**The University of Mississippi**

**Radiation Safety**

**Standard Operating Procedures**

ENVIRONMENTAL HEALTH & SAFETY



Revised February 2025

Table of Contents

[SOP 1: PROCEDURES FOR THE AUTHORIZATION OF PERSONNEL 3](#_Toc191285855)

[SOP 2: PROCEDURES FOR DOSIMETRY 4](#_Toc191285856)

[SOP-3: LOCATION CLASSIFICATION 5](#_Toc191285857)

[SOP-4: PROCEDURES FOR THE PROCUREMENT OF RADIOACTIVE MATERIALS, RADIATION GENERATING DEVICES, AND LASERS 6](#_Toc191285858)

[SOP-5: REGISTRATION OF X-RAY DEVICES 8](#_Toc191285859)

[SOP-6: REGISTRATION OF CLASS 3B AND 4 LASERS 9](#_Toc191285860)

[SOP 7: USE OF CAUTION SIGNS AND LABELS 10](#_Toc191285861)

[SOP 8: GENERAL SAFETY RULES FOR RADIOISOTOPE LABORATORIES 11](#_Toc191285862)

[SOP 9: RADIATION EMERGENCY PROCEDURES 13](#_Toc191285863)

[SOP 10: PROCEDURES FOR PERSONNEL DECONTAMINATION 17](#_Toc191285864)

[SOP 11: CALIBRATION OF INSTRUMENTS 19](#_Toc191285865)

[SOP 12: SEALED SOURCE LEAK TESTING 20](#_Toc191285866)

[SOP 13: SURVEYS 21](#_Toc191285867)

[SOP 14: CONTAMINATION SURVEYS 23](#_Toc191285868)

[SOP 15: RADIOACTIVE LIQUID WASTE 26](#_Toc191285869)

[SOP 16: RADIOACTIVE SOLID WASTE 28](#_Toc191285870)

[SOP 17: PROCEDURES FOR SHIPPING RADIOACTIVE MATERIALS 29](#_Toc191285871)

[SOP 18: PROCEDURES FOR DECLASSIFICATION OF EQUIPMENT AND WORK AREAS 30](#_Toc191285872)

# SOP 1: PROCEDURES FOR THE AUTHORIZATION OF PERSONNEL

**THE RADIATION SAFETY COMMITTEE (RSC)** reviews user applications and research protocols for the use of radiation or radioactivity within the institution from the standpoint of radiological safety. The RSC approves or disapproves the applications, protocols, and proposals based upon user competence, training, and experience to assure regulatory compliance and radiological safety.

**PROCEDURES FOR AUTHORIZATION**

The **applicant** must:

* Complete the smart sheet “Application for the Authorization to Use Radioactive Materials, Radiation Generating Devices or Lasers (Class 3B or 4)” located at <https://research.olemiss.edu/rsc/forms>.
* Complete the appropriate training module (Radiation Materials, Radiation Devices, or Laser Safety Training) on CITI training as directed by the RSC.
* Inform the RSC upon successful completion of the CITI training module.
* The RSC will inform the Radiation Safety Officer (RSO) of the applicants’ completion of CITI training.

The **Radiation Safety Officer** (RSO) will:

* Contact the applicant to schedule a meeting to discuss:
  + The safe handling of radioactive materials or devices
  + Regulatory compliance
  + The proposed research areas
  + The proper use and storage of dosimetry
* Deliver dosimetry to designated location.
* Permanently maintain Authorization Records.

# SOP 2: PROCEDURES FOR DOSIMETRY

* + Personnel will be required to wear an appropriate monitoring device (Dosimeter) when any of the following apply:
    - Working with or around unsealed, high-energy beta or any energy gamma emitters
    - Working with or around radiation generating devices
    - All personnel who may be exposed to neutrons are required to have a neutron dosimeter or a combination beta, gamma, and neutron dosimeter.
  + All dosimetry badges are collected and processed on a quarterly basis.
  + The Radiation Safety Officer (RSO) will provide an annual report to each individual monitored under Rule 1.4.18 of the dose received in that monitoring year if:
  1. The individual’s occupational dose exceeds 1mSv (100mrem) TEDE or 1 mSv (100 mrem) to any individual organ or tissue; or
  2. The individual requests their annual dose report.
  + Any exposure that exceeds the dose limits specified in the Radiological Safety Manual (Section 5), will be reported to the Research and Environmental Compliance Officer and to the Division of Radiological Health as specified in Rule 1.4.55 and Rule 1.4.56.
  + The Research and Environmental Compliance Officer will take any immediate action deemed appropriate to remedy the situation in consultation with the Mississippi State Department of Health.
  + Exposure records on all personnel will be maintained as permanent records.

# SOP-3: LOCATION CLASSIFICATION

All laboratories and areas where radioactive materials, radiation generating devices, and/or class 3B and 4 lasers are used or stored must be approved by the Radiation Safety Officer (RSO)/Laser Safety Officer (LSO) prior to use.

Classification of locations will be accomplished in a three-step process.

1. Application for use:
   1. Unsealed Radioactive Materials
      1. The Principal Investigator (PI) will complete “**Application for Radioisotope Use in a Location”** Smartsheet located at <https://research.olemiss.edu/rsc/forms>.
   2. Radiation Generating Devices
      1. The PI will complete the Radiation Device Registration Smartsheet located at https://research.olemiss.edu/rsc/forms.
   3. Lasers (Class 3B and 4)
      1. The PI will complete the Laser Registration Smartsheet located at https://research.olemiss.edu/rsc/forms.
2. The Radiation Safety Officer (RSO) will review and complete the formsand conduct a Site Safety Audit based upon the proposed protocol and the proposed use location.

The Audit will cover the following items:

* 1. The type of radiation/laser work as well as the proposed amounts to be handled and stored in the area, and,
  2. The necessary controls to reasonably protect personnel and equipment, including:
     1. Personnel Protective Equipment requirements,
     2. Personnel and/or area monitoring requirements,
     3. Laboratory Survey requirements, and,
     4. Compliance with State Laws and University Policies and Regulations.
  3. The RSO can approve the protocol as submitted, approve with modifications, or disapprove the protocol(s).

1. If the application is disapproved by the RSO, the PI may submit the application to the Radiation Safety Committee (RSC) for further review at its next scheduled meeting.
2. The RSC can approve the protocol as submitted, approve with modifications, or disapprove the protocol(s). The decision of the RSC is FINAL.
3. Records of approved locations will be kept on file.

# SOP-4: PROCEDURES FOR THE PROCUREMENT OF RADIOACTIVE MATERIALS, RADIATION GENERATING DEVICES, AND LASERS

The Principal Investigator (PI) is the only authorized user permitted to submit requests to purchase radioactive materials and radiation generating devices. The PI must be an authorized user.

**PROCEDURES FOR THE PROCUREMENT OF RADIOACTIVE MATERIALS**

The PI will submit a completed Form DHS-026, "Radioactive Material Purchase Application" together with an attached quotation from the vendor to Environmental Health & Safety (EH&S). This form must be signed and dated by the PI.

* Purchases must follow all relevant Procurement Policies and Procedures.
* The completed Purchase Requisition Form must be submitted to Environmental Health & Safety (EH&S) for review and processing.
* If the request is approved after evaluation by EH&S, the Radiation Safety Officer (RSO) will obtain a Purchase Order and will place the order with the vendor specified on the Purchase Order.
* The PI will be notified of the status of the procurement request.
* If the procurement request is denied for any reason, the PI will be notified in writing of the reasons for denial, and all application forms will be returned.
* All radioactive materials will be delivered to EH&S\* for inspection, radiation surveys, leak testing, inventory control, and storage until arrangements for delivery have been scheduled by the RSO.
* When the radioactive material is ready to be released from the RSO, the RSO will deliver the radioactive material directly to the location of use by the RSO and will maintain records.

***\*In the event that an incoming package is improperly delivered to another University location, please contact Environmental Health & Safety immediately at 662-915-5433. Do not open the package.***

**PROCEDURES FOR THE PROCUREMENT OF RADIATION GENERATING DEVICES**

* All purchases of radiation generating devices or devices containing x-ray tubes require prior consultation with and approval from the RSO before devices can be delivered to campus.
* The RSO has the authority to deny any request if the location does not have suitable shielding, which must be validated prior to installation of the equipment.
* Devices purchased without prior authorization from the RSO can be deemed inoperable until authorization is obtained.

**PROCEDURES FOR THE PROCUREMENT OF LASERS (CLASS 3B AND 4)**

* All purchases of Class 3B and 4 lasers require approval from the Laser Safety Officer (LSO) before lasers can be delivered to campus.
* The LSO has the authority to deny any request if the location does not have the appropriate safety equipment, which must be validated prior to installation of the equipment.
* Class 3B and 4 lasers purchased without prior authorization from the LSO can be deemed inoperable until authorization is obtained.

# SOP-5: REGISTRATION OF X-RAY DEVICES

All ionizing radiation producing devices must be registered with the Mississippi State Department of Health in accordance with Subchapter 2 of the Regulations for Control of Radiation in Mississippi.

* Principal Investigators (PIs) must complete the “Radiation-Generating Device Registration form” located at [research.olemiss.edu/rsc/forms](https://research.olemiss.edu/rsc/forms). The registrations of x-ray equipment and other ionizing radiation producing devices will be maintained at Environmental Health & Safety (EH&S).
* Individuals and/or departments obtaining ionizing radiation producing devices will be required to make application for registration of such devices through EH&S. Within five working days of receipt of an ionizing radiation device, the Radiation Safety Officer (RSO) will be notified. The use in any manner of such equipment will be prohibited until authorization to use it is given in writing by the RSO.
* Devices in this category include, but are not limited to:
  + X-ray generating units
  + X-ray diffraction units
  + Electron capture detectors
* All persons utilizing ionizing radiation producing devices must be approved by the RSO prior to use.
* Personnel monitoring devices, including TLD ring badges, are required of all individuals using x-ray generating devices.
* All x-ray generators or diffractometers will be inspected annually for radiation leakage by the RSO. The results of these surveys will be recorded and maintained on file in EH&S.
* The person designated in charge of an instrument producing ionizing radiation is solely responsible for the safe use and operation of these devices. The RSO, with the approval of the Research and Environmental Compliance Officer, will have the authority to require cessation of a known unsafe practice.
* An ionizing radiation device cannot be sold or disposed of by any individual or department without the written consent of EH&S.

# SOP-6: REGISTRATION OF CLASS 3B AND 4 LASERS

* Principal Investigators (PIs) must complete “Laser Registration form” located at [research.olemiss.edu/rsc/forms](https://research.olemiss.edu/rsc/forms). The registrations of Class 3B and 4 lasers will be maintained at Environmental Health & Safety (EH&S).
* Individuals and/or departments obtaining Class 3B and 4 Lasers will be required to complete the application for registration of such devices through EH&S. Within five working days of receipt of a Class 3B or 4 laser, the Laser Safety Officer (LSO) will be notified. The use in any manner of such equipment will be prohibited until authorization to use it is given in writing by the LSO.
* All persons utilizing Class 3B and 4 lasers must be approved by the LSO prior to use.
* All Class 3B and 4 lasers will be inspected annually by the LSO. The results of these inspections will be shared with the PI and maintained on file in EH&S.
* The person designated in charge of a Class 3B or 4 laser is solely responsible for the safe use and operation of these devices. The LSO, with the approval of the Research and Environmental Compliance Officer, will have the authority to require cessation of a known unsafe practice.
* Class 3B or 4 lasers cannot be sold or disposed of by any individual or department without the written consent of the LSO.

# 

# SOP 7: USE OF CAUTION SIGNS AND LABELS

The use of caution signs, labels and state postings are used in all radiation areas as specified in 10 CFR Part 20, Subpart J.

* The posting of laboratories and areas containing radioactive materials must be in accordance with 10 CFR Part 20.
* The posting of laboratories in which radiation producing devices are operated will be labeled in a conspicuous manner which cautions individuals that radiation is produced when it is energized in accordance with 10 CFR Part 20.
* The posting of laboratories and areas containing class 3B or 4 lasers must be in accordance with ANSI-Z136.1 “American National Standard for Safe Use of Lasers”.
* The University of Mississippi Material License or Device Registration will be conspicuously displayed within the lab where radioactive materials or radiation generating devices are used.
* The Mississippi State Department of Health Form No. 935, "Notice to Employees", the "Emergency Notification" and the "No Smoking, Eating or Drinking" signs must be posted in each area where radioactive materials or radiation producing devices are used.
* The labeling of all radioactive containers will bear a “CAUTION, RADIOACTIVE MATERIAL” label and include the quantity of radioactive material, estimate of radioactivity, date for which the activity was estimated and kind of materials in accordance with the 10 CFR Part 20.
* Each location where Radioactive Materials are used will have a copy of the “Emergency Procedures for Spills Involving Radioactive Material” posted near every entrance and exit.
* The labeling of Class 3B and 4 lasers will bear the words “CAUTION” (Class 3B) or “DANGER” (Class 4) with wavelength and power included on the entrance.
* All appropriate signage is provided by Environmental Health & Safety.

# SOP 8: GENERAL SAFETY RULES FOR RADIOISOTOPE LABORATORIES

* Preventing Contamination: Extreme personal cleanliness and careful techniques are the primary means of preventing contamination and protecting against ingestion of loose radioactivity. To minimize contamination and prevent entrance of activity into the body, the following rules must be observed in radioisotope laboratories where unsealed sources of radioactive materials are present or in use.
* Eating, drinking, smoking, the use of cosmetics, food preparation, and the storage of items for these purposes will not be permitted in laboratories where radioactive material is used or stored.
* The storage of human food items, such as milk, eggs, cheese, bread, meat, and the like, to be used as part of an experimental procedure and not intended for human consumption is permitted in a restricted or prohibited area containing radioactive material provided that the following provisions are met:
  + The food item is not stored in its original container, but is stored in a different suitable container not labeled as human food; and
  + The item is clearly, legibly, and permanently marked to indicate what the item is, what the item is used for, who is using the item, and the date of storage in the restricted or prohibited area, and additionally marked with the following words:

**EXPERIMENTAL FOOD ITEM - NOT FOR HUMAN CONSUMPTION**

* If there is a specific radiological hazard associated with the food item, appropriate radiological markings are to be added to the outside of the container in accordance with this manual.
* Food items discovered in restricted or prohibited areas not satisfying these criteria will be immediately confiscated and disposed of by the RSO according to the hazards involved.
* The use of milk bottles or other food containers for handling or storing radioactive materials is strictly prohibited.
* The presence of empty cups, food wrappers, containers or any waste associated with food will not be allowed inside of any laboratory where radioactive materials are used or stored.
* The pipetting of radioactive materials and/or solutions by mouth is strictly prohibited. Auto-pipettes, pipette controls, and similar devices are commercially available and mandatory for such applications.

**Additional Safety Precautions**:

* + - Dry runs involving all facets of an experimental procedure except the actual use of radioactive material are to be completed prior to commencement of experimental protocols involving the use of radioactive material. Such practice runs should be performed until the procedure is reproducible. Any modifications made along the way which enhance radiological controls should be incorporated into the protocol.
    - Any work which can expose radioactive material to atmospheric distribution will be done in a suitable containment device approved by the RSO. Specifically, complete containment is required when working with tritium in amounts in excess of 100 mCi (3.7 Gbq), and for all loose alpha emitters.
    - Personnel are not permitted to work with radioactive material if there are open cuts, wounds, or abrasions on the body. Extreme precautions must be taken to avoid the introduction of radioactive materials into the body through puncture wounds or cuts, especially when working with materials of high radiotoxicity or high specific activity.
    - Care must be taken when using organic solvents to avoid skin contact with radioactive materials. Solvents may make the skin more permeable.
    - Appropriate protective clothing and/or devices will be used for all manipulations of unsealed sources. Surgical glove techniques are to be used when putting gloves on and removing gloves to avoid contaminating the inside surfaces of the gloves and/or the skin of the user.
    - All personnel will perform personal monitoring of hands and feet upon preparation to leave a radioactive material work area.
    - Laboratory protective clothing and equipment used in radioisotope work areas will be monitored routinely during the course of work and when work with radioactive material is temporarily or completely halted. Contaminated disposable clothing and equipment will be disposed of as radioactive waste unless contamination surveys determine that there is no contamination present. Contaminated non-disposable items will be decontaminated, decayed to background, or disposed of as radioactive waste.
    - Approved auxiliary storage and waste containers, blotters, and covers will always be used where danger of spills or personnel and equipment contamination is possible.
    - Contaminated equipment, or equipment that has been used and is suspected of contamination, will be appropriately labeled and isolated in designated areas within the laboratory or in suitable, approved storage areas.
    - Tools, equipment, and apparatus, that may be contaminated should be placed in non- porous metal trays or pans lined with absorbent disposable paper. Trays, paper, and/or pans should be monitored frequently, and appropriate disposal or decontamination performed when contamination exceeds 10 times the Action Level of the location.
    - The declared and labeled radioactive material use area will remain free of unnecessary tools, equipment, and/or clutter to prevent contamination and to minimize the generation of waste.
    - Removable contamination above the limits for uncontrolled access for the type of radiation in question will not be allowed to remain on the floors. Where floors are known or suspected to be contaminated above the limits for uncontrolled access, traffic in the area involved will immediately be halted by the person in charge of the area. The location will be declared a restricted access location until decontamination can be completed. The RSO will be notified immediately.

# SOP 9: RADIATION EMERGENCY PROCEDURES

Emergencies resulting from accidents in radioisotope use locations may range from minor spills of radioactivity involving relatively little personal hazard, to major radiation incidents and spills involving extreme hazards and possible bodily injury or life- threatening situations. Because of many complicating factors which may arise in any given accident involving radioactive material, and because of the variety of additional hazards normally found in facilities located at the University, regulations for handling emergencies involving radiation cannot be made for all possible situations.

**In any emergency involving radioisotopes, always remember to protect personnel from radiation hazards and confine or contain the contamination to the area of the accident and restrict the movement of potentially or actually contaminated individuals.**

**IN ANY ACCIDENT OR INCIDENT INVOLVING PERSONAL INJURY, THE FIRST CONSIDERATION SHOULD BE FOR THE INJURED PARTY, AND**

**NOT THE SPREAD OF CONTAMINATION. Contamination can be cleaned up after the fact.**

**Minor Spills:**

* + - The term minor spill will be defined for the purposes of these regulations to mean a total spill of less than 100 µCi (3.7MBq) of loose radioactive material, wet or dry, outside the confines of a controlled area, and which does not constitute a direct radiation hazard or a significant airborne hazard. A controlled area is an area within an approved use location which is specifically identified by the supervisor as the radioactive work area and is correctly labeled with appropriate signs, tapes, and/or insignia as described in the MSDH Regulations.
    - The immediate actions for handling a minor spill are as follows:
* **Notify all persons in the area** that a minor spill has occurred.
* **Prevent the spread of contamination** by using the minimum number of personnel necessary to adequately confine the spill.
  + Liquid Spills:
    - Put on protective gloves
    - Cover the spill area with absorbent material.
  + Solid Spills:
    - Put on protective gloves
    - Dampen the area of the spilled material with an appropriate dampening agent, taking care not to spread contamination or create an airborne hazard.
    - Cover the spill area with absorbent material.
    - Clean up the spill.
    - Using protective gloves, and remote handling tongs, if necessary, to place the absorbent material into a plastic bag.
    - Remember to place other contaminated materials, such as gloves into the plastic bag.
    - Dispose of the bag in the radioactive waste container.
  + **Survey** with a low range thin-window G-M Survey meter or a wipe test, to check for contamination in the cleaned area, on hands and clothing.
  + **Report the spill** to the RSO, phone 662-915-5433, and the area supervisor as soon as possible.

**Major Spills:**

* + - The term major spill will be defined to mean a spill of 100 µCi (3.7 MBq) or more of loose radioactive material, a spill of loose radioactive material which constitutes a significant direct radiation hazard, a spill of loose radioactive material which can result in an airborne radioactivity hazard, or a spill of any amount of radioactive material outside the physical boundaries of an approved use location.
    - The immediate actions required in the event of a major spill are as follows:
* **Clear the Area**: Notify all persons not involved in the spill to evacuate the room or area.
* **Prevent the Spread**: Cover the spill with absorbent material. Do not attempt to clean up the spill. Confine the movement of all personnel potentially contaminated. If the spill can create an airborne hazard, switch off any fans, to minimize air dispersal.
* **Shield the Source**: If possible, the spill should be shielded, but only if it can be done without further spread of contamination or without significantly increasing your radiation exposure.
* **Close the Room and Secure the Area**: Leave the room and lock the door to prevent entry until emergency personnel arrive. If the spill occurs outside an approved location, withdraw a safe distance from the spill and maintain watch over the spill area, warning all passersby to stand clear of the spill.
* **Call for Help**: Notify the RSO as soon as possible (phone 662-915-5433), or call the University Police Department campus phone 4911, also notify the location supervisor, if known.
* **Personnel Decontamination**: If the spill is on the skin, flush thoroughly with water and then wash with mild soap and lukewarm water into a leak-proof catch basin, and not down sewage drains. If clothing is contaminated, remove and store affected clothing for further evaluation.
* The RSO will then notify Mississippi State Department of Health, Division of Radiological Health 601-987-6893 (Weekdays from 8 am to 5 pm).

**Airborne Radioactivity Accidents:**

**Accidents involving radioactive mist, dust, fumes, organic vapors, and gases** require special equipment and training. In the event of a spill of radioactive material which can reasonably be believed to have created an airborne hazard, the following immediate actions are required.

* **Clear the Area**: Notify all persons not involved in the spill to evacuate the room or area.
* **Prevent the Spread**: If appropriate respirators are immediately available for the material encountered, put on the respirator, switch off any fans, or air circulating equipment and close any windows or doors. Do not waste time in indecision. Vacate the room as soon as possible. If respirators are not available, evacuate the room immediately.
* **Close the Room and Secure the Area**: Leave the room and move all personnel potentially exposed to the airborne contaminants to a safe single location. Lock any doors to prevent entry until emergency personnel arrive.
* **Call for Help**: Notify the RSO as soon as possible (phone 662-915-5433), or call the University Police Department campus phone 4911, also notify the location supervisor, if known.
* **Additional Precautions**: Secure all ventilation into and out of the airborne contamination location from power panels outside the airborne hazard perimeter if possible. Ensure all entrances and exits are closed, locked, and posted with signs prohibiting access. If necessary, post guards at doors to prevent entrance by unauthorized persons.
* **Do Not Reenter**: Do not enter the airborne hazard location until approval of the RSO is secured.

**Radiation Hazard Accidents with Injuries:**

* + - Wash minor wounds with little or no bleeding immediately under running water. If the wound is a puncture, let it bleed freely for a few minutes to wash out any contaminants.
    - If the wound is bleeding heavily, apply direct pressure using a gloved hand, if possible, and a dry sterile dressing over the wound.
    - Get competent medical attention immediately. Immediate help may be available from the Employee or Student Health Service or Baptist Memorial Hospital-North Mississippi.
    - Report all accidents with injuries involving radiation hazards to the RSO as soon as possible, including, but not limited to, puncture wounds, cuts, abrasions, suspected overexposure, ingestion, and/or inhalation accidents.
    - Permit no person with a radiation injury to return to work without expressed written approval from the RSO and the attending physician.

**Overexposure or Ingestion Injuries:**

* + - Any person who suspects overexposure, which is defined as whole body exposure in excess of 1.25 rem (0.0125 Sv) in 13 calendar weeks, is required to report this fact to the RSO immediately.
    - Any person who ingests, absorbs, inhales, or has skin or eye contact with radioactive materials, in the workplace, must immediately report the incident to the RSO in person or by messenger. Persons undergoing medical diagnosis or therapy involving ingestion of radioactive materials will not be required to report such ingestion to the RSO.

**Bioassays:**

* + - Persons working with I-125 and/or I-131 are required to have bioassays performed to determine if an intake occurred in the thyroid during the handling of the radioactive iodine.
    - A baseline bioassay is required on all individuals before beginning work with radioactive iodine.
* Per the Nuclear Regulatory Commission NUREG 8.20, for laboratories that only work with I-125 in radioimmunoassay (RIA) kits, the quantities of I-125 are very small and in less volatile forms; thus, the limit of 100 mCi during any 3-month period will be used for bioassay requirements.
* When an individual routinely handles and works near unsealed quantities of less than 10 percent of the limit of 100 mCi during any 3-month period, a routine bioassay is not necessary.
  + - Bioassays will be performed at Environmental Health & Safety at the following intervals:
* Quarterly intervals (routine)
* Emergency
* Post-Operational
* Diagnostic
  + - Results of bioassays performed will be documented and all records will be maintained in Environmental Health & Safety.
    - The annual limit on intake (ALI) for the thyroid is 40 µCi for oral ingestion and 60 µCi for inhalation.
    - In the case of internal exposure or contamination, persons on the campus of the University of Mississippi may be required to submit to blood or urine tests for bioassay analysis.

**Radiation Hazards in Fires:**

* + - Attend to injured persons and remove them from harm.
    - Alert all personnel: Notify all people in the immediate area to evacuate and activate the nearest fire alarm (or call 9-911).
    - Close all doors and windows to confine the fire.
    - Call Environmental Health & Safety (phone 662-915-5433).
    - Evacuate to a safe area or exit the building. Do not use the elevator.
    - Have a person knowledgeable of the incident and laboratory report to the emergency personnel.

# SOP 10: PROCEDURES FOR PERSONNEL DECONTAMINATION

* + The Radiation Safety Officer (RSO) must be notified immediately of any incident involving personnel contamination regardless of the radionuclide or activity.
  + Radiation surveys should be conducted to locate contamination on the body. A background reading should be obtained prior to performing surveys.
  + Form DHS-129 "Personnel Contamination Report,” must be completed and submitted to the RSO. Records will be maintained at Environmental Health & Safety (EH&S).
  + All personnel who have undergone decontamination procedures are required to report to the Employee or Student Health Service for a checkup by a physician before returning to normal activities.
  + Save all materials used, including water, for disposal as radioactive waste.

**Procedures for Skin Contamination:**

1. Notify RSO immediately whenever any case of skin or body contamination occurs.
2. Instruments used must be checked for proper operation and must be within calibration dates.
3. Personnel assisting in decontamination will use necessary precautions and protective clothing to prevent the spread of contamination to themselves or the surrounding area.
4. Decontamination will be performed in a manner which will not spread contamination to other parts of the body.
5. Remove and collect any contaminated clothing.
6. When washing a contaminated area of the body, care must be taken to prevent abrasions, cuts, or other invasions of the skin to prevent internal contamination.
7. Wash skin using mild soap and body temperature water for 2-3 minutes. Do not scrub skin or use hot water. Several gentle washes using mild soaps are much better than one severe scrubbing. \*If an individual has visible breaks in the skin, do not perform decontamination – immediately escort the person to Employee or Student Health Services.
   * Warm water opens pores. Cold water closes pores. Body temperature water is recommended for decontamination.
8. When drying an area of the skin which has been decontaminated by washing, do not rub the skin. A gentle patting of the skin with drying material is recommended.
9. Measure and record the count rate after the initial attempt at decontamination. Survey and repeat decontamination until the count rate cannot be reduced any further.
10. If the skin becomes irritated, or the individual feels ill, discontinue decontamination, and immediately escort the person to Employee or Student Health Services.
11. When decontamination efforts are not immediately successful, further decontamination efforts will be determined by competent medical authority. Often a substantial reduction in count rate is achieved during the next 24 hours with periodic washings with soap and water, combined with normal flaking of the skin.
12. Record all required information on Form DHS-129 "Personnel Contamination Report.”
    * Name of the individual requiring decontamination
    * Date of the incident
    * Location of the incident
    * The time the contamination was discovered
    * Isotope(s) involved
    * Exposure and decontamination time
    * Surveyor name and instrument used
    * Location(s) of contamination
      + Including approximate size
      + Activity
    * Initial survey meter reading.

# SOP 11: CALIBRATION OF INSTRUMENTS

All survey and monitoring instruments used for compliance purposes will be calibrated annually in accordance with applicable sections of the Radiation Safety Standard Operating Procedures. Environmental Health and Safety will maintain information on calibration vendors for survey meters and area monitors.

# SOP 12: SEALED SOURCE LEAK TESTING

In accordance with the special conditions of the University's Broad Scope License, all Sealed Sources except those exempted by the MSDH Regulations cited in the Broad Scope License, will be tested for leakage and contamination at intervals not to exceed six (6) months. The Radiation Safety Officer (RSO), or a representative, will perform leak tests.

All sealed sources will be physically inventoried at intervals not to exceed six (6) months.

A report will be filed within 5 days with the Mississippi State Department of Health if the test for leakage or contamination indicates a sealed source is leaking or contaminated. The report will include the equipment involved, the test results and the corrective action taken. Any incident of a lost or stolen licensed and/or registered source of radiation will be reported immediately to the Mississippi State Department of Health.

# SOP 13: SURVEYS

**Routine surveys:**

Routine surveys for contamination or radiation exposure will be conducted in laboratories and areas approved for use with radioactive materials or radiation generating devices by the Radiation Safety Officer (RSO). Records of survey results will be maintained by the institution in accordance with current laws and regulations. In addition, the following requirements will be met:

* + Routine survey frequency will be determined by the RSO and will depend upon the classification of the area. Classification of an area will be based upon the criteria expressed in the section on Location Classification.
  + Survey points which exceed the prescribed Action Level assigned to the area containing the points will be considered evidence of contamination. The area supervisor will be notified of the presence of contamination, the levels, and the locations of the contamination in writing by the RSO, except in cases where contamination exceeds the Action Level by a factor of 10.
  + In cases where areas of contamination exceed the Action Level for the given location by a factor of 10, the area supervisor will be notified as soon as possible.
  + All work will cease in the area by order of the RSO, if deemed necessary, until all contamination is removed, and area surveys indicate removable activity below the Action Level for the given location.
* In cases of known or suspected airborne contamination in excess of the limits in the "[Regulations for Control of Radiation in Mississippi](https://services.statescape.com/RegsText/StaticDownloads/132909_238115.pdf)," the location will immediately be evacuated. Ventilation will be stopped, and personnel exposure will be assessed. Further immediate actions are stated in the section on Radiation Emergency Procedures.
* Areas closed because of a radiological hazard cannot be reopened without the written approval of the RSO or the Research and Environmental Compliance Officer from Environmental Health & Safety.
* Surveys of equipment and areas by Authorized Lab Personnel:
  + Equipment, tools, and work areas will be monitored daily following their use with radioactive materials. Appropriate surveys will be performed by authorized personnel providing that work involving the use of radioactive tracers, radiation generating devices, or other radioactive materials or equipment was performed during that particular day in the specified location.
  + Written records of daily surveys will be made available for inspection at the request of the RSO or his representative.
  + All records of daily surveys will be reviewed quarterly by the RSO.
  + All personnel authorized to handle radioactive materials in an approved location or facility will be trained to perform the appropriate surveys necessary for contamination and exposure control. All training of persons requesting authorization will be the responsibility of Environmental Health & Safety.
  + Each building in which radioactive materials are used will have appropriate calibrated survey instrumentation for the use of authorized users in performing contamination and/or radiation surveys.

**Procedures for performing general area radiation surveys:**

1. Laboratories in which there are sources capable of delivering whole body exposures in excess of 5 mr/hr (0.05 mSv/hr) must have on hand in the laboratory and in good operating condition, a calibrated monitoring instrument capable of measuring the exposure or dose rate for the radiation type to be encountered. Consult with the RSO on matters involving the selection or calibration of monitoring instruments.
2. Obtain the appropriate survey instrument, laboratory diagram and personnel dosimetry from the Radiation Safety Officer (RSO). Ensure the detecting probe and instrument are fully operational, functional, and in calibration.
3. Permanent records of all radiation surveys, including negative results, must be maintained. The records must include:
   * Date and Time
   * Surveyor name/ title
   * Instrument (Model number, serial number, calibration date)
   * Location
   * Background radiation level
   * Device
   * Reason for the survey
   * Areas Surveyed
4. General area surveys are to be performed with the energized detector probe at waist level. Surface scans should be performed slowly approximately 1 inch from the surface.

***Note: The probe of the survey meter should never make contact with any surface areas during surveys.***

1. All radiation survey results will be maintained on file in EH&S.

# 

# SOP 14: CONTAMINATION SURVEYS

Contamination surveys are to be performed in all Active Locations (locations where radioactive materials have been used within the last month) approved for radionuclide research that involve the handling or use of unsealed radioactive material and the generation of radioactive waste. The Radiation Safety Officer (RSO) will conduct monthly surveys in all Active Locations. Records will be maintained by Environmental Health & Safety (EH&S) in accordance with the regulations of the Mississippi State Department of Health, Division of Radiological Health.

**Survey Frequency:**

When using unsealed radioactive materials, contamination surveys will be conducted by the Principal Investigator (Pl), or an appointed designee, according to the frequencies listed below:

|  |  |  |
| --- | --- | --- |
| **Radiation Type** | **Isotopes** | **Survey Frequency\*** |
| Beta (<200 keV) | H-3, C-14, S-35 | Weekly (Wipes) |
| Beta (>200 keV) | P-32 , P-33 | Daily (Area), Weekly (Wipes) |
| Gamma | I-125, I-131 | Daily (Area), Weekly (Wipes) |

\*Contamination surveys do not need to be performed during periods when no radioactive materials are used.

Action Levels for mandatory decontamination:

|  |  |
| --- | --- |
| **Radiation Type** | **Action Level** |
| Beta, x-ray (<200 keV) | ≥ 2200 dpm |
| Beta (>200 keV) | ≥ 220 dpm |
| Alpha | ≥ 22 dpm |

If action levels are exceeded, contact the RSO as soon as possible.

In accordance with the ALARA concept, it is recommended that an item or location below action level but suspected of being contaminated should be cleaned until background levels are obtained for both fixed and removable contamination. The suspected contaminated location should be resurveyed and the results documented.

**Survey Methods:**

Contamination surveys can be performed using a variety of methods. The two most common methods are "area" and "wipe" surveys.

**Area (meter) survey:**

* Measures both fixed and removable contamination, and,
* Performed with an appropriate portable radiation survey meter.

**Wipe survey:**

* Measures only removable contamination, and,
* Is performed using “wipes” counted on a liquid scintillation counter or a gamma counter.
  + Wipe tests are the most versatile and most sensitive method of detecting low- level contamination in the laboratory.

The area supervisor or a designee must complete contamination surveys of the active work area at the end of each week during which operations involving the use or handling of loose radioactive material occurs.

**Recording Survey Results:**

The PI must maintain permanent records of all contamination surveys, including negative results. The records must include:

* Date of survey
* Type of instrument used
* Name of person conducting the survey
* Survey results - must be keyed to locations on the area drawing, and
* If contamination is found, the results of retesting after decontamination

**Procedures for Wipe Testing:**

1. Obtain the survey list and/or map from the RSO. A survey diagram is posted in every Active Laboratory for reference.
2. Test each location specified on the survey map at least once. The smear test is performed by using wet or dry filter paper or swab, and then gently rubbing the filter paper or swab over an area of approximately 100 sq.cm. with sufficient force to remove loose material from the surface without destroying the filter paper or swab.
3. Place each completed smear inside the scintillation vial labeled for the position tested. Scintillation fluid must be added to each vial prior to counting (typically 50- 100% of the vial volume for optimum efficiency).
4. When ready to obtain counting data for the completed survey, place the vials containing the smears in appropriate racks inside the liquid scintillation counter, with a background scintillation vial as the first vial. The background vial should contain liquid scintillation fluid with a clean sample.
5. Obtain counting data by selecting the appropriate counting protocol, or by selecting the Direct **D**isintegrations **P**er **M**inute (DPM) option and selecting the appropriate lower and upper regions for the isotopes to be counted. If the appropriate selections are made in the counting protocol, the data will give the **C**ounts **P**er **M**inute (CPM), DPM, activity per unit area or volume and the efficiency of each sample counted.
6. After the counting interval is complete, check the dates printed on the data sheet and identify the positions of all locations surveyed.
7. Record the results.
   * Check each location for removable activity in excess of the established Action Level listed for the laboratory.
   * If any location exceeds the Action Level, immediately notify the RSO. If the Action Level is exceeded by a factor of 10 or greater, all lab activity should safely be terminated as soon as possible.
   * Activity in the area may continue only after written approval from the RSO.

# SOP 15: RADIOACTIVE LIQUID WASTE

* + The Radiation Safety Officer (RSO) is responsible for the collection and disposal of all radioactive waste and associated materials.
  + Separate procedures must be followed for the disposal of bulk fluids, liquids contained in scintillation vials, sharps and other materials that pose a puncture hazard to personnel, and samples with visible residues.
  + Wastes which are not correctly identified by the user/generator will be returned.
  + Only Non-Flammable Scintillation Fluid may be used in laboratories.
  + Any sewer/sink disposal of Radioactive Waste by laboratory personnel is strictly prohibited.
  + All waste is to be separated into solids, liquids, or gases by the user for pickup.
  + Solid waste should not contain any free-standing liquids.
  + Liquid wastes are to be separated into aqueous (water-based materials containing no other hydrocarbon solvent capable of flammability), and organic (hydrocarbon solvents capable of being burned), and further segregated according to radioisotopes.
  + Aqueous liquids are to be bulked up into suitable containers which have secure, leak proof seals (caps) and are properly labeled.
  + Each container should contain only one radioisotope.
  + Contact the Radiation Safety Officer (RSO) prior to the production of any liquid waste containing multiple isotopes.
  + Scintillation fluids are to be left in individual scintillation vials, tightly capped.
  + Organic liquids containing radioisotopes will have to be evaluated on a case by case basis by the RSO to determine the best method of packaging.

**Procedures for Generators of Liquid Radioactive Waste:**

1. Liquid waste must be collected in the plastic containers provided by Environmental Health & Safety (EH&S). The “Radioactive Materials” tag attached to the container must be completed, including:
   * Material I.D. (Radioisotope)
   * Principal investigator (PI) or an appointed designee, and
   * Current Date
2. The Radioactive Waste Disposal Request must be completed on the EH&S website, https://olemiss.campusoptics.com/hw/radioactive-pickup.
3. The radioactive liquid waste description must include the following information:
   * Chemical components of the waste
   * Relative amounts of any chemicals present in the waste, identified +/- 1% of the total volume
4. Liquid radioactive waste must be segregated by radionuclide
5. Use separate waste containers for Organic Waste and Aqueous waste.

**Procedures for Generators of Liquid Waste with Scintillation Vials:**

Liquid Scintillation Vials (LSV) are to be placed in a sturdy receptacle with 2 liners provided by EH&S.

1. The following criteria must be followed for the collection of LSVs:
   * The average specific activity of waste generated must be less than 0.05 µCi/ml (1.85 MBq/ml).
   * The vials are to be tightly capped and there should be no leaking vials within the lot.
   * There must be no visible solids or residues (tissue, organs, etc.) contained in the vials.
2. Liquid radioactive waste which do not meet the criteria above are to be packaged as follows:
   * The contents of any vials or similar glass or plastic containers are to be emptied into an appropriately marked liquid container which has a leak proof, screw-on cap.
     + Do not mix nuclides without prior approval from the RSO.
     + Each container should be labeled with a tag showing the isotope, activity and volume with the completed waste form and activity analysis attached.
   * Empty vials and other empty glass or plastic containers are to be tightly capped and discarded into a double polyethylene bagged step-pedal type waste container.
     + When the bag is three quarters (3/4) full, seal the bags with tape and label the outer bag with the radioisotope, activity and weight with the completed waste form attached.
   * Puncture hazards such as broken glass, aluminum crimp seals, syringes, syringe needles, pipettes, pipette tips, and other sharp objects contaminated with radioactive material are to be segregated by nuclide and chemical compatibility and discarded into appropriately labeled puncture and leak proof containers.
     + When the container is three quarters (3/4) full, the sealed puncture and leak proof containers are to be labeled with the radioisotope, activity and weight with the completed waste form attached.
   * After properly packaging the material for disposal, complete the Radioactive Waste Disposal Request on the EH&S website, https://olemiss.campusoptics.com/hw/radioactive-pickup.

# SOP 16: RADIOACTIVE SOLID WASTE

* + The Radiation Safety Officer (RSO) is responsible for the collection and disposal of all radioactive waste and associated materials.
  + Wastes which are not correctly identified by the user/generator will be returned.
  + Any Dumpster disposal of Radioactive Waste by laboratory personnel is strictly prohibited.
  + The weight limit for a solid waste bag is 25 pounds.

**Procedures for Generators of Solid Waste:**

1. Solid radioactive waste must be collected in the yellow Radioactive Waste bags provided by Environmental Health & Safety (EH&S). Bags should be securely closed with zip ties. The “Radioactive Materials” tag attached to the container must be completed, including:
   * Material I.D. (Radioisotope)
   * Principal investigator (PI) or an appointed designee, and
   * Current Date
2. The Radioactive Waste Disposal Request must be completed on the EH&S website, <https://olemiss.campusoptics.com/hw/radioactive-pickup>.
3. The radioactive waste description must include the following information: Chemical components of the waste, and, relative amounts of any chemicals present in the waste, identified +/- 1% of the total volume.
4. Radioactive-Biological Waste which is pathogenic or infectious must be autoclaved or disinfected prior to disposal.
5. Solid radioactive waste must be segregated by radionuclide and chemical compatibility (if applicable)
   * Use separate waste containers for Organic (burnable) Waste and Inorganic (Metals, Glass, etc.) waste.
   * Solid waste containers offered for disposal must not contain standing fluids.
   * Solid waste plastic bags are to be filled no more than 75% full to allow for adequate closure.
   * Sharp objects, puncture hazards, and broken glass are to be packaged separately from burnable and other non-burnable wastes, segregated by nuclide, and contained in a puncture and leak proof sealable container.
6. Containers offered for disposal must be clearly labeled with a “Caution - Radioactive Material” tag, including generator name, radionuclide and date.
7. After properly packaging the material for disposal, contact EH&S to arrange for pickup.

# SOP 17: PROCEDURES FOR SHIPPING RADIOACTIVE MATERIALS

* The Radiation Safety Officer (RSO) is responsible for the shipping of all packages containing radioactive materials.
* A wipe will be performed on the outside of the package to determine the surface contamination level.
* For high energy beta emitters and any gamma emitters, a radiation survey will also be made at the surface of the package and 3 feet (1 meter) from the surface of the package. This will be done according to the procedures as referenced above.
* The results of the survey(s) will be recorded and kept on file in Environmental Health & Safety (EH&S).

# SOP 18: PROCEDURES FOR DECLASSIFICATION OF EQUIPMENT AND WORK AREAS

* + No room, location, or equipment used for radioactive work or storage may be returned to general use until satisfactory declassification has been certified by the Radiation Safety Officer (RSO).
  + Certification of declassification will be deemed appropriate when all survey points indicate activity less than the limit for uncontrolled access as established by the “Regulations for Control of Radiation in Mississippi”.
  + Notify the RSO in writing of the intent to declassify any equipment or any location authorized for radioisotope use.
  + Radiation surveys and/or wipe tests will be collected and a detailed contamination survey of the area of interest will be completed in accordance with SOP-14, “Contamination Surveys”.
  + The RSO will schedule a declassification survey after surveys and wipes have been performed by the supervisor.
  + Consult the RSO for proper transport and storage of all sources of ionizing radiation PRIOR TO REMOVAL.
  + Surveys and maintenance of records performed for declassification are the responsibility of the lab supervisor.
  + The RSO will retain copies on file in Environmental Health & Safety (EH&S).

**Procedures for Declassification of Equipment:**

1. Equipment which is to be released from restricted use in a radioisotope use location must be thoroughly cleaned and inspected by the area supervisor.
2. The area supervisor will conduct a surface contamination and radiation level survey of the equipment in accordance with SOP 14, “Contamination Surveys.”
3. Upon satisfactory completion of the supervisor’s survey(s), the supervisor will notify the RSO that the equipment is ready for declassification, providing the RSO with:
   1. Name and department of lab supervisor submitting request
   2. Equipment name
   3. Model and serial number of the item (if applicable)
   4. UM property control number of the item (if applicable)
   5. Current location of the item
4. Loose surface contamination levels must fall below the applicable levels contained in Table 1 below, and the radiation level must be at or below background in order for the item to be declared declassified.

**Table 1**

|  |  |
| --- | --- |
| **Radiation Type** | **Activity Level (dpm/100cm²)** |
| Alpha | ≤ 22 |
| X-ray, Beta or gamma | ≤ 220 |

1. The results of the surveys will be recorded, and records of the survey and wipe results will be maintained including diagram of surveys collected.
2. If the equipment being declassified meets the criteria specified in Table 1, all radiation symbols, associated labels and laboratory signs should be removed. The equipment should immediately be removed from any authorized location where radioactive materials are used, stored, or handled.

**Procedures for the Declassification of Locations:**

1. Locations authorized for radioisotope use which are being declassified must have all sources of ionizing radiation removed from the location and transported for storage and/or use in another location with radioisotope authorization.
2. After all sources of ionizing radiation are removed, detailed contamination and radiation surveys of the entire location and its contents are performed by the supervisor.
3. Upon successful completion of the radiation and contamination surveys performed by the supervisor, notify the RSO that the location is ready for declassification.
4. Loose surface contamination levels must fall below the applicable levels contained in Table 1 below, and the radiation level must be at or below background in order for the item to be declared declassified.

**Table 1**

|  |  |
| --- | --- |
| **Radiation Type** | **Activity Level (dpm/100cm²)** |
| Alpha | ≤ 22 |
| X-ray, Beta or gamma | ≤ 220 |

1. The results of the surveys will be recorded and records of the wipe results will be maintained including diagram of surveys collected.
2. If the equipment being declassified meets the criteria specified in Table 1, all radiation symbols, associated labels and laboratory signs should be removed. The equipment should immediately be removed from any authorized location where radioactive materials are used, stored, or handled.

**Procedures for Decommissioning a Radioactive Device**

* Determine if the device will be decommissioned or transferred to another location or organization.
* For devices that will be decommissioned, contact the RSO to isolate cooling water and remove the x-ray tube or the module that physically produces x-rays. The RSO will notify the MSDH to cancel the registration. The x-ray tube module will be stored at EH&S.
* Devices that will be transferred to another location at UM must be disassembled and reassembled by a certified field technician. The RSO must be contacted to verify the new location meets the requirements set forth by the MSDH. The RSO will request an amendment to the current registration from the MSDH as to the new location of the device.
* Devices that will be transferred to another organization will be the responsibility of the new organization once a bill of sale and a certified letter denoting the serial number of the machine and the x-ray tube that is transferred. The RSO will submit the documents to the MSDH to cancel the registration.

**Procedures for Decommissioning a Class 3B or 4 Laser**

* Class 3B and 4 lasers may be placed Out of Service (OOS), transferred, or completely removed from service.
  + To place a laser OOS contact the RSC. The RSC will have the LSO attach an OOS tag on the removed key or power cord. The laser may not be operated until the LSO verifies and authorizes reactivation. The status of the laser will be updated in the records.
  + To transfer a laser to another location on campus, notify the RSC as to the new location. The RSC and LSO will verify the new location meets the requirements set forth in ANSI Z136.1 and update the location in the records.
  + To transfer a laser to another organization, contact the RSC and provide documentation (Bill of Sale, etc.).
  + To completely remove a laser from service, contact the RSC. The LSO will coordinate with the PI to disassemble the laser to a point that it can never be reactivated. The laser will then be removed from the records.