Radiation Safety Retraining
Spring 2009

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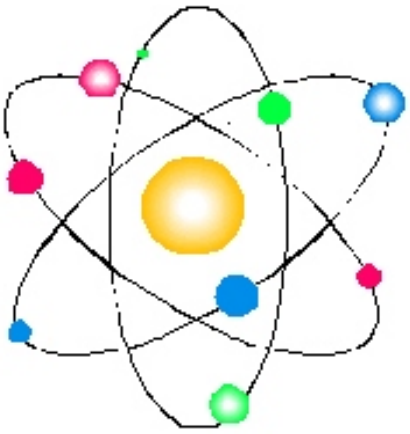

Thank You!

During the past year EHS staff have performed over a thousand laboratory radioactive material safety inspections and have not found any serious problems. Thank you. This really makes our job easier.

In addition to the audits of radioactive material users performed by EHS, EHS's radiation safety program was audited by the Pennsylvania Department of Environmental Protection (DEP). No safety problems or concerns were identified. As you may recall, Penn State is now licensed to use radioactive material by the DEP. To keep policies and regulations consistant with national and most other state requirements, Pennsylvania adopted all the Nuclear Regulatory Commission regulations. Thus any reference to the NRC's requirements is equivalent to referencing the DEP requirements.

Biological Effects and Exposure Limits

The Nuclear Regulatory Commission (NRC) has two very good documents explaining the health effects of ionizing radiation. They are Regulatory Guide 8.29 Instruction Concerning Risks from Occupational Radiation Exposure and Regulatory Guide 8.13 Instruction Concerning Prenatal Radiation Exposure. These documents are available from the EHS website or the NRC web site at http://www.nrc.gov/reading-rm/doc-collections/reg-guides/occupational-health/active/

The NRC's exposure limits are:

Whole Body:	5,000 mrem per year	Skin:	50,000 mrem per year
Lens of eye:	15,000 mrem per year	Extremities:	50,000 mrem per year

Non-radiation workers (general public): 100 mrem per year

Fetus of "declared pregnant" radiation worker: 500 mrem per nine months

Typical Whole Body exposure at PSU for persons with dosimeters:	0 to 20 mrem per year
Typical Extremity exposure at PSU for persons with ring dosimeters:	0 to 40 mrem per year
Typical background radiation to everyone:	300 mrem per year

Aside from the significance of any given exposure, it is the policy of Penn State University, as established by the University Isotopes Committee, that the exposure of people to ionizing radiation shall be kept As Low As Reasonably Achievable (ALARA). If you have any questions about the health risks of your exposure, an NRC- prepared document, *Risks From Occupational Radiation Exposure,* is available on the EHS web site and provides a clear explanation. If you have any questions, or would like help reducing your exposure,

please contact our office.

Required Training for Radiation Workers

Penn State's Radiation Safety Policy and the University Isotopes Committee (UIC) require all users of radioactive material, and supervisors of radioactive material laboratories, to complete radiation safety training prior to beginning work with radioactive material. The goal is to provide each individual with information needed to work safely with radioactive material. This training includes:

- An on line Radionuclide Safety Training course. http://www.ehs.psu.edu/radprot/rad_course.cfm At the end of the on line training you will find a link to allow you to register for one of the regularly scheduled Radionuclide Safety Orientation and Quiz classes. If none of the available classes works with your schedule, please contact us to schedule an additional class.
- An in class lecture which normally includes hands on training in the use of radiation detection equipment.
- An exam given at the completion of the classroom training.
- Specific training which must be provided to each individual by the laboratory supervisor or some other senior lab member. There is no specific time frame for this, since it is given by the laboratory supervisor or senior research staff in the laboratory.
- Once training is completed, your dosimetry needs may be assessed. If you and your supervisor think your radiation exposure requires monitoring, download the Application for Dosimeter from the EHS web site, carefully read the instructions, complete it and mail it to 228 Academic Projects Building. The form must be completed by the prospective dosimeter user and countersigned by the supervisor. Gennerally dosimetry is only provided to those whose exposure could exceed 10% of the NRC's exposure limits listed above.
- This annual refresher training is required by the University Isotopes Committee. This retraining is required of everyone currently working with radioactive materials and everyone currently issued a radiation dosimeter (except for x-ray use only). The UIC also recommends that everyone in all radioactive material laboratories be aware of these requirements.

Training for Non-radiation Workers

Persons who work in and around your laboratory, but do not work with radioactive material, should be instructed to read the Radiation Safety Information for Ancillary Personnel http://www.ehs.psu.edu/radprot/ancillary.cfm This basic information explains radiation, the radiation symbol, the basic rules to follow, and what to do in case of an emergency. Everyone in your laboratory should be aware of this information. The UIC recommends that all personnel in your laboratory view the on-line Radionuclide Safety Training course. http://www.ehs.psu.edu/radprot/rad_course.cfm

Need, Care, and Use of Personal Dosimeters

State and federal regulations require that personal radiation monitoring device(s) (dosemeters) be supplied to everyone who is likely to receive more than 10% of the annual dose limits listed above. At Penn State it is rare that anyone ever exceeds 10% of the annual dose limits, so dosimetry is usually not required by regulations. However, in order to monitor individuals who might receive a significant dose, or whose work requires dosimetry based on other regulatory requirements, EHS uses the following guidelines in issuing personnel dosimetry:

Dosimetry need for users of radioactive material is based on the number of millicurie-hours (mCi-hr) of exposure. The term mCi-hr refers to being in close proximity to or handing 1 mCi source for 1 hour or 0.5 mCi for 2 hr, etc., at 30 cm from the body, 4 cm for the hands.

WHOLE BODY dosimeters will be issued to all personnel who use radiographic or fluoroscopic x-ray machines, and radioactive material users with potential exposures exceeding:

a. An average of 0.1 mCi-hr per week for gamma-ray emitters with energies exceeding 0.1 MeV,
b. An average of 1 mCi-hr per week for gamma-ray emitter with energies less than 0.1 MeV,
c. An average of 1 mCi-hr per week for P-32 or other high energy beta emitters.
d. Any exposure to X-Rays.

WRIST dosimeters will be issued to individuals who use analytical x-ray equipment and are required to be monitored by Pennsylvania Department of Environmental Protection requirements/

FINGER dosimeters may be issued to personnel with exposures exceeding 1 mCi-hr per week for P-32 or other high energy beta or gamma emitters. A whole body dosimeter is also issued when a ring dosimeter is used. Ring dosimeters must always be worn on the hand that you believe will be closest to the radiation source and worn facing towards the radiation. Normally this means wearing the ring with the dosimeter facing your palm. Also this is normally the hand other than the one with which you use a pipette. The pipette hand usually receives the least exposure.

A personal dosimeter is issued to obtain a specific individual's radiation exposure information. This information is equivalent to medical records because the device tracks the individual's exposure to a hazardous material. Like falsifying other medical records, providing false information relative to radiation exposure is very serious situation.

- Never intentionally expose your, or anyone else's, dosimeter,
- Never wear anyone else's dosimeter,
- Never lend your dosimeter to anyone,
- Always wear your dosimeter(s) when working with radioactive material,
- Always wear your monitors so that they face the radiation.

Intentionally exposing any dosimeter to a radiation field or radioactive material when it is not being worn by the correct individual is falsifying the medical record. PSU will then have an inaccurate record of radiation exposure for that individual.

Failing to wear your issued dosimeter(s) when working with radioactive material, or in an area with a radiation field, is the equivalent of falsifying your own medical record. Although some people may think that it is a personal decision to not monitor (report) this exposure, the purpose of the dosimeter is to obtain an accurate as possible record of your exposure. In addition, if due to not wearing your dosimeter the reported exposure is much less than the real exposure, there will be no impetus to change the procedure to minimize your exposure or exposures to others performing similar tasks. Thus your failure to properly use the dosimeter may cause exposures to others here at Penn State. In addition, considerable time and resources will be spent determining the cause of the exposure or the lack of exposure.

Mishandling someone else's dosimeter, or failing to wear your own dosimeter while working around radioactive material or a machine that produces radiation is the equivalent of intentionally providing false or inaccurate information to University officials. Intentionally providing false information is prohibited by the University's Code of Conduct and is against DEP regulations.

Anyone who intentionally, or habitually inadvertently, misuses an exposure monitoring device may have their dosimeter canceled and may be prohibited from working with radioactive material or radiation producing equipment anywhere at Penn State. In addition, all information relative to such actions will be turned over to Penn State's Office of Judicial Affairs for further action.

One change from previous years is that EHS is now only required to notify dosimetry users of their exposure if the individual's exposure exceeded 100 mrem during the previous year. So if you do not receive a note with your next dosimeter with your exposure information from last year, then the total of last year's exposures were less than 100 mrem. If you wish to know your measured radiation exposure, please contact our office.

What Everyone in Your Lab Should Know

Every person who works with or around radioactive material should be able to answer the basic questions listed below on the left. Very brief typical answers are shown on the right, however, your answers must be specific to your laboratory requirements. When EHS inspects your laboratory or if the Nuclear Regulatory Commission were to inspect your laboratory, these are the kinds of questions that you would be expected answer.

Laboratory supervisors should save this list to help you verify the knowledge of people who join your laboratory group.

Typical Questions		Typical General Answers
For individuals who do NOT work with radioactive material:		
What do you do if someone comes into the room whom you have never met?	–	Ask for identification and reason for entry.
Who do you ask for more information about radiation?	–	My supervisor or EHS
Where do you store or eat your lunch?	–	Not in a radioactive material laboratory.
What radioactive material do you handle?	–	None, but I may sign for a package delivered by EHS.
What do you do when you leave the laboratory and no one else is here? Why?	–	Lock the door to prevent the theft of radioactive material and other things.
For individuals who work with radioactive material:		
What do you do if someone comes into the room whom you have never met?	–	Ask for identification and reason for entry.
What radioisotopes do you work with?	–	P-32, S-35, tritium . . . .
How did your laboratory become authorized?	–	Form to EHS, UIC approval.
What training have you had at PSU?	–	EHS class and technical training by professor. Plus EHS annual retraining newsletters.
How do you get your radioactive material?	–	Process standing order. Call vendor. It is delivered to EHS, they bring it to our lab.
Where are your radioactive material stocks stored?	–	Locked freezer.
What do you do with the empty box?	–	Survey the box, remove the labels, place in trash.
How much do you use at a time?	–	25 uCi.
How do you keep track of your inventory?	–	Document use on yellow inventory sheet. Return sheet to EHS when the vial is empty. Put vial in rad waste. Plus annual inventory audits.
What do you do before working with radioactive material?	–	Put on lab coat and gloves, survey the area.
How do you survey your work area?	–	For P-32 or S-35 and C-14: wipe test with paper towels and a GM meter. For I-125: towels and a NaI detector. For tritium use an LSC.
How do you know your GM meter is working?	–	Battery check, measure check source.
What do you do if the meter does not properly respond to the check source?	–	Use a different meter, call EHS for loaner or repair.
What could cause high meter response?	–	Contaminated probe, bad electrical connection or cable. Or maybe the entire room is contaminated.
What could cause zero meter response?	–	Dead batteries or bad electrical connection.
What do you do after you have completed work?	–	Secure the material, survey all areas and myself.
What do you do if you find a little contamination?	–	Clean it.
How would you decontaminate the lab bench?	–	Water or *Formula 409* and paper towels.
What do you do if you find contamination all over the place?	–	Call for help! (See below) Warn others, call EHS, clean it up, tell my supervisor. Lab specific instructions include _____.
If you use tritium, how do you survey?	–	Smears and a LSC.

What would you do if you became pregnant?	–	Discuss possible exposure with Radiation Safety Officer
Where is your waste stored?	–	In designated area, secure from removal.
How is your waste collected?	–	Request on web, EHS collects it.
Where do you eat your lunch?	–	Not in lab, sometimes at the HUB ☺.
What do you do when you leave the laboratory and no one else is here?	–	Lock the door. Secure all radioactive material.
If you have a body dosimeter, where do you wear it?	–	Clipped to my clothes at chest height.
If you have a ring dosimeter, how do you wear it?	–	Facing toward the radiation. If I will be holding a vial of material, I wear the ring with the monitor towards my palm. I always wear it on the hand closest to the radiation.

Everyone in your laboratory who works with radioactive material should be able to answer all of these questions without hesitation. In addition, staff who do not work with radioactive material should know not to touch the radioactive material, know how to keep the material secure, and know about the prohibition against eating or drinking in the laboratory. Everyone should know to contact EHS if they have any questions.

Remember, the training provided by EHS in our office or through this newsletter does not prepare you with the techniques for working safely in a laboratory. It is the responsibility of the principal investigator to ensure that the experiments are being performed safely and properly. Ultimately, every person working with radioactive material is responsible to make sure that it is handled safely and properly.

What to Do When Spills Happen.

Yes, it can happen to you. It probably will some day. People spill things. What do you do now? If the spill is just a couple of spots on the lab bench, the answer is easy: Clean and resurvey. If the spill is wide-spread or has a significant amount of radioactive material, then the answer is more difficult.

- If the spill involves a small quantity of radioactive material and you are familiar with and have been trained in proper clean-up procedures, follow those instructions and inform your supervisor as soon as possible.
- If you are not comfortable in cleaning up the spill, don't have proper clean-up materials, or have not received training in proper procedures, call EHS for assistance.
- If the spill has entered a drain (eg. floor, sink, hood) or could enter the drain, call for assistance immediately.

As you should remember from the training provided by EHS, you need to:

1.	Stop the spill.	Pick up the jug or turn off the pump, make sure it does not get worse. Put paper towels down to stop it from spreading.
2.	Warn others in the laboratory.	This will help minimize the spread of the contamination.
3.	Isolate the area.	Prevent anyone from walking through the spill area. If there is any sign of hallway contamination, fix ropes across the hall at least 10 feet from the laboratory door on both sides of the lab. Enforce the no-pass rule and station someone in the hall to stop traffic.
4.	Minimize exposure to radioactive materials.	Laboratory coats and gloves are required whenever you work with radioactive material. Shoe covers may be required.
5.	Call for help if needed.	The laboratory supervisor should be present to organize the cleanup if there has been a large spill. Request help from EHS by calling 814-865-6391.
6.	Establish a 'Clean' area.	This area should be inside the room if possible, in the hall if not. Issue plastic bags as shoe covers. Bench paper is handy for covering floors to make a clean area.
7.	Survey all lab personnel.	Record the results (e.g. Joe Smith, left shoe: 10,000 cpm-GM at 1 cm, Betty Brown, palm of right hand: 950 cpm-GM at 1 cm). Pay special attention to skin contamination. Measure the contamination levels prior

		to a quick clean, clean then recheck to see if the contamination levels are decreasing. Clean the skin with lots of room temperature water.
8.	Survey other labs	Check neighboring labs if widespread problems may be possible. Ask your neighbors to survey their own labs.
9.	Survey public areas.	Have someone without contaminated shoes survey the hall, elevator, stairs, etc. If contamination is found outside the laboratory, expand the roped-off potentially contaminated area. Laboratory personnel should clean the halls while others continue to survey the other public areas. Extend the roped off area as necessary. Do not decontaminate inside laboratories until all public areas are clean.
10.	Survey the room.	Keep people out of the laboratory until a survey of the room is completed by laboratory staff or EHS. Smears are not necessary unless it is a tritium spill, but documentation is necessary. This is to find the extent of the contamination so that it is not spread further during the decontamination phase.
11.	Clean and decontaminate.	Work from cleaner areas towards areas with more contamination. Clean up the floors and other public areas before beginning to clean benches and private areas. Survey shoes regularly. Change gloves whenever they are contaminated. Borrow extra meters, gloves, bench paper, paper towels, and other cleaning tools from neighboring laboratories. Do not spread contamination by leaving the area with contaminated shoes, but do not remove contaminated shoes until you have the time and materials to decontaminate them (contaminated feet are harder to clean.)
12.	Resurvey the room.	After decontamination, resurvey the room to verify that all areas have been properly decontaminated. Document your results.

EHS staff will not decontaminate your laboratory. They will help train, supervise, and monitor your activities. Remember, there is no penalty imposed by the UIC on laboratory groups who detect a spill of radioactive material and promptly notify EHS.

Time Distance Shielding

Usually the basic principles of radiation safety for external radiation sources are considered to be Time, Distance, and Shielding. The parts of this principle are:

- Minimize the duration of exposure to radioactive material,
- Maximize your distance from the radioactive material, and
- Shield yourself from the source.

A more complete way of minimizing your exposure is to follow these steps.

Plan your procedure –	Detail the steps that must be performed, including the order in which they must be completed. Plan on using long handled tools to maximize your distance. Plan to work behind a shield. Neatly write up your procedure to help you remember the seemingly small things that could ruin your experiment if not properly performed.
Practice the steps–	Practice, practice, practice. Set up at your work site, complete with shield and long-handled tools, then repeatedly perform all the required steps. Watch yourself to see if you are storing your tools or materials in an awkward location. This prior practice will speed your work and reduce your exposure time. In addition, it will reduce the likelihood of spilling or performing the steps in the wrong order.
Prepare for the work–	Be certain that you have all the tools and materials present. Do you have enough gloves and pipette tips? Did you pre-heat the hot plate? Did you reserve the centrifuge? Do you have ice? Is the centrifuge cold? Did you thaw everything you need? Did you pre-label all of the little tubes so you will not confuse product A with product B?
Survey the area–	A quick pre-use survey may save you lots of decontamination time. If the previous

worker left the bench contaminated, you do not want to be responsible for spreading the problem.

Do the work– Schedule plenty of time so you don't have to rush, particularly the first few times. We have all tried to hurry simple tasks that caused us to waste a lot of time (speeding tickets waste time and money). Eliminate as many distractions as possible prior to starting. Every time you have a couple free minutes review your procedure, check for problems, and survey your hands.

Survey and clean the area – When done, survey your area and the soles of your shoes. Then clean the area for the next person.

Critique your performance – Think what steps you could have done differently to minimize your exposure. Could you build a little tool to help you hold the stock vial? Does your lab need to purchase a different shield or pipette with a longer handle?

Revise the procedure– Rewrite your procedure so that you will learn from your experience. Share your experiences and improvements with your co-workers. The discussion may spark suggestions that may improve your work.

Spending time organizing your work processes will save you time and effort in the long run, and it will probably also give you more reliable results.

Moving to a Different Campus Laboratory

Closing out a laboratory and moving to a different one here on campus is a painful experience for everyone. There are some simple steps that can be taken to make the whole process less difficult.

1. Plan ahead. EHS has some simple check sheets that will provide you with a list of notifications and steps that will make the move easier. Please call Kevin Myers (814-865-6391) who coordinates the EHS moving requirements.
2. Reduce the amount of chemicals and radioactive material that needs moved by cleaning out and disposing of items that are no longer useful. This will reduce your work because each lab must be emptied of ALL chemicals, including chemical wastes, radioactive materials, radioactive waste, biological materials, biological wastes, sharps, and sharps containers through the appropriate procedures prior to vacating the lab.
3. Plan where items will go in your new laboratory. Plan spaces for secure storage of radioactive material and radioactive waste. Contact Eric Boeldt (ejb6@psu.edu) for suggestions on arrangements for these purposes.
4. EHS must perform a radiological survey of your laboratory after you move out and before the new tenant or construction personnel move in, so keep EHS informed of your schedule.

University Isotopes Committee

The University Isotopes Committee is responsible for the administration of specific licenses issued to the University for the use of radioactive materials and insuring that such licensed use meets federal, state, and University regulations. The UIC evaluates procedures, and approves, denies, or rescinds, individual University isotope authorizations. UIC members have considerable experience working with radioactive material and will be happy to answer questions or point you in the right direction for an answer. The current UIC membership is:

Craig Baumrucker	Robert Paulson	Philip Bevilacqua
Jack Brenizer	Andrea Mastro	Candice Yekel
David Gilmour	Catharine Ross	Eric Boeldt

Radioactive Material Authorization Fee

On March 31, 2008, the Commonwealth of Pennsylvania and the Nuclear Regulatory Commission (NRC) came into an agreement to have the Pennsylvania Department of Environment Protection (DEP) become responsible for the licensing of radioactive material within Pennsylvania. This Agreement State Status, as it is known, has had little effect on your day to day operations. The regulations did not change, the exposure limits did not change, nor did the University Isotope Committee's requirements

The DEP is required by Pennsylvania law to recoup its expenses for the task of regulating radioactive materials. Under the NRC Penn State was exempt from this fee due to our non-profit status. This exemption did not carry over into DEP's regulations. Thus DEP will be billing PSU for this service,

As you are aware, beginning July 1, 2008 Environmental Health and Safety began requiring licensing fees from each supervisor who uses radioactive material. EHS requires these funds in order to recoup the license fees charged by the Pennsylvania Department of Environment Protection (DEP). Therefore each authorized supervisor of a radioactive material laboratory is required to supply an equal share of the license fee. Currently there are slightly about 90 authorized supervisors, so each share will be about $90 to $100 for the 2008/2009 fiscal year. Note that EHS passing this cost onto the users of the radioactive material is consistent with the manner in which any other license or registration fee is handled at Penn State. For fiscal year 2009/2010 the Commonwealth's license fee will increase from $8,300 to $15,100, approximately doubling. Thus during next fiscal year you will receive a request for about $180.

There continues to be no charge by EHS for applications, package receipt and delivery, laboratory audits or contamination surveys, waste collection and disposal, or spills. Nor will EHS charge a handling fee collecting these monies. The annual radioactive material fee will be collected during the 2008/2009 school year. You will soon be receiving a letter requesting information to reduce the administrative requirements for processing these funds. This letter will be sent out once the bill is received from the State and the amount is finalized.

Endnote

In late December 2008, GE Healthcare Life Sciences announced it will be dropping their tritium and carbon-14 radiochemical business at the end of 2009. See the web address below for more details.
http://www5.gelifesciences.com/APTRIX/upp01077.nsf/Content/portfolio_simplification

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