
Laboratory Safety Reminders

July 2012 ♦ Mount Holyoke College – Environmental Health and Safety

Safe Use of Radioactive Materials in MHC Research Labs

Research Protocols

A Radioactive Materials (RAM) use Protocol is a “step by step” procedure you will use when performing any experiment using radioisotopes. Your faculty advisor must evaluate your planned use of RAM for many hazards including: external dose, internal uptake, release of RAM into the lab or to the environment, contamination potential, use of RAM in animals, need for personnel dosimeter, etc.. The Radiation Safety Officer (RSO) reviews all RAM use procedures with the faculty member to ensure safe use and compliance with the College license to use RAM. The Radiation Safety Committee also approves each protocol.

Safety Training Required

After the safety evaluation of the Protocol and approval by the Committee, your faculty advisor will meet you in the lab and review the Protocol. At this meeting, you will learn lab techniques to prevent/minimize uptake, external exposure, contamination, etc.. You may also practice techniques using non-radioactive materials. **No student researcher may use RAM until they have received specific radiation safety training from their faculty advisor.** The College license mandates this specific safety review/training procedure.

Exposure Levels

ALARA is an acronym for “as low as reasonably achievable”. Faculty and students must plan and conduct their research using RAM to ensure they have taken all precautions necessary to minimize their exposure to radiation to well below regulatory limits, i.e., as low as reasonable achievable, by using approved procedures and engineering controls to prevent exposures.

State regulations establish occupation exposure limits, which are described in the MHC Laboratory Safety Handbook. The Handbook also described special requirements for prenatal exposure. If you are or become pregnant while working with radioactive materials, consult the Handbook for details.

Storage of RAM

All RAM received from vendors and experimental samples generated must be stored in a secondary container, e.g., a labeled plastic box with a cover, before placing RAM in the refrigerator or freezer for storage. This is important to **prevent the spread of RAM contamination** in the lab refrigerator. Control of RAM to prevent contamination is one of your primary concerns as a student researcher using RAM.

RAM Use Area or Lab

Specific areas must be designated for RAM use and RAM cannot be used in any other areas of the lab. All RAM use areas, e.g., bench tops, sink, refrigerator, hood, etc., must be properly marked with “Caution Radioactive Material” tape and signs. The area must also be prepared for spills with plastic backed paper (two layers) and/or spill trays with elevated sides. **Use of long half-life isotopes, e.g., H-3, C-14, must be done on trays only** to reduce the amount of contaminated bench paper. This greatly reduces the cost of off-site RAM waste disposal.

<p style="text-align: center;">Campus Emergency Number 1911 (cell phone or off-campus: 413-538-2304)</p>

If you will be using mCi quantities of high energy beta/gamma emitting isotopes, you must use a work bench plexiglass shield. Shields are clear, leaded and multilayered and greatly reduce the exposure rate. Your faculty advisor will install the appropriate shield for your planned RAM work and any other special equipment/shields to minimize exposure.

Posting and Labeling

The RSO posts all license required signs in your lab including labeling of your RAM waste containers. You must label all your research generated RAM containers with "Caution Radioactive Material" tape. Many research containers are very small and are difficult to label with tape. It is acceptable to label the tray or plastic storage box you are using to store small vessels in your refrigerator or freezer.

Proper Protective Clothing

All RAM users must wear a lab coat, safety glasses, and "appropriate" gloves, i.e., the gloves must be impervious to the solution in use. If improper gloves are selected for the solution in use, radioisotopes can pass through the glove and onto the skin. In fact, the solution may pass through the skin and also result in an internal uptake of RAM.

Since the potential for a spill of RAM onto the lab floor is high, users should also wear long pants with closed shoes (heel and toe with no perforations) and socks. If necessary during hot summer months when shorts and sandals are worn to the lab, keep a pair of old pants and shoes/socks in the lab for use in RAM procedures. If you spill RAM and it splashes on your lower leg, you then only need to remove and bag your old clothing. This will save you and your advisor from performing a long and tedious decontamination of your skin/lower legs.

If you have contaminated your lab coat, e.g., on the chest or arms, during routine procedures and the level is below a few thousand cpm (counts per minute), you may still continue to use the coat in your research with RAM. Low energy beta emitting isotopes, e.g., H-3, C-14, S-35,

won't penetrate your coat. This same small level of high energy beta emissions, e.g., short half-life P-32, is greatly reduced by cloth lab coats and will result in insignificant doses to your skin or arms.

If you find significant contamination on your coat during monitoring when using isotopes for which monitoring is appropriate, e.g., 10,000 cpm or greater in any one location, bag, date, label, and store the coat for 10- half-lives and get another coat to wear during your RAM research. If you know you contaminated your coat with H-3 or C-14, which you can't monitor, ask your faculty advisor for advice. You may need to dispose of the coat as radioactive waste.

Personnel Dosimeters

Dosimeters measure exposure during use of radioisotopes. Not all users are issued dosimeters. Low energy beta emissions, e.g., from H-3, C-14, S-35, are so weak they cannot penetrate the dosimeter encasement and therefore are ineffective and not issued.

If you have been assigned a whole body and/or ring dosimeter (or "badge"), you must wear it during research while working with the radioisotope specified, e.g., P-32. The ring dosimeter must be worn with the ring "face" on the palm side of the hand most likely to hold containers of RAM and under your protective glove. If you wear the ring with the face side toward the back of your hand, your hand will shield the radiation from being measured. Your body dosimeter can be worn on your lab coat at the chest pocket.

When you are not wearing your dosimeter, you must store it in a designated location in your lab. You must also monitor your dosimeter before you place it in the storage location to ensure that it is not contaminated. If you find that your dosimeter is contaminated, notify your faculty advisor immediately. Another dosimeter will be issued to you.

Never wear another person's dosimeter. If you receive a dose during research work, the dose will be assigned to the person assigned that

dosimeter. If you lose your dosimeter, notify your advisor and another will be assigned to you. If you unknowingly take your dosimeter home and it is laundered, notify your advisor and a replacement will be issued to you.

Ordering/Receiving RAM

Only faculty authorized by the Radiation Safety Committee may order RAM. Only the faculty member and their trained assistants may receive and open RAM packages.

RAM Waste Disposal

Briefly, the following methods are approved for RAM disposal. Faculty will establish specific procedures in the lab in consultation with the RSO.

1. Aqueous liquids discharged into the lab sink drain (be sure the sink drain is not leaking).
2. Solid contaminated lab materials are placed into properly marked waste containers with lids. All solid waste must be segregated by isotope, except H-3 and C-14 and other long half-life (>90 days) isotopes that may be placed in the same container.
3. Liquid scintillation cocktail (LSC) vials separated by isotope, except H-3 and C-14 may be placed in the same container as solid waste.
4. Non-toxic LSC vials must be separated from hazardous LSC vials.

RAM must never be disposed of into the normal lab trash can!! Monitor all lab waste carefully to make sure it is properly separated when you are using RAM.

Monitoring Your RAM Use Area

Most radioisotopes used in biological research emit beta particles, H-3, C-14, and P-32. A few also emit x-rays and/or gamma rays in addition, e.g., Cr-51, Fe-55. High energy beta emitters are easily monitored using a GM survey meter. Low energy beta emitters (e.g., C-14, S-35) can be detected with a GM survey meter at very low efficiency, i.e., about 4% or only if 10,000 dpm (disintegrations per minute) or more activity is present. Therefore, a work surface wipe test must be performed to ensure that you will detect any

contamination present by using the liquid scintillation counting (LSC); H-3 can only be detected using LSC.

You must have the appropriate monitoring equipment in your lab or have immediate access to the equipment to ensure that you will make the proper contamination surveys in your RAM use area. **At a minimum, you must monitor your work area following completion of each RAM use/experiment.** You must also monitor your work area at various intervals during long experiments, e.g., while waiting for samples to complete centrifugation, water bath treatment, etc., or whenever you suspect contamination is probable.

When using the GM survey meter, use only the “CPM” scale to determine the contamination level along with the efficiency found on the calibration sticker. The mR/hr scale is not calibrated and has no meaning.

Spill Response

You must report all spills or contamination to your faculty advisor as soon as possible.

If you know you have **contaminated your skin**, you should go to the lab sink and wash the area with warm water and liquid hand soap. Then dry the area and monitor with the GM meter. Repeat this until the area of the sink contamination is at background, but no more than 3 times. **You must not redden or break the skin** by rubbing too hard. If there is residual contamination remaining after 3 cleaning attempts, your advisor and the RSO will evaluate the dose from remaining contamination, a requirement of our License, and discuss it with you.

If the radioisotope spilled on your skin is H-3, no external dose is possible, i.e., the beta emission is too weak to penetrate your dead skin layer. However, any isotope can penetrate the skin if the solution spilled on the skin can penetrate, as through a cut or other opening in the skin, or if the solution is a chemical that is skin absorbed. Your advisor will call the RSO for additional assistance on any spill if deemed necessary.

If a small RAM spill occurs that you know just happened, the first step in dealing with it is to visually check yourself for spill splash. Tell others in the lab to not come into the area of your spill until you have monitored and cleaned the area. Notify your faculty advisor for supervision/assistance in cleaning up the spill.

If the spill is small and you are not contaminated, absorb (don't spread the liquid with the usual wiping motion) the liquid with Kim-Wipes or paper towels. Then spray the spot with Dow Spray Cleaner and re-blot with paper towel. Monitor the area and surrounding area carefully to be certain that all are at background level. Re-clean and remonitor as necessary to complete the clean-up. **If the spill is large, call for help immediately.**

You should never be working in the lab alone, however, if you are alone and need help, try calling out for help; if this is unsuccessful after repeated tries, take off your gloves and walk slowly to the phone to call your faculty advisor or Campus Police; **stay put until help arrives, to limit the spread of contamination.**

Emergency phone numbers are posted in the lab or on the lab door.

Transport of RAM

You may transport RAM between labs as long as your faculty advisor has approved transport. The RAM must be placed into an unbreakable secondary container, e.g., a plastic box with a snap lid or a styrofoam box with the lid taped down, to ensure that no RAM will be spilled during transport. **Transport of RAM to any other location is strictly prohibited.**

For Emergency Assistance

Faculty Advisor:

(ask your faculty advisor for contact information and make sure it is posted in the lab)

Campus Police Emergency ext. 1911

Campus Police Emergency from a cell phone (413)538-2304

Campus Police (routine calls ext. 2304)

Assistant Radiation Safety Officer, Janice Hudgings, ext. 2206

To contact the Radiation Safety Officer Call: (413)323-9571

Office of Environmental Health and Safety, ext. 2529, or Campus Police, ext. 2304

