in a secondary, unbreakable and corrosive resistant container. Please consult the RSO if additional training is needed.

### **Fume Hoods**

Experiments that generate aerosols or use volatile radionuclide compounds must be performed in EHLS inspected fume hoods with adequate flow rate. All iodination must be performed in an approved fume hood without exception. Additionally, experiments with such radionuclides should be performed in an area under negative air pressure. Refer to the fume hood procedures in the [EHLS Safety Manual](#) for more information on laboratory fume hoods.

## **Radioactive Material Laboratory Safety Guidelines**

Basic laboratory safety guidelines are necessary to ensure personnel safety and prevent radioactive contamination or spills and ensure compliance. Consistent and active participation by all laboratory staff is essential.

The following set of guidelines is not exhaustive.

- Non-essential personnel should not be allowed in the laboratory while radioactive procedures are in progress.
- A portion of the laboratory should be set aside only for radioactive procedures. Locate these work areas away from heavy traffic and doorways. Do not change pre-approved work space without consultation with the RSO.
- Work with radioactive material should be done rapidly but carefully to minimize exposure.
- Every container of radioactive material should be labeled for identification with the radiation warning symbol and pertinent information such as the radionuclide content, date and activity.
- Exercise deliberate caution in handling radioactive material and transport them in doubly contained and shielded containers to protect against external radiation exposure and spills.
- Wear laboratory coats and other recommended protective clothing at all times in areas where radioactive materials are used.
- Wear disposable gloves at all times while handling radioactive materials.
- Do not eat, drink, smoke, apply lip balm, or apply cosmetics in any area where radioactive materials are stored or used.
- Do not store food, drinks, or personal effects within radioactive material laboratories.
- Dispose of radioactive wastes only in specially labeled and properly shielded receptacles.
- Never pipette by mouth.
- Absorbent paper shall be used to cover workbenches, trays, and other surfaces where radioactive materials are handled.
- Monitor hands and clothing for contamination after each procedure or before leaving the area. This is done using a survey meter.

- Survey all areas where radioactive materials are used in uncontained form after each procedure and/or at the end of the day. Decontaminate immediately if necessary.
- Records of all monthly and post-experiment surveys must be performed and maintained by the Principal Investigator, and Authorized Users.
- Work should be planned ahead; whenever possible, a practice run should be performed to test the procedure.
- The laboratory should be kept clean and orderly at all times.
- Radiation survey instruments should be checked prior to use to ensure proper operating conditions. That includes a battery check to be performed before each use.
- Radiation badges, when assigned, shall be worn at all times while in areas where radioactive materials are stored or used. Assigned ring badges shall also be worn at all times when handling radioactive materials.
- All radioactive materials must be secured at all times to prevent unauthorized access and the laboratory must be locked when no one present.
- If a suspected or known overexposure occurs to any individual, the Radiation Safety Officer must be notified immediately.

# **Radioactive Material Laboratory Survey and Wipe Test Procedures**

Radiation exposure and radioactive contamination are significant sources of radiation dose in the laboratory. In order to know if the working surfaces in your laboratory are free of radioactive contamination, a contamination check should be performed after each experiment and recorded. This is achieved using a survey meter and/or a wipe test. These checks are necessary to keep radiation exposures ALARA and do not replace the mandatory monthly laboratory surveys and wipe tests.

## **Monthly Surveys and Wipe Tests**

### **Frequency**

Radioactive Material PIs with active use of radioisotopes must perform monthly laboratory surveys and wipe tests on all authorized labs where there is use or storage, e.g. counting rooms, cold rooms, shared rooms, and other such locations. However, the RSO may recommend a different wipe test frequency depending on the radionuclides and amounts used. Active listed labs with no use or storage will require documentation indicating “No Use or Storage”, if surveys and wipe tests are not performed. Radiation Safety personnel also perform lab surveys and wipe tests on a quarterly basis to verify compliance.

Lab surveys and wipe tests are to be performed and documentation due by the 15th of each month to the RSO via e-mail, by inter-campus mail to EHLS-1005, or by fax at 713-743-8035. Lab surveys and wipe tests received late without previous notice will be cited for noncompliance; repeated violations will jeopardize the PI’s sublicense. It is mandatory that all required lab surveys and wipe tests be completed each month and documentation submitted for review without exception to prevent a Notice of Violation to the University’s License from the Texas Department of State Health Services. The RSO will maintain these records as required for regulatory inspection.

Inactive Radioactive Material PIs (PIs without any radioactive material stored or used and granted inactive status by the RSC) are exempt from the survey and wipe test procedures. A Radioactive Material PI may request inactive status designation at any time by notifying the RSO, properly disposing of all radioisotopes, samples, and waste and submitting a verified survey and wipe test document. Conversely, an inactive Radioactive Material PI may become active by notifying the RSO.

### **Surveys**

Wipe tests are preceded by an overall survey to determine immediate external exposure hazards and areas which require detailed attention during wipe testing. A survey must be performed using survey meter on all labs using radioisotopes other than H-3, C-14 and S-35 (Low energy beta emitters). Before using any survey meter, check for current calibration and proper functioning. If the batteries are weak, replace them before performing the surveys. Check that the meter is properly responding by holding the probe close to the radiation source, without touching it. Obtain background readings before surveys.

Several probe types are available for portable survey instruments. The most common types are the end-window, pancake, and side window probes. All probes are to be positioned so that the detection window is facing the area to be checked. For the side window probe, the shield must be opened when surveying for beta emitter contamination. Additional training on this procedure should be requested as needed.

Monitoring for contamination is performed by slowly moving the detector over all surfaces at a distance of approximately 1 centimeter. The survey meter should be turned on before entering any radiation area starting with the lowest setting for known radiation fields. The audio should always be “on” since small increases of radiation exposure are easily detected by listening to the clicks. It is easier to pay attention to the surface being monitored and the meter does not have to be constantly watched. Care must be taken not to contaminate the probe by touching the surface being checked. Request assistance from the RSO for contaminated probes.

Any area with meter readings above twice background or greater with the survey meter must be thoroughly investigated and immediately decontaminated if necessary, then resurveyed to confirm that the area is below twice background. Decontamination must be documented.

Calibrations of survey meters must be performed annually and is coordinated by the RSO or designee. Calibration is also required after a repair or the replacement of parts (e.g. probe). EHLS personnel will pick up the meters and labs will be provided with loaner meters during the period. Calibrated meters will have a calibration label affixed to the side or bottom with the date of calibration and serial number of the instrument. The calibration certificate will also be provided for laboratory records.

### **Wipe Tests**

Cotton swabs or small filter paper discs are used for wipe tests. Either dry or wet wipe tests are acceptable. To perform a wipe test, start with the outer perimeter of least suspected contamination and then move to the center of the highest possible contaminated area in order to prevent the spread of contamination. For example, one would wipe the sash and outer area of a fume hood before wiping the inner surfaces. Appropriate personal protective equipment must be worn when performing wipe tests.

Wipes are to be taken at strategic locations around the laboratory, to be decided by AUs based on knowledge of material use. Any area found with a wipe test result of 200 dpm per 100 cm<sup>2</sup> or greater from a liquid scintillation counter or a gamma counter is considered contaminated. This area must be immediately decontaminated until the wipe test count is below 200 dpm. Areas to consider for testing include:

- work benches and lab notebooks
- fume hoods
- sinks and adjacent areas

- radioisotope storage areas
- refrigerator/freezer surfaces and handles
- light switches and door knobs/handles
- lab telephone handsets and key pads
- centrifuge handles and controls knobs
- incubators
- floors beneath work areas and around waste areas

### **Documentation**

Lab surveys and wipe tests must be recorded on the lab specific Radioactive Material Laboratory Survey and Wipe Test Forms provided. **Please use the Radioactive Material Laboratory Survey and Wipe Test Form issued by Radiation Safety, with the layout of your lab already drawn.** The locations of each survey and wipe test must be properly identified on the form. Information on the forms must be completely filled out or it will be returned. Completed survey documentation and current copies of the form are to be retained for inspections and future use.

## **Personnel Monitoring Procedure and Guidelines**

Radiation dosimetry involves the estimation of the absorbed dose resulting from exposure to indirectly and directly ionizing radiation. Use of personnel dosimeters ensures that we are following the principle of ALARA, maintaining exposures as low as reasonably achievable. The Radiation Dosimetry Program is administered within the Radiation Safety Program and includes both internal and external exposures. Radiation badges/monitors are only required to be issued to radiation workers likely to receive one-tenth of the maximum permissible exposure limits. While this exposure level is generally unlikely at UH labs, badges are issued to users of larger amounts of high energy beta and gamma emitters, as well as the primary users of x-ray diffraction machines and particle accelerator to ensure exposures are in compliance. Area badges are also located in or around potentially higher exposure laboratories for Public Dose Monitoring.

Radiation badges are issued on a quarterly basis (except for fetal badges) and all monitoring records are maintained by the RSO at the Environmental Health and Life Safety Department. Any unusual or high doses will be investigated and the appropriate agency and/or participants will be notified as required. The investigation level of the ALARA program is set at one-tenth of the maximum permissible exposure limits (See occupational exposure limits below).

Radiation workers that may require radiation badges must fill out a Radiation Badge Request Form and submit to Radiation Safety Officer by electronic mail to [ehs@uh.edu](mailto:ehs@uh.edu), fax to 713-743-8035, or to mail code EHS-1005. All forms can be found on the Environmental Health and Life Safety website at <http://www.uh.edu/ehls>.

### **UH Pregnancy Brochure**

A pregnant radiation worker who wants to be monitored as a pregnant worker while working with radioactive materials or radiation producing devices is required by regulations to voluntarily declare, in writing, to her employer of her pregnancy with the estimated date of conception. Pregnancy monitoring is accomplished via the RSO at UH. A monthly fetal badge will be issued to be worn at the waist and the dose will be monitored during the entire pregnancy as stipulated in the State Radiation Regulations. A pregnant radiation worker may undeclare the declaration, in writing, to her employer at any time during the pregnancy without explanation. More information on pregnancy declaration, undeclaration and associated forms can be found at <http://www.uh.edu/ehls/about/forms/>

Further information on radiation protection during pregnancy is provided at the NRC Regulatory Guides 8.13 Instruction Concerning Prenatal Radiation Exposure at <http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/rg/division-8/division-8-1.html>

### **Occupational Maximum Permissible Exposure Limits**

Current dose limits for occupational radiation exposure as specified in Texas DSHS regulations (25 TAC 289.202) are based upon the conservative assumption that there is no safe level of exposure. This assumption has led to the general philosophy of not only keeping personnel doses below recommended levels or regulatory limits but of also

maintaining all doses ALARA. This is a fundamental philosophy of current radiation safety practice.

The limits are:

<b>Area</b>	<b>Dose (Rem/year)</b>
Whole Body	5
Any Individual Organ or Tissue	50
Eye	15
Skin or Extremity	50
Minor (Under 18 years old)	10% of the listed limits
Individual member of public	0.1
Embryo/ Fetus	0.5 rem/ 10 months

The radiation badge should only be worn while working with radiation sources. When not in use, badges should be kept in a secure location away from radiation sources. The radiation badge should never be taken out of the facility or left in a car. Laboratories should maintain a designated location for dosimeters.

The radiation badge should be worn properly between the neck and waist area with the back of the badge facing the body. The radiation badge should only be worn by the assigned individual (whose name is on the badge) because it is a measure of that individual's personal exposure. The radiation badge in no way provides protection from radiation. Its sole purpose is to measure the amount of radiation to which it is exposed.

Do not experiment with a radiation badge by deliberately exposing it to radiation. The radiation badge is only for occupational exposure measurement at UH. Intentionally exposing any radiation badge is prohibited by state regulations and will lead to disciplinary actions.

### **Lost, Damaged, or Contaminated Badge**

If a badge is lost, damaged or contaminated, notify your PI and RSO immediately for a replacement badge. This must be done prior to conducting any additional duties within the radiation work area.

PIs and/or Authorized Users that do not promptly report lost badges or return old badges may be charged for the cost of the badge plus administrative fees. PIs must also immediately report when their Authorized Users terminate and arrange to return the badge promptly to the RSO.

A dose assessment is required for all lost or damaged badges. The radiation badge from the previous quarter or wear period must be turned in promptly when a new badge is distributed. Any old badges that are found should be returned promptly to the RSO at EHLS-1005. Authorized Users must notify their PI and the RSO if they terminate employment and turn in their badges.

In addition to radiation badges for external exposures, bioassays may be required to determine potential internal exposures. Baseline bioassays will be taken when potential for internal exposure is identified. Bioassays will be necessary when an individual handles certain quantities of unsealed Iodine-125 (I-125), Iodine-131 (I-131), or Tritium (H-3) in open form, over any three (3) month period, or at any one time, as specified in the regulations. A thyroid scan will be required between 24 and 72 hours for all personnel who worked with 1 milliCurie (mCi) or greater amounts of I-125 in open form at a time. A urinalysis will be also required for individuals who work with shipments of 100 mCi or greater of H-3. Bioassays may also be necessary due to an incident resulting in internal deposition from accidental inhalation, ingestion, injection, or absorption of a radioisotope, such as exposure to Tritium release from Tritium containing Exit signs.

## **Radiation Safety Procedures for the Use of Radioactive Material in Animals**

A Radioactive Material PI with a Sublicense, planning to use radioactive material in animals must complete an Application for Use of Radioactive Material in Animals, and submit to the RSO for review. Radiation safety forms can be found in the Radiation Safety forms available at <http://www.uh.edu/ehls/>.

Investigative procedures involving animal vary widely as do applicable safety techniques. The use of radioactive material in animals requires additional safeguards in the handling of affected animals. The information provided on the application will enable Radiation Safety to formulate necessary safety measures and assist the PI in implementing these measures. It is important that all requested information is included and the application fully completed i.e. experimental protocols must be described in detail.

Details concerning the actual use of animals must be discussed with Animal Care Operations and the research protocol approved by the Institutional Animal Care and Use Committee (IACUC). No research activities using animals can be started without prior approvals.

The RSO will submit all applications to the RSC for review and approval. However, the RSO may also grant interim approval to PIs subject to ratification and final approval of the RSC. Approved PIs will receive an amended Authorization Permit to work with radioactive material in animals, which is proof of radiation use authorization at UH and may be submitted with Grant Proposals. Once authorized, the PI will remain so until voluntary sublicense termination by the PI or revoked by the RSC for noncompliance. The IACUC will be notified and provided with a copy of the approved application.

The PI is responsible for the overall radiation safety of the project, including radiation exposure monitoring of the animals, cages, and procedures; analytical determination of radioactivity in urine, feces, bedding; and labeling of all cages containing radioactive animals. Consultation and assistance will be provided upon request. Tags for this purpose must indicate the radioisotope, the activity (in  $\mu\text{Ci}$  or  $\text{mCi}$ ) and the date. Animal Care Operations must be notified per terms of the IACUC protocol approval prior to housing animals with radioactivity in their facility. Such notification may not necessary for use within the PI's authorized laboratories.

### **Procedure for Disposal of Radioactive Contaminated Animals/ Associated Waste**

All animal remains, i.e., viscera, tissue, serum or other fluid, and the carcass containing radioactive material [except H-3, C-14, and I-125 as described below] are to be disposed as follows:

- Place the remains in a yellow radioactive materials waste bag. Secure the bags closed with tape and indicate the radioisotope, the activity (in  $\mu\text{Ci}$  or  $\text{mCi}$ ) and the date on the tags. Submit a waste pick up request via EHLS website (see radioactive waste disposal

section). The bag will be collected by EHLS and stored in the radioactive material labeled freezer at the Radioactive Waste Facility for future disposal or incineration through a regulated vendor at a regulated onsite facility as determined by the Radiation Safety Officer.

- All animal wastes with short half-life isotopes ( less than 165 days) will be placed in a clear bag and securely shut with tape and indicate with radioactive material stickers, radioisotope, the activity (in  $\mu\text{Ci}$  or  $\text{mCi}$ ) and the date on tag. Submit a waste pick up request on the EHLS website (see radioactive waste disposal section). The bag will be collected by EHLS and stored in the radioactive material labeled freezer at the Radioactive Waste Facility for at least 10 half-lives. After 10 half-lives, the waste will be surveyed and transferred for disposal as regular animal wastes.
- Animal remains containing H-3, C-14, and I-125, in quantities less than 0.05  $\mu\text{Ci}$  per gram, may be disposed of as non-radioactive waste. Place the remains in a clear waste bag without a radioactive material label. The bag is to be placed in the non-labeled freezer in the Animal Care Facility as prearranged with Animal Care Operations. The PI must maintain inventory records with the date, activity, and radioisotope used in the animal.

25 TAC §289.202(fff)(1) provides for the disposal of certain excess materials without regard to its radioactivity as follows:

- 1) 0.05 microcuries or less of H-3, C-14, or I-125 per gram of medium used for liquid scintillation counting or in vitro clinical or laboratory testing;
- 2) 0.05 microcuries or less of H-3, C-14, or I-125 per gram of animal tissue, averaged over the weight of the entire animal.

All excess materials containing radioactive materials shall be picked up by EHLS and a determination shall be made by RSO as to the qualification of the materials with regard to 25 TAC §289.202(fff). Documentation shall be generated and maintained to verify qualification of this waste as exempt waste.

The following table can be used to determine activity levels in animal remains that may be disposed of as non-radioactive (exempt) waste:

**Amount of H-3, C-14 or I-125 in Animal Remains  
that May be Disposed of as Non-Radioactive Waste**

<u>Weight</u>		<u>Activity</u>	<u>Weight</u>		<u>Activity</u>
Grams	Pounds	µCi	Kilograms	Pounds	µCi
100	0.22	5	2.5	5.5	125
200	0.44	10	3	6.6	150
300	0.66	15	3.5	7.7	175
400	0.88	20	4	8.8	200
500	1.1	25	4.5	9.9	225
600	1.32	30	5	11	250
700	1.54	35	7.5	16.5	375
800	1.76	40	10	22	500
900	1.98	45	20	44	1.0 (mCi)
1 (Kg)	2.2	50	30	66	1.5 (mCi)
1.5 (Kg)	3.3	75	40	88	2.0 (mCi)
2.0 (Kg)	4.4	100	50	110	2.5 (mCi)

**Procedure for Cleaning and Decontamination of Animal Cages**

To minimize the spread of contamination, animals used in studies with, or injected with radioactive material shall be housed in cages or stalls separate from other animals in a separate room. The cages or stalls shall be labelled and secured from unauthorized access. Designated animal care-givers will receive appropriate radiation safety training. To reduce the potential for personal contamination, care-givers will wear gloves, lab coat, and eye protection as appropriate. Special care and additional protective clothing will be worn when cleaning the cages or stalls. Other personal protective equipment and controls will be implemented depending on exposure and contamination potential. Since the cage or stall, beddings, and waste from the animal may contain radioactive material, they will be properly disposed of as described in the section Waste Disposal Procedures for Animal Materials.

**Procedure for Ensuring Animal Rooms are Locked or Otherwise Secured Unless Attended**

The Animal Care Facility at UH is currently under restricted access with card keys accessible to authorized personnel only. Radiation use locations have additional access restriction to authorized users only. All Animal Care Operations workers that may come in contact with animals containing radioactive materials are required to complete the UH radioactive material safety course. Training content includes the requirement to ensure rooms where radioactive material is stored or used remains locked or secure whenever unattended.

## **Radioactive Waste Disposal Procedures**

Radioactive waste requires the same safety and security measures similar to radioactive materials. The PI is responsible for the safe, secure, and proper storage of radioactive wastes generated until removed by the EHLS department. The University's Radiation Safety Manual establishes guidelines to ensure compliance with the required procedures for collection, packaging, labeling, transport and disposal of radioactive wastes generated under licensed activities conducted at UH.

EHLS is responsible for the pickup, management and disposal of all radioactive wastes from the laboratories. Radioactive waste management including segregation, direct handling, repackaging and, physical disposal will be conducted by trained and authorized personnel only under the direction of the RSO. Consequently, radioactive waste violations pertaining to the radioactive waste areas in the labs and the radioactive waste picked up from the labs will be cited for non-compliance. Serious violations such as sharps found in solid waste bags pose immediate danger to the safety and health of personnel. Poor radioactive waste disposal practices also lead to a higher threat of radioactive material contamination and spill. Non-compliance items are expected to be addressed immediately and procedures put in place to prevent recurrence.

PIs are responsible for implementing effective radioactive waste management procedures in the labs. They must provide adequate radioactive material labeled receptacles for each radioisotope and type of radioactive waste generated. The disposal of all radioactive waste must be recorded on the Radioactive Waste Disposal Form available at <http://www.uh.edu/ehls>.

Radioactive waste should not be stockpiled in the lab. A radioactive waste area should be located away from heavy traffic or high use areas. Adequate space for shielding should be considered. High energy beta and gamma emitters must be stored behind appropriate shielding material to minimize the external exposure to lab personnel. Plan to contain liquid waste in the event of a spill or failure of the plastic carboy. Containment can be easily achieved by placing the carboy or liquid waste container in a secondary container or by placing plastic backed absorbent paper beneath them.

Do not, under any circumstances, place radioactive waste where it might be picked up by housekeeping personnel and be disposed of as ordinary waste in the dumpsters. Accidental and improper radioactive waste pick-up and/or disposal must be reported immediately to the RSO.

Before requesting a radioactive waste pickup, please make sure the containers are properly sealed and the Radioactive Waste Disposal Forms are completely filled out and attached. Full waste containers that require shielding should not be left outside of shields while awaiting pickup. All requests for radioactive waste pickups in the labs or other special areas will be completed online using the UH Hazardous Waste form link at <http://www.uh.edu/ehls>.

The interactive form streamlines the documentation of waste information and provides a printable record for reference. Specific information such as PI, location, waste type, number of containers, etc must be provided. In addition, indicate if replacement radioactive material bags, carboys or radioactive contaminated sharps containers are needed. A reference number will be issued with every request. The waste will be picked up per EHLS schedule unless there is inclement weather. Contact EHLS office at 713-743-5858 for questions and assistance with waste pick up request and documentation.

## **Waste Segregation and Minimization**

Waste segregation by form and isotope is an effort to minimize the volume of radioactive waste disposed at licensed land disposal facilities. For this initiative to succeed, it is necessary that all PIs and laboratory personnel follow proper radioactive waste procedures as much as possible.

Radioactive waste must be segregated by radioisotope and physical form. The only general exceptions are the radioisotopes H-3 and C-14 which can be stored together. Any other exception must be pre-approved by the RSO. The basic physical forms are: solids, glass, sharps, liquid, liquid scintillation vials (LSV), biological, animal remains, source vials, lead pigs, and sealed sources.

### **Solid**

Solid radioactive waste is comprised mostly of solid disposable items that have been contaminated with radioactive material including absorbent work surface coverings, gloves, tubing, etc. This waste is disposed in yellow radioactive material bags supplied by EHLS. The use of any other type of plastic bag to collect the solid radioactive waste in the laboratory is prohibited. The yellow radioactive material bags must be placed in waste receptacles that remain closed at all times. Deface or remove all radioactive labels before placing waste into the bags. Do not place anything in the bags in such a way that they may tear it. Inspect the plastic waste bag for leaks prior to removal from the lab. Use a second yellow bag to contain the waste if necessary. Do not mix liquid scintillation vials, lead pigs, and stock vials with the solid waste, **especially sharps**. Plastic source vial containers, but not the lead impregnated type, may be disposed in the solid waste after being defaced of all radioactive labels. Every bag must be securely sealed and have a completed Radioactive Waste Disposal Form attached prior to pickup.

### **Glass**

Radioactive contaminated glassware and other unbroken glass should be packaged separately from other solid radioactive waste. A strong cardboard box is adequate for disposal use. Every box must be labeled, securely sealed with a completed Radioactive Waste Disposal Form attached prior to pickup.

## **Sharps**

Sharps are defined as anything that could tear the yellow radioactive material bag including needles, razor blades, capillary tubes, broken glass etc. This waste type is disposed in clear, puncture resistant plastic tubes supplied by EHLS. These tubes are only for the disposal of radioactive contaminated sharps. Do not recap sharps, exercise caution when putting sharps into the container and do not overfill. Make sure that all sharps are dry before placing into a container. When full, securely cap the tube and have a completed Radioactive Waste Disposal Form attached prior to pickup.

## **Liquid**

Radioactive liquid waste can be further divided into aqueous, acids and bases, and pump oils. Aqueous liquids are water-based liquids with a pH between 5.0-9.0, such as saline and buffer solutions or washings from radioactive contaminated laboratory glassware, and weak acids and bases that contain no biological, pathogenic, or infectious materials. Liquid waste is disposed in 5-gallon plastic containers called carboys, supplied by EHLS. These carboys are not to be filled more than 4/5th full to prevent spills or overflows. No radioactive liquid is to be poured down the sink. Sinks will be checked during routine lab surveys and wipe tests. Pipettes and other such items must not be placed in the carboys. All biological material in the carboys must be properly deactivated using 10 percent bleach solution. Do not mix liquid waste types in the carboys.

Double containment in a tray or pan that will adequately contain the liquid is recommended as a precaution against leakage or a spill. This will also control accidental overflow and drips due to pouring. At a minimum, plastic backed absorbent paper shall be placed under all liquid waste containers. Carboys should be kept as free of contamination as possible. Glass containers, such as used bottles of chemicals must never be used for storage of radioactive liquid waste unless the carboy provided is incompatible with contaminated acids or bases. These, whenever used, must be double contained. Every carboy must have a completed Radioactive Waste Disposal Form attached prior to pickup.

## **Liquid Scintillation Vials**

Liquid Scintillation Vials are glass or plastic vials containing organic or aqueous based liquid scintillation fluid. This waste is disposed in the original cardboard trays and placed in a yellow radioactive material bag or double bagged in yellow radioactive material bags. Glass vials not in the original trays must be double bagged in yellow radioactive material bags. Ensure that all vial tops are closed tightly because all scintillation fluids will dissolve plastic in time. Every bag or box of vials must be securely sealed with a completed Radioactive Waste Disposal Form attached prior to pickup. The use of biodegradable scintillation fluid is strongly recommended.

## **Biological**

This category covers liquid radioactive waste containing biological, pathogenic, or infectious material including by-products of animal waste, labeled culture media, etc. This waste is disposed either in yellow radioactive material bags and labeled with biological

waste stickers, or in red biological bags labeled with radioactive material stickers. Both types of bags are supplied by EHLS. Liquids must be absorbed into some absorbent material such as paper towels, sponges, gauze, etc. prior to placing into bags. Pathogenic and infectious waste must be sterilized by chemical treatment. Do not autoclave radioactive contaminated biological waste except the autoclave is dedicated for such waste only. Every waste bag must be securely sealed with a completed Radioactive Waste Disposal Form attached prior to pickup.

### **Animal Remains**

This category covers radioactive animal carcasses and by-product waste including viscera, serum, blood, excreta, tissue, etc. to be incinerated. Animal remains containing radioactive material are subject to handling according to the guidelines stated in the Radiation Safety Procedures for the Use of Radioactive Material in Animals. This waste is disposed in yellow radioactive material bags supplied by EHLS. Every bag must be securely sealed with a tag indicating the date, radioisotope, total activity, and the PI tied to the bag. Liquids must be absorbed into some absorbent material such as paper towels, sponges, gauze, etc. prior to placing into bags.

### **Source Vials**

These are the original vials that the radioactive material was shipped in to a lab and includes full, partially full, and empty vials awaiting disposal. All source vials must be returned to EHLS for proper disposal according to licensee's operational conditions. Source vials are handled differently from the solid waste. Segregation of vials by radioisotope does not apply to source vials. A Radioactive Waste Disposal Form is not required, but the Radioisotope Tracking Form should be returned along with the source vial.

### **Lead Pigs**

These are the original lead and/or lead impregnated shielded containers of source vials. Lead is a hazardous waste and must be picked up for recycling or proper disposal by EHLS. Lead pigs and lead impregnated shielding containers must be kept separate from the solid waste. A Radioactive Waste Disposal Form is not required. Segregation by radioisotope does not apply to lead pigs.

### **Sealed Sources**

Sealed sources include calibration sources, check sources, quenched standard sets, electron capture gas chromatograph detectors, etc. Final survey and/or leak tests are required to be performed on all sealed sources prior to disposal. All sealed sources must be turned in to EHLS for proper disposal even if it is deemed decayed. PIs and AUs must check for broken or crushed sources and handle these damaged sources with extreme care. Notify the RSO immediately if a source breach or contamination is found or suspected. Sealed sources must be kept separate from the other wastes for disposal. A Radioactive Waste Disposal Form is not required. Segregation by radioisotope does not apply to sealed sources.

## **Radioactive Material Spill, Accident, and Emergency Response**

Radioactive material incidents may involve three levels of response due to severity: spills, accidents, and emergencies. All these events may raise exposure and contamination concerns with potentially increased dose both internally and externally to the lab personnel, the environment and members of the public. Each incident must be carefully evaluated before proceeding and approached properly to prevent additional hazards and personnel exposure. Contact numbers are listed below for assistance.

Every radioactive material laboratory using open sources must have a radioactive material spill kit designed to handle a small spill (as defined below). A spill kit should contain the following at the minimum:

### **Basic Spill Kit Items**

Radioactive decontamination reagent, plastic backed absorbent, radioactive waste bag 24 x 36 inches, latex gloves, cotton swabs, shoe covers, sealable plastic bag 12x15 inches, sealable plastic bag 4x6 inches, etc.

## **Radioactive Material Spill**

A radioactive material spill may be in the form of liquid, powder, mist, fume, organic vapor, or gas. The spill may pose cross-contamination concerns to the lab and adjacent areas as well as personnel.

Two types of spills are possible in a lab situation depending on the volume and activity:

Small Spill- Small amount of activity (less than 100 micro Curies) and/or small volume (typically less than a pint) within a small area. The cleanup of small spills is a routine responsibility for radioactive material authorized users. However, Radiation Safety personnel will provide assistance with small spills whenever requested.

### General procedures:

- Notify all personnel in the room of the spill.
- If personnel are contaminated, proceed immediately with personnel decontamination using techniques as described further in this section.
- If there is personnel contamination, the RSO must be notified immediately
- Confine the spill as soon as possible using absorbent pads.
- Decontaminate the area (as described in the Decontamination section below) using spill cleanup supplies with appropriate personal protective equipment
- Perform surveys and wipe tests to verify that the area has been adequately decontaminated.
- Dispose of all spill clean-up material as radioactive waste. This includes any contaminated broom, mops, dust pan, etc.

Large Spill - Large amount of radioactivity greater than 100 microCuries, high radiation exposures at the surface (> 100 mR/hr), large volume of fluid (typically > 1 pint), and/or

large surface area contamination, e.g. entire bench top or laboratory floor area. The RSO or other Radiation Safety personnel must be contacted immediately for large spills to take charge of clean up operations and follow up to verify decontamination to acceptable levels. Personnel are expected to use sound judgment in initiating cleanup efforts.

#### General procedures:

- Evacuate the affected area. If appropriate, survey all persons not involved in the spill and vacate the room.
- Prevent the spread of contamination by covering the spill with absorbent paper (paper should be dampened, if solids are spilled), but do not attempt to clean it up. To prevent the spread of contamination, limit the movement of all personnel who may be contaminated.
- Shield the source only if it can be done without further contamination or significant increase in radiation exposure.
- Close the room entry ways and lock, otherwise secure the area to prevent entry. Post the room with a sign to warn anyone trying to re-enter that a spill of radioactive material has occurred.
- Survey all personnel who could possibly have been contaminated. Decontaminate personnel by removing contaminated clothing and flushing contaminated skin with lukewarm water and then washing with a mild soap.
- Allow no one to return to work in the area unless approved by the RSO.
- Assist the RSO and/or Radiation Safety staff (e.g., investigation of root cause, provision of requested bioassay samples).
- Follow the instructions provided by the RSO and/or Radiation Safety staff (e.g., decontamination techniques, surveys, provision of bioassay samples, requested documentation).

If you need assistance with a large spill after normal working hours, please call the UH Police Department's at 713-743-3333 and the RSO will be notified.

## **Decontamination**

Decontamination is the removal of unwanted radioactive materials. Contamination can be on an area, on personnel, and in some cases, involves injury to personnel. Major personal injuries take priority over decontamination which can be performed at a later time.

### **Personnel Decontamination**

Contaminated clothing, including shoes, should be removed before an individual leaves the area. The clothing material will be labeled and held in storage by the RSO or designee at designated areas until decayed, decontaminated, or disposed of as radioactive waste.

For decontamination of the skin, use running lukewarm water to avoid reddening the skin and prevent absorption. Also, use light pressure with heavy soap lather. Use care not to scratch or erode the skin. Care must be taken to prevent internal deposition. Thorough washing, preferably showers, should be performed immediately where major personnel

contamination has occurred. Monitor personnel after washing. Repeat the personnel decontamination procedure above if necessary.

### **Personnel Injury**

For serious injuries involving radioactive material, such as a life-threatening situation, immediately call 911. Minor cuts should be allowed to bleed, thereby reducing absorption. First aid of major cuts or abrasions, lacerations, etc. should be considered before decontamination. Proceed with personnel decontamination if possible. Contact the RSO for assistance. Please note the following:

- Treatment of the serious injury should take precedence over almost all concern for contamination control and radiation exposure.
- No transport restrictions should be imposed that would seriously compromise the patient's medical care.
- When transporting a contaminated patient to a hospital emergency room or the designated emergency receiving point, the following procedures should be followed:
  - Contaminated clothing should be removed if, possible.
  - If skin decontamination is necessary, wash the patient thoroughly with soap or detergent and water.
  - Wrap patient in a clean sheet or blanket.
  - A representative from Radiation Safety should accompany the patient, but do not delay transport if Radiation Safety personnel are not present.
- External contamination is not immediately harmful to the patient unless the skin is badly punctured or wet.
- Minor injuries can usually be treated at the scene and can usually wait until after an initial radiation survey has been completed.

All radiation accidents (wound, overexposure, ingestion, and inhalation) must be reported to the RSO as soon as possible since this may require regulatory notification. No one involved in a radiation injury will be permitted to return to work without the approval of the RSO.

### **Area Decontamination**

All persons not involved and not contaminated should leave the area.

- Put on lab coat, protective eyewear, gloves and shoe covers before entering the contaminated area.
- Prevent liquids from spreading by placing any absorbing material over it.
- Monitor the spill, equipment, and people involved to determine the radiation exposure levels.
- Wash the area with a minimum of soapy water or a standard radioactive decontaminating agent. Any broken glass or sharps should be swept up using a broom and dust pan to prevent accidental cuts. Using paper towels, start at the furthest end or the place of least contamination and move inwards toward the highest point of contamination.
- Using a filter paper or cotton swab, wipe the area. Count the wipe using a scintillation or gamma counter as appropriate. If the count is greater than 200 dpm, repeat area decontamination until the count is below this level of contamination.
- Dispose of all radioactive waste properly according to the radioactive waste procedures.

## **Accident**

Accidents typically exceed the single lab ability to decontaminate a spill area and require the involvement of the RSO. Accidents may involve a release of radioactive material into the air, water or outside the lab. In case of an accident involving radioactive material, notify all personnel to leave the area immediately. Notify the RSO for immediate response. Do not re-enter the room until approval of the RSO is obtained.

If the accident occurs after hours, notify the UH Police department at 713-743-3333 and the RSO will be notified.