

Welcome to the 2011 Radiation Safety Refresher Training session for users of **Gas Chromatographs with electron capture devises (ECD)**. As a radiological worker, training concerning the safety aspects related to using radioactive materials must be provided **annually**. All Principal Investigators (PIs) and Associate Investigators (AIs) authorized to use radioactive materials at the University at Buffalo (UB) work under a Radioactive Materials License from the New York State (NYS) Department of Health (DOH). The Radiation Safety Division of Environment, Health & Safety (EH&S) Services oversees this license and presents the Refresher Training.

Topics

Annual Reminders:

- Sealed Source Use at UB
- Authorized Users of Sealed Sources
- Lab Signage Program (New 2011)
- Safe Use of Sealed Sources
- EH&S Sealed Sources Rules
- Emergency Procedures

Gas Chromatographs (ECD)

- Leak Testing and Inventory
- Appropriate Use of Sealed Sources
- Source Disposal (New 2011)



We will try to keep this training as quick as possible while providing radiation safety program refresher reminders. The topics listed above are described in this presentation.

Sealed Source Use

Sealed Source:

- Any radioactive material permanently bonded or fixed in a capsule or matrix designed to **prevent release** of the material under the most severe conditions likely to be encountered in normal use and handling.
- PI must be authorized for the isotope of the source before use.



Sealed sources are encapsulated radioactive materials (in solid, liquid, or gas states) and can take many different forms. All forms share some type of encapsulation (typically inside metal or plastic) that prevents the radioactive contents from leaking or dispersing – barring tampering or a severe accident. In some forms, the radioactive material is an inherent part of the source and cannot be separated. Most "sealed sources" are designed to be handled without concern that the radioactive material will rub-off or be dispersed onto hands or clothing. There is, however, reason to be concerned about exposure to the radiation emitted from some types of sealed sources.

State and federal regulations control the use of radioactive materials at UB. The university has been issued a license by the New York State (NYS) Department of Health (DOH) that allows the use of radioactive materials and also requires UB to control and monitor the use of these materials. The safe use of radioactive materials is best accomplished when the end user and radiation safety personnel act in cooperation.

Types of Sealed Sources

Uses:

- Plated Sources for Mossbauer Effect (Co-57)
- Encapsulated for Calibrations (I-129, Co-60, C-14)
- Electron Capture Devices in Gas Chromatograph (Ni-63)
- Sample Irradiator (Cs-137)
- Ionization Static Eliminators and Neutralizers (Kr-85, Po-210, Am-241)



Sealed sources at UB take many different forms and contain a variety of isotopes:

- Plated radioactive material (various nuclides) coating a disk or a planchette. This coating may be covered, depending upon the type of radiation emitted, by Mylar, aluminum, steel, or plastic.
- A capsule usually made of metal surrounds the radioactive material. These sources are often placed onto the end of metal or plastic handling rods. Another example of a capsule is when a mixture of radioactive compounds is placed into a container and welded or sealed closed.
- Ni-63 or H-3 electron capture devices found in gas chromatographs with a housing containing the source and an inlet and outlet ventilation to the housing.
- Cs-137 sources of high activity, permanently housed in apparatus intended for irradiating animals or cells or other materials.
- Kr-85 (gas), Po-210, and Am-241 used to eliminate static and dust and neutralize and clean surfaces at remote distances.

Authorized Users of Sealed Sources

Radiation Safety Program Participants:

- DOH
- Radiation Safety Committee
- EH&S
- Principal Investigator (PI)



In order to possess or use radioactive sealed sources (or devices containing sealed sources) at UB, the Principal Investigator (PI) must have a radioactive materials permit approved by the Radiation Safety Committee (RSC). The PI's permit is an authorization to use radioactive material under DOH License 1049.

To obtain a permit, the PI must meet minimum experience and training requirements. This training is one of those requirements. The PI and everyone in a laboratory must satisfactorily complete the training before they begin to work with sealed sources.

Authorized Users of Sealed Sources

University at Buffalo
Environment, Health & Safety Services
APPLICATION TO USE RADIOACTIVE MATERIAL
RADIACTION INVESTIGATOR ACTIVATION

Part 1 Instructions: Fill in the information requested below. Print neatly.

Last Name	First Name	Middle Initial	Name of Principal Investigator	Office Address
Office Telephone	Cell Phone Number	Date of Birth	Sex	Department
Do you have a license for a vehicle that has a license plate that has the word "RADIOACTIVE" on it? (If yes, give the license plate number.) Do you have a license for a vehicle that has a license plate that has the word "RADIOACTIVE" on it? (If yes, give the license plate number.)				Social Security Number (SSN)* (If you do not have an SSN, please leave this field blank.)
Radiation Material & Quantities to be Used (Specify item name, activity, and quantity)				Location of use (Specify room and building)
Have you ever worked with Radioactive Material or Radiation Sources at UB previously? () No () Yes. If yes, list the Principal Investigator(s) with whom you have worked.				

Part 2 Instructions: Check off the training and approval items. Check off requirements below.

I have indicated that I have indicated the above named individual on: <input type="checkbox"/> Health, protective procedures with radioactive materials <input type="checkbox"/> Radiation safety training <input type="checkbox"/> Availability of radiation monitoring equipment <input type="checkbox"/> Appropriate responses to possible emergencies	I have indicated that I have indicated the above named individual on: <input type="checkbox"/> Procedures to minimize radiation exposure <input type="checkbox"/> Radiation safety training <input type="checkbox"/> Laboratory cleaning procedures
Principal Investigator's Signature	Date

Part 3 Instructions: Read and sign certification.

I, the undersigned, hereby certify that I will adhere to the rules and regulations contained in the University at Buffalo Radiation Safety Manual and the University at Buffalo Radiation Safety Manual. I will not use radioactive materials until I have attended the Basic Radiation Safety Orientation and satisfied any additional training requirements.

Principal Investigator Signature: _____ Title: _____ Date: _____

Part 4 Instructions: For this completed form to RSC-2008 or return form to: EH&S Radiation Safety Division, 14 Parker Hall, South Campus. EH&S will contact you concerning training required prior to the use of radioactive materials at UB.

***** EHS USE ONLY *****

Orientation Date: _____ () Entered in Database () Exam Score Entered Date Certificate Sent _____

Duplicates Ordered: () N/A () YES Location Code: _____ Warner Number: _____

Approved By: _____ Date: _____

Associate Investigator (AI) Requirements:

- Submit **RMA-2 Form**
- Receive Initial Training
- Annual Refresher Training

By issuing a radioactive materials permit, the RSC recognizes that the PI has assumed certain responsibilities, including assuring that everyone in the lab will have the experience and equipment necessary to safely use the radioactive source(s). This includes helping Associate Investigators (AI) complete and submit the “Application to Use Radioactive Material” (RMA-2) form to EH&S (Form can be found at the EH&S website, www.ehs.buffalo.edu) and providing training mandated by state law. All sealed source users must be registered with EH&S using the RMA-2 application (unless the individual is using radioactive material as a student conducting supervised work for a course).

Authorized Labs for Sealed Sources

Approved Sealed Source Storage Locations:

- Must be posted with Proper Signage
- Rooms with **Only** Sealed Sources Posted as a "Sealed Source" Lab


Lab Signage Program
www.ehs.buffalo.edu

All labs with radioactive material must be posted with proper signage. Rooms with only sealed source radioactive material are posted as a “Sealed Source Only” lab. Labs that manipulate un-encapsulated radioactive materials are posted as Open Source labs.

The type (nuclide) and amount (activity) of radioactive material in the sealed source determines the safety requirements for using the source. Under normal conditions, sealed sources present an external radiation hazard as opposed to a contamination hazard. When working with any radioactive materials, the main concern is controlling exposure to radiation. Since any radiation exposure presumably involves some risk to the individual involved, the level of exposure received should be worth the result that is achieved. In principle, the objective of radiation protection is to balance the risks versus the benefits from activities that involve radiation. Different uses of ionizing radiation warrant consideration of different exposure guidelines or means to reduce exposure.

EH&S has instituted a university wide Lab Signage Program. An example of the new sign is seen in the slide. Signage should contain information about all the hazards present within the laboratory. If your lab does not have up-to-date signage, please refer to the EHS website at www.ehs.buffalo.edu for information and to obtain the Lab Signage forms. Click the link for Lab Signage. Download and complete a form for each lab and then fax or mail to EH&S.

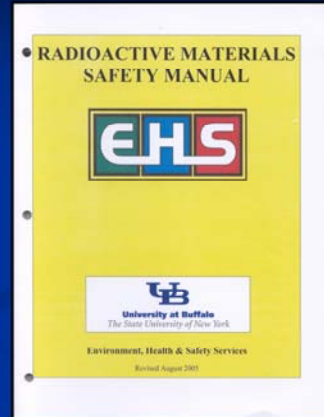
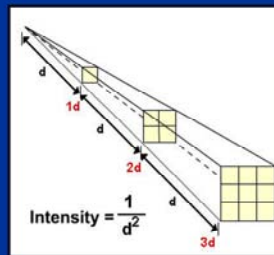
Postings

<p style="text-align: center;">STATE OF NEW YORK NOTICE TO EMPLOYEES STANDARDS FOR PROTECTION AGAINST RADIATION</p> <p style="text-align: center;"></p> <p>YOUR EMPLOYER'S RESPONSIBILITY The transfer, receipt, possession or use of all sources of ionizing radiation in the State of New York is controlled by the applicable rules, regulations and orders of either the New York State Department of Labor or health to the State of New York Department of Health. These agencies require either the registration or licensing of all significant radiation sources, and they require your employer to post certain notices in your laboratory to protect both yourself and other persons make available to you a copy of the applicable regulations, codes, and regulations, and the operating procedures existing in the work in which you are engaged and to submit relevant provisions to you. The applicable regulations in this notice are Part 16 of the New York State Building Code.</p> <p>YOUR RESPONSIBILITY AS A WORKER You should familiarize yourself with the provisions of the New York State Building Code, laws and regulations and the operating procedures which apply to the work in which you are engaged. You should observe these provisions for your own protection and the protection of other workers.</p> <p>WHAT IS COVERED BY THESE REGULATIONS</p> <ol style="list-style-type: none"> 1. Limits on exposure to radiation and radioactive material in controlled and uncontrolled areas. 2. Procedures to be followed after radioactive spillage. 3. Personnel monitoring, surveys and equipment. 4. Caution signs, labels and safety practice equipment. 5. Exposure records and reports, and exposure meters. <p style="text-align: center;">POSTING REQUIREMENT</p> <p>Copies of this notice must be posted where employees working in or frequenting any portion of the laboratory have a ready and easy way to get from their place of employment. Copies of Part 16 and other radiation documents, if not posted, are available for review at the following location:</p> <p style="text-align: center;">University at Buffalo Environmental, Health & Safety Services Radiation Safety Division 14 Parker Hall (716) 624-5281</p> <p style="text-align: center;">800-442-2686</p> <p style="text-align: center;">Contact Environment, Health and Safety at 829-3281 for assistance. After normal working hours, call University Police at 645-2222.</p>	<p style="text-align: center;">Safety and Emergency Procedures for Radioactive Materials Laboratories</p> <p>General Precautions</p> <ul style="list-style-type: none"> • Use of radioactive material is allowed in approved and posted areas by authorized individuals only. • Label all containers of radioactive material & contaminated items. • Wear prescribed personal protective equipment (PPE). • Do not handle clean items with gloved hands. • Do not store food with radioactive materials. Do not eat, drink, or apply cosmetics in radioactive materials areas. • Perform a contamination survey after each use of radioactive material using portable survey meter and wipes. • Wear issued dosimeters. • Maintain exposure as low as reasonably achievable (ALARA). <p>Spills</p> <ul style="list-style-type: none"> • Stop the spill. Turn the container up right and/or apply absorbent material to minimize spread of contamination. • Warn others. Notify all other persons in the room to avoid the spill. • Isolate the spill. Prevent others from entering the area. • Minimize exposure. For small spills initiate decontamination. Otherwise obtain assistance from EH&S. Begin at the periphery and work towards the center. Place contaminated items in the proper waste containers. • Survey the area. Perform and document the decontamination. <p>Personnel Contamination</p> <ul style="list-style-type: none"> • Notify all other persons in the area and ask for assistance. • If contamination is found on skin or personal clothing or internal exposure (inhalation/ingestion) is suspected, immediately notify EH&S. • Remove contaminated clothing. • Wash contaminated skin or hair with mild soap and water. Do not irritate the skin. • Do not leave the area until found free of contamination. <p>Loss of Radioactive Material or Release to Environment</p> <ul style="list-style-type: none"> • Notify EH&S immediately if radioactive material is missing or inadvertently released to the sewer, non-radioactive trash or air.
---	--

The “Notice to Employees” sign includes the safety and emergency information and is posted in a conspicuous location inside each lab. Only the radioactive materials posting with emergency contact information will be posted on each lab door. The “Safety and Emergency Procedures” sign provides general written information concerning requirements for maintaining a radioactive material permit and gives the steps to be taken to minimize the spread of contamination during an incident. And the “Notice to Employees” sign is required by the DOH to be displayed “wherever individuals work in or frequent any portion of a restricted area” [Part 1613(b)(3)].

Safe Use of Sealed Sources

- When Working with Sources
Maintain **ALARA** Controls:
- Minimize **Time** with Source
 - Maximize **Distance** from Source
 - Use Appropriate **Shielding**



Sealed sources can emit any type of ionizing radiation, including alpha particles, beta particles, gamma rays, x-rays, or neutrons. An essential facet of radiation protection practice is the ALARA (As Low As Reasonably Achievable) philosophy. The ALARA concept gives primary importance to the principle that ionizing radiation exposure should always be kept as low as practicable.

When working with radiation, be aware that exposure is directly proportional to the time spent in the field. Minimize the amount of time exposed to the source to reduce dose. The dose received is inversely proportional to the **SQUARE** of the distance of separation. Thus, the distance of separation between a person and a source has a greater relative influence on dose than does the time factor. Use controls and tools to keep your body as far away as possible from the exposed source at all times.

A simple, yet effective, way of reducing radiation exposure in conjunction with or when the previous methods cannot be used, is by placing appropriate shielding between the user and the source. To properly utilize this method, it is necessary to understand what shield material works best for which types of radiation. Contact EH&S for help in designing necessary shielding for your source.

Safe Use of Sealed Sources

University at Buffalo
Environment, Health & Safety Services
RADIOACTIVE MATERIALS EXPERIMENTAL PROCEDURES APPLICATION
IN VITRO PROTOCOL

Part 1 Instructions: Complete this form for each new or amended radioactive materials experimental procedure authorization (in vitro protocols only). For in vivo protocols, use Form (RMA-2). Submit this form with an electronic (Microsoft Word preferred) copy of the protocol to EH&S for approval. **Print clearly!**

Name: _____ **PI Number (and required for initial applications)**

Descriptive Title of the Protocol: _____

Building and Room(s) Where Experiment is to be Performed: _____ **Room(s):**

The experiment requires: **Physical form of radioactive material used or reaction results:**
 Biosafety Cabinet Gas/enc. Solid - Powder
 Fume Hood Solid - Pellet Liquid

Part 2 Instructions: Attach a complete protocol description. Include and check off the following requirements:

List all steps needed to understand the **safety aspects** of the experiment.
 Include the amount of radioactive material used at each step.
 Include equipment and materials that will be used as part of the radioactive procedures.
 Describe potential hazards and radiation safety procedures (survey, PPE, shielding, and detector requirements, etc.) to be used to mitigate the hazards.
 Show calculations to justify the amount of radioactive material requested. Adjust the total amount requested in the lab at any one time to allow ordering of additional material while current material is still in use.
 State the types of waste generated (i.e. aqueous, elemental, mixed with hazardous chemical, etc.) and the estimated volumes. Indicate the **waste minimization techniques** to be employed.

Part 3 Instructions: List amount of radioactivity involved and waste generated based on the protocol description.

Maximum activity used per each experiment (mCi): Decay Source (half life less than 90 days)
 Liquid Formulation In Vitro
 Hazardous Chemical (i.e., toxic, carcinogenic) Mixed with Radioactive Materials
 Contaminated Sharps (i.e., Razor Blades, Pasteur Pipettes, Syringes, etc.)
 Infectious or Potentially Infectious
 Human Blood
 Tissue or Animal Carcasses

Part 4 Instructions: Sign and fax this completed form to 607-255-2023 with all required attachments. Name, e-mail address, and phone number of person completing form of either these fill:

PI Signature: _____ Date: _____

EH&S Approval by: _____ Date: _____
 RSC Approval Date: _____ () N/A. Date Change of Status Issued: _____

(RMA-42) (01/05/09)

- Experimental Protocols:**
- Required by License and RSC
 - Must Have Specific Details
 - Describe **all** Safety Requirements
 - Important Worker Training Tool

Anyone working with radioactive materials must be familiar with the approved safety protocol for the source being used. Use a “Radioactive Materials Experimental Procedures Application” (RMA-42) form to document all of the safety related requirements for the sealed source. The PI should provide these procedures, in written form, to each person involved in the experiment. If you have any questions about proper operating procedures for working with radioactive material, please refer to the UB “Radioactive Materials Safety Manual” that is available in each laboratory or call EH&S at 829-3281.

EH&S Sealed Source Rules

1. All sources must be secured from unauthorized removal
2. Do not touch electroplated sources
3. Sealed Sources shall not be opened under any circumstances
4. Exhaust from gas chromatographs shall be directed into a hood
5. Sources must be leaked tested at designated intervals by EH&S
6. Wear dosimeters, if issued



The UB "Radioactive Materials Safety Manual" lists the following safety requirements for working with sealed sources:

1. All sources must be secured from unauthorized removal. Storage containers must be properly labeled. If a sealed source is missing, notify EH&S promptly at 829-3281. Under some circumstances, UB must notify the DOH when a radioactive source cannot be located. EH&S will make the determination whether notification is necessary and will assist in efforts to locate the source.
2. Do not touch electroplated sources, as this may result in the removal of the active material. Do not use handling tools in such a way as to penetrate the surface of the source. Storage containers should not have material that abrades the surface of the electroplated sources.
3. Sealed sources shall not be opened under any circumstances. Only authorized individuals shall perform the repair and cleaning of sources.
4. The exhaust from gas chromatographs shall be directed into a fume hood whenever detectors are in use. Detectors shall be stored in a well-ventilated and secure location whenever they are not mounted in the chromatograph unit.
5. Sealed and electroplated sources must be leak tested at designated intervals by EH&S. Generally, alpha sources need leak testing every three months while beta sources require leak testing every six months.
6. Sealed source users who are working with sources of higher energies are given dosimeters to monitor any dose the user might receive to insure that ALARA is being practiced. Wear whole body dosimeter on the outside of protective clothing at collar level and ring badges under protective gloves.

Emergency Procedures



Contact EH&S:

- Radioactive Contamination of a Lab
- Loss of a Radioactive Source
- Overexposure of a Person to Radiation

If a situation representing a life-threatening emergency occurs in the lab, personnel should call University Police at 645-2222 from a safe telephone. If the situation is not a life-threatening emergency, EH&S should be contacted at 829-3281.

EH&S should be notified of any emergency involving radioactive materials, including but not limited to: radioactive contamination of a laboratory, loss of a radioactive source, or overexposure of a person to radiation. After normal business hours, EH&S personnel can be reached by calling the UB Police Department at 645-2222.

Sealed Source Inventory

Inventory:

- Conducted Quarterly
- Performed and Documented by EH&S



Inventory is a verification of the presence and proper storage of the sources listed in the EH&S sealed source database. Sealed sources are inventoried every three months. **If a source is found to be missing, EH&S must be notified as soon as possible.**

Sealed Source Leak Testing

Leak Test:

- Every 6 Months for **Beta** Sources > 100 μCi
- Every 3 Months for **Alpha** Sources > 10 μCi
- Performed and Documented by EH&S



A Leak Test is a survey for removable contamination performed in accordance with the instructions provided with the source or by using safe handling practices. Leak tests are accomplished by wiping a piece of filter paper ("wipe smear") across a source or source housing. Radioactive contamination leaking from the source can then be measured by analyzing the filter paper using an appropriate detection system. Leak test and inventory requirements are stipulated in the DOH License 1049. EH&S follows all required schedules and limits, and performs the leak tests and analysis of wipes.

The following limits are used for leak tests at UB:

- No action is taken if a leak test on a source reveals removable contamination below 0.001 μCi per wipe.
- If source wipes reveal contamination above 0.001 μCi per wipe, but below 0.005 μCi per wipe, EH&S recommends the source be removed from use.
- If the leak test reveals contamination above 0.005 μCi per wipe, the source is required to be removed from use and either repaired or disposed of appropriately. This level of contamination requires notification of state regulatory agencies.

Leak Test for ECD

- Leak Test performed as per the operating manual for specific Gas Chromatograph.
- Typical Leak Test includes:
 - Swipe of inlets
 - Swipe of outlet and immediate ventilation location
 - Swipe of the ECD housing

Each Gas Chromatograph (GC) on campus has an operating manual that is on file at radiation safety. The operating manual for the Gas Chromatograph states that the electron Capture Device (ECD) must be leak tested. The manual also describes how the ECD for that specific GC should be leak tested.

Leak test and inventory documentation are maintained by EH&S. The PI also receives a copy of the current leak test certificate. For more information pertaining to leak testing or inventory, please contact EH&S.

Appropriate Use of GC's and ECD's



In 2009, EH&S discovered a leaking Ni-63 Electron Capture Device (ECD) inside an older model Gas Chromatograph (GC) during a routine leak test. The machine had been used to dry silica gel in the oven. The ECD did not have a gas column on it and was not properly capped, which allowed the GC fan to blow the silica gel through the ECD and strip Ni-63 from the source within.

This leak caused a large amount of Ni-63 to mix with the silica gel and contaminate the machine and could have potentially contaminated the lab. The GC had to be removed from the lab and be dismantled in order to decontaminate it. The machine eventually had to be scrapped. A significant amount of radioactive waste was generated during the decontamination. This waste is expensive to dispose of. If the GC could not have been decontaminated, the entire unit would have required disposal as radioactive waste.

Appropriate Use of Sealed Sources

- Use sealed sources and instruments as they were intended.



Please make sure you use your sealed source and instrumentation in a manner as it was intended. Using equipment for something other than its intended purpose could result in source rupture and cause radioactive material to leak. If your lab has a gas chromatograph with an electron capture device that is not being used, make sure that it is capped to prevent gas or other substances from passing by the source. Decontamination of equipment is time consuming and can be costly.

ECD Source Disposal

**Contact EH&S
Radiation Safety
Division to
discuss disposal
options**



Radioactive material can not be disposed through the regular waste stream. All radioactive material must be disposed in accordance with State and Federal regulation. ECD's from Gas Chromatographs must be removed and shipped to a certified vendor for disposal and the cost will be the lab's responsibility. Please contact EH&S Radiation Safety if you are planning on disposing of a ECD.

Conclusion

Thanks for Participating:

- Please fill out a Required Reading Form.
- Submit the form to EH&S
- Visit our Website at www.ehs.buffalo.edu



Thanks for reviewing this Sealed Source Refresher Training information. Remember the EH&S website (www.ehs.buffalo.edu) has links to guidance documents and forms that can be downloaded.

Work Cited:

Thanks to the University of Colorado
(<http://www.colorado.edu/EHandS/hpl/training/sspkt.html>).