

RADIOISOTOPE LABORATORY SETUP GUIDE

Purpose

The purpose of this document is to assist the Authorized User (AU) in properly setting up a laboratory for the use of unsealed radioactive materials. This guide is intended to be used in the initial setup of a laboratory and is also a useful reference for existing facilities or for persons relocating their laboratories.

Precautions and Limitations

Prospective users should plan their setup procedures but may not want to begin procurement of materials (i.e. waste containers) until they have been notified that their radioactive materials use has been approved by the Radiation Safety Committee.

Prior to setting up a laboratory for radioisotope use ensure that all general lab safety equipment is in place and suitable for use. The lab safety representatives of the Environmental Safety Division should be consulted for specific requirements.

Some recommendations of this guide are mandated by regulatory requirements established by state or federal agencies and are described in the UGA Radiation Safety Manual. The information in this guide should be used as a supplement and not a replacement to those regulations and documents.

Instructions for the Use of this Guide

This guide is provided primarily as a tool for your use. For new Authorized Users, access to procurement of radioactive materials will not be granted until the required laboratory setup has been verified as complete by the Radiation Safety staff.

Contact Information for the UGA Radiation Safety Staff

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Item 1 Planning

- Plan your radiological work in relation to the layout of the laboratory.
- Consider the locations of storage freezers, fume hoods, work benches, sinks, counting equipment, waste receptacles, etc. When practical, it is better to keep your radiological use components in close proximity to each other to reduce the likelihood of spreading contamination. The exception to this is to allow an appropriate distance between personnel and sources of radiation likely to result in personnel exposure. If you want to relocate any large equipment, it is generally easier to do so before you begin radiological work than after.
- If your planned use of radioactive materials is anticipated to produce radiation levels of ≥ 0.05 mrem/hr at 30 cm (1 foot) from the source, consider the potential impact on nearby non-radiological use areas. Radiation sources placed against the exterior walls of your laboratory could result in unacceptable radiation levels in adjacent rooms.
- A physical barrier is required between radioactive material areas and areas used for eating, drinking, food storage, etc. There should be walls and doors separating these areas.
- Look under sinks for evidence of water leaks; it is better to have them fixed now than to find leaks after you begin use of radioisotopes.
- Verify that laboratory equipment planned for use with radioactive materials is properly functioning (centrifuge, freezers, incubators, etc.) prior to radiological use.
- It is recommended that a radiation survey be performed in the laboratory prior to the start of radioisotope use. To perform this task, slowly walk through the laboratory taking radiation readings with a portable survey instrument and record the results. These readings indicate the background radiation levels for your location. The average background levels on the Athens campus vary, but are generally ≤ 0.02 mr/hr. Levels in excess of 0.05 mr/hr should be investigated.

Item 2 Radioactive Materials Security

Federal and state regulations require that radioactive material be kept secure from unauthorized use. To facilitate this, UGA requires that radioactive materials laboratories be locked, or that radioactive materials within laboratories be kept in locked enclosures, or that the lab be continuously occupied by individuals with training in radiation safety that are willing to challenge other personnel who might be attempting unauthorized access. As a part of laboratory setup, you should:

- Ensure that locks are properly working and keys are available for appropriate Radiation Workers to laboratory doors.
- Provide for additional locking devices on storage cabinets, freezers, waste containers, and the like as needed to control access.

Item 3 Protective Coverings and Secondary Containment

- Areas with the potential for becoming contaminated should be evaluated before applying protective coverings. The first step is to ensure, whenever practical, that underlying surfaces are made of non-porous materials.
- Consider the use of trays or bins which can catch small spills and are easily decontaminated.
- Remember that radioisotope work areas are not the only sources of contamination. Consider where you will store lab equipment used with radioisotopes, such as glassware and other small items. If these items are stored in drawers or cabinets, use removable trays or coverings to protect underlying surfaces from contamination.
- Apply protective coverings which have an absorbent work surface and waterproof backing when appropriate. However, excessive use of such materials can contribute to unnecessary generation of radioactive waste.
- Use secondary containment devices for any bulk storage of liquid radioisotopes. This should include the use of trays or bins under your liquid waste carboys to contain spills or leakage.

Item 4 Fume Hoods

- The use of an approved fume hood is required for any activity likely to generate dust, fumes, or vapors containing radioactive materials.
- Fume hoods should be used when working with volatile radioactive materials, and when initially opening vials containing milliCi quantities of radioisotopes.
- Fume hoods are checked on an annual basis by the lab safety staff of the Environmental Safety Division. If your fume hood does not have a current certification label, contact ESD at 542-5801 to have it checked.

Item 5 Spill Kits

- All radioisotope use locations should have a spill kit appropriate for the intended use.
- Spill kit locations should be easily accessible and not blocked by other items.
- When training laboratory workers, remember to inform them of the locations of spill kits and how to use the equipment.
- “Attack Pak” brand name spill kits are available from Central Research Stores (CRS) or Campus Scientific Stores (CSS) product #931770. The website address for CRS is <http://crs.uga.edu/> and for CSS is <http://css.uga.edu/> .
- Spill kits can also be prepared from readily available supplies. A spill kit should include absorbent materials (vermiculite, “kitty litter”, sorbent pillows or pads), PPE (gloves), and items to be used in cleanup of the absorbent material (bags, a dustpan or scoop, etc.).

Item 6 Personal Protective Equipment (PPE)

- Lab coats and disposable gloves should be procured and available for use. This is considered the minimum acceptable PPE for handling unsealed radioactive materials.
- Eye protection in the form of safety glasses or face shields should be available for use by persons handling unshielded or milliCi quantities of P-32, or when performing operations with the potential for liquid splash.

Item 7 Radiation Shielding

- Plexiglas or Lucite shielding is recommended for laboratories using milliCi quantities of P-32. Self-supporting shields and blocks designed to hold glassware are commercially available from lab safety supply companies.
- Lead shielding is recommended for use with milliCi quantities of I-125/131, or with other gamma emitting isotopes with potential exposure rates of ≥ 1 mrem/hr @ 1 foot.
- Spare shielding materials are sometimes available from Radiation Safety; call for details.

Item 8 Portable Survey Instruments

- A radiological use laboratory must have a portable survey instrument suitable for the radioactive materials planned to be used. A borrowed instrument is only acceptable as a backup.
- This requirement does not apply to laboratories using exclusively H-3. The exclusive use of I-125 immunoassay kits with <10 microCi per kit is also exempted.
- A suitable instrument typically has a thin window detector, a calibration adjustment mechanism, and a readout in units of millirem. One recommended example of a general purpose instrument suitable for radioisotope laboratory use is the Ludlum Model 3 with 44-9 probe. Information on the Ludlum brand of monitoring instruments is available on their website at <http://www.ludlums.com/>.
- Instruments must be calibrated on an annual basis. Calibration of portable radiation monitoring instruments is a service provided by the Radiation Safety staff.

Item 9 Counting Instrumentation

- A liquid scintillation counter is the standard instrument recommended for counting of wipe tests and for liquid analysis for sewer disposal.
- A shared LSC is considered appropriate, but the room where the LSC is located must be listed on your permit.
- Biodegradable scintillation fluids must be used in order to avoid the generation of mixed radioactive waste. One recommended biodegradable scintillation fluid for general purpose counting is Ecoscint from National Diagnostics. The Fisher products Cytoscint and Scintisafe are also good biodegradable LSC fluids.

- Other counters such as gas proportional counters, gamma well counters, etc. may be suitable for wipe test counting and analysis of liquid samples for sewer discharge. If you need additional information about a particular instrument refer to the manufacturer's technical manual or contact the Radiation Safety staff.

Item 10 Personnel Dosimetry

- Dosimetry is required for all individuals working with gamma and high energy beta emitting isotopes (P-32, I-125, I-131, Na-22, Tc-99m, Cr-51, etc.) except as noted below.
- Radiation Workers without dosimetry may perform limited tasks approved and supervised by the AU or Advanced Radiation Worker. Individuals without dosimetry shall not be exposed to dose rates ≥ 2 mr/hr and should not be allowed to frequent areas with dose rates ≥ 0.2 mr/hr. These radiation exposure levels are for whole body dose rates as measured at 30 cm (approximately 1 foot) from the radiation source.
- Extremity monitoring (finger rings) is required for all individuals performing operations that involve direct handling of un-shielded containers of individual quantities of ≥ 1 milliCi of P-32 or other gamma and high energy beta emitting isotopes.
- Dosimetry is not required for personnel working in laboratories permitted only for milliCi quantities of isotopes which emit primarily beta radiation with energies below 250 keV (H-3, C-14, S-35, and P-33). The exclusive use of I-125 immunoassay kits with < 10 microCi per kit is also exempted.
- Individuals required to have dosimetry must fill out and submit request forms to Radiation Safety. Dosimetry request forms are available from the radiation safety section of the ESD website at <http://www.esd.uga.edu/>. Allow a minimum of two weeks time for procurement of dosimetry. Dosimetry is a service provided by the Environmental Safety Division.
- Dosimetry may be discontinued for individual workers on a case by case basis if historical data indicates that exposures are consistently minimal. This determination will be made by the radiation safety staff. In most cases a representative individual in the laboratory who performs the majority of the radiological work will continue to be monitored with dosimetry.

Item 11 Radioactive Waste Containers for Dry Materials

- The currently approved container for dry, solid radioactive waste is a 30 gallon fiber drum with lid and locking band.
- Alternative containers that may be used include 5 gallon plastic pails with secure screw top lids and 10 to 20 gallon capacity all fiber drums. The all fiber drums are recommended for incinerable H-3/C-14 dry waste. Plastic pails are appropriate for small quantity generators and provide additional shielding for high energy beta emitters such as P-32.
- Separate containers must be provided for each of the following materials:
 1. short lived radioactive materials (half life < 120 days)

2. long lived radioactive materials (half life > 120 days)
 3. mixed radioactive waste (contact the Radiation Safety staff for details)
- Ensure that each waste container has a “Caution, Radioactive Materials” labels on it prior to use. Radiation Safety can provide these labels and a minimum of 2 labels should be put on opposite sides of the container.
 - The form “DAW Container Log” should be used to document the contents of each waste container. This form is available from the ESD website at <http://www.esd.uga.edu/>
 - Users of P-32, radioiodine, and other gamma emitters should consider the need for shielding waste drums. Commercially made shield boxes are available through lab safety suppliers.
 - A sufficient quantity of radioactive waste containers and liner bags (\geq 6 mil thickness) should be procured by the AU to allow for the anticipated volume of waste generated. After decay in storage for 10 half lives, short lived waste containers will be returned to the AU.
 - Approved drums are available from Central Research Stores (CRS) or Campus Scientific Stores (CSS) product #768900. 30 gallon liner bags are also available from the same source, product #675830.

Item 12 Radioactive Waste Containers for Liquid Waste

- The currently approved container for liquid radioactive waste is a 2.5 gallon poly carboy.
- Separate containers must be provided for each of the following materials:
 1. short lived radioactive materials (half life < 120 days)
 2. long lived radioactive materials (half life > 120 days)
 3. mixed radioactive waste (contact Radiation Safety for details)
- Ensure that each waste container has a “Caution, Radioactive Materials” label on it prior to use. Radiation Safety can provide these labels and a minimum of 2 labels should be put on opposite sides of the container.
- The form “Liquid Radioactivity Analysis Form” should be used to determine the activity of each waste container prior to pickup. This form is available at the ESD website at <http://www.esd.uga.edu/>
- Other forms may be used for analysis of low level liquids for release or for sewer disposal. See the Radiation Safety Manual for details or contact the Radiation Safety staff for assistance.
- Liquid waste carboys should be stored in trays or bins which provide secondary containment for preventing spills.
- A sufficient quantity of liquid radioactive waste containers should be procured by the AU to allow for the anticipated volume of waste generated. After decay in storage and/or sewer disposal by Radiation Safety, liquid waste containers will be returned to the AU.

- 2.5 gallon Nalgene carboys are available from Central Research Stores (CRS) or Campus Scientific Stores (CSS) product #721925.

Item 13 Radioactive Material Signs and Labels

- Doors to radioactive material areas must be posted with a radioactive materials sticker on the standard laboratory hazard door sign. In addition the posting “Notice to Employees” is required. The Radiation Safety staff will provide these postings. Other labeling materials should be procured by the AU and are generally available through commercial lab safety suppliers.
- All enclosed containers, freezers, refrigerators, equipment, or cabinets where radioactive materials or contaminated items are used or stored must be labeled with the standard radiation symbol and the words “Caution, Radioactive Material.”
- Radioactive waste containers must be labeled as previously discussed.
- Tape bearing the standard radiation symbol and the words “Caution, Radioactive Material” should be used to post the boundaries of all countertops and similar locations routinely used for radioisotope work.
- Containers of radioisotopes should be marked with the standard radioactive material markings and should additionally be labeled with the isotope, quantity (mCi or microCi), and date.
- Instruments that contain radioactive sources such as GC’s and LSC’s should be labeled with a “Caution, this instrument contains radioactive material” sign or approved equivalent. These instrument labels are available from Radiation Safety.

Item 14 Initial Radiation Safety Training

- The AU is responsible for training of individual Radworkers in their laboratory. Support information for this training, including a form to document the training and a PowerPoint presentation are available at the ESD website. The ESD website address is <http://www.esd.uga.edu/>.
- At least one person in an authorized use laboratory is required to successfully complete Advanced Radworker training. Advanced Radworker training is provided and documented by Radiation Safety. Six months will be allowed for completion of all modules of this training.

Item 15 Radiation Safety Records

Records in support of the requirements described in the UGA Radiation Safety Manual must be maintained in the laboratory. Copies of blank forms are available in the radiation safety section of the ESD website. It is recommended that records be organized in binders for easy access and to facilitate the review process. These records should include:

- radioactive materials permit application
- radioactive materials permit

- radioactive materials permit sign-in sheets
- radioactive materials permit amendments
- monthly survey records
- sewer disposal records
- radioactive materials inventory sheets
- summary of isotopes inventory forms
- copies of radioactive materials forms used to record waste disposal
- training records