



Lab Safety

Spectrum

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Chemical and Radiation Protection
<http://www.fpm.wisc.edu/safety>

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Radiation and Chemical Safety groups recently merged. Because we were attempting to get a single program off the ground, the last two newsletters included a lot of Chemical Safety information. I'd like to give researchers some time to digest our suggestions, so this newsletter is addressed mainly to radiation issues. Many workers adopt preconceived notions from working around people who work with radioactive materials. This newsletter will investigate many of these so called

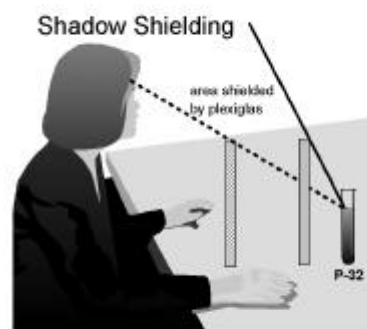
Radiation Myths

- 1. My detector / GM clicks, so I am being exposed.** Your Geiger counter is a tool to detect radiation, it is not a dosimeter. It is designed to detect beta-particle radiation. The fact that it clicks, does NOT mean you are being irradiated. The key to radiation safety is to understand the ENERGY of the radiation. Energy is related to how far the radiation travels. Low energy betas emitted from S-35, P-33, Ca-45 do not travel far. If you wear a double pair of disposable gloves, no beta energy from these nuclides will penetrate, so no dose. So, why does the meter click? The GM can detect beta radiation if the energy is greater than 100 keV (S-35 has a maximum energy of 167 keV). Efficiency is really low, about 1 - 3% at 1 cm. Efficiency is better for P-32, but the maximum energy of P-32 is 1710 keV, hence it travels farther. How can you tell the difference? If you do not know which radionuclide you are detecting, use the credit card (or ID card) test: Place a credit card against the end of the GM detector and measure the spot again, if you get essentially background, the radiation is low energy (e.g., C-14, S-35, P-33, Ca-45). If you get a reduced count, but still quite a bit, it is probably P-32 or Rb-86 (or other high-energy beta).
- 2. A Lead Apron will reduce my dose.** The only radiation workers who will benefit from lead aprons are those working with I-125. Lead aprons are designed for x-ray use. They stop radiation best if the x-ray energy is between 30 - 50 keV. What about Cr-51 or Rb-86? The energy of Cr-51 is 320 keV and Rb-86 is about 1160 keV. The lead apron will not even slow down these gamma rays. We say, "Do NOT wear a lead apron for Cr-51/Rb-86." That is because: (1) it doesn't help and (2) it may give you a false sense of security (resulting in your working poorly). Use shielding for high energy betas and gammas. Plexiglas for betas, lead for gammas. Refer to Chapter 4 of the training manual for the appropriate amount of lead.



3. Beta Glasses. While there may be such a thing, they are not worth it. Glasses for shielding are effective for x-ray users and we recommend that persons working in x-ray clinics like cardiology, angiography, etc. where they may have their head near an x-ray beam wear LEADED glasses. For beta particles, wearing laboratory safety glasses or individual prescription eye glasses is sufficient. Remember, for low energy beta emitters (e.g., C-14, S-35, P-33, Ca-45), there is no radiation exposure. The proper solution to reducing exposures from high energy beta and gamma emitters (e.g., P-32, Rb-86) is shadow shielding with plexiglas for P-32; lead for Rb-86, Cr-51. In many ways radiation is just like light.

There is some scattering of beta particles, just as light scatters. To shield large quantities of beta particles, simply place a Plexiglas shield, 1/3-inch thick, between your body and the radioactive material. The closer the shield is to the vial of radioactivity, the larger the area shielded. If you can only see the vial behind the plexiglas shield, the beta particles can not reach your head. When should you shield? If using more than 0.1 millicuries (100 microcuries) of a high-energy beta (or gamma). Below this activity



you may not have enough activity to really matter. The goal of shielding the eyes is to reduce the risk of cataracts. You should understand that cataract formation is a threshold event, generally it requires at least 200 rads of absorbed dose to produce this effect, and 600 rads is closer to norm. If you wonder how much radiation you get, look at the dose recorded on your whole body badge. The average dose at the UW is about 15 millirem per year, that is about 0.015 rad per year. Even a high dose in a research lab is about 100 millirem (i.e., about 0.1 rad). You can see that your cumulative radiation dose will never be enough to come even close to the threshold.

4. I can feel the radiation. Some people when they first start working with radioactive material, feel an itching sensation and attribute the itching to the radioactivity. No one at the UW has enough radioactivity to make you "feel it." If you feel anything, you may have a latex allergy or you may be allergic to the powder many vendors place in their gloves. Additionally, if you have used some of these protective gloves for a long time, you may become sensitized to either the latex or the talcum powder. This sensitivity is usually demonstrated by a rash or hive-like reaction when you put on protective gloves. There are gloves that are talcum free and there are gloves that are latex free. Talk to your PI or the Safety Department. Remember, when wearing gloves, wear a double pair and frequently check the outer pair on a GM to make sure it is not contaminated. While there is no physical hazard from the radiation in the quantities routinely used, contaminated gloves may contaminate the lab, the contamination may be spread within the lab or to your home and it may also affect your research results.

5. There must be radiation somewhere here. As a variant of #4, some researchers experience an effect in their work (e.g., contamination, film fogging, etc.) and believe there is an unknown source of radiation causing the effect. Each lab has survey instruments capable of detecting radiation. If contamination is the suspect, a wipe survey can confirm or deny the suspicion. Safety does not have any other special type of detector. We have a pretty good idea of activities used by labs on campus and are skeptical of all unknown radiation sources on campus.



Decay vs Decay-in-Storage

While sounding similar, these are two different ways to reduce your CORD inventory. We do not encourage either, but before we can talk about them, let's define them.

Decay is the application of the universal decay law to your CORD inventory. This is usually done with P-32 because it has a 14.3-day half-life. Suppose that you received 1 millicurie on 1 June, 1 millicurie on 7 June, and 0.5 millicurie on 14 June. Your CORD inventory says you have in your lab 2.5 millicuries. You go to order a 1 millicurie vial for 21 June and the CORD tech say, "Sorry, you can't order that, you will exceed your possession limit. Why not decay some of your material, FAX CORD (2-6767) a Disposal Form and we will order it." What does the tech mean? Because P-32 has a 14.3-day half-life, it rapidly decays. The 1 millicurie you received on 1 June is only 0.36 millicuries on 21 June, the 1 millicurie you received on 7 June is only 0.507 millicuries, and the 0.5 millicuries you received on 14 June is only 0.356 millicuries. So, you actually have about 1.277 millicuries, not 2.50 millicuries. To remove that activity from your CORD inventory, complete the lower right hand box on a Waste Disposal Form, indicate Method #1 (Decay); isotope is P-32; activity is 1.223 millicuries and send the form to CORD. On your inventory sheet for each of the vials list under the "other" disposal method, activities of 0.64 millicuries (1 June), 0.493 millicuries (7 June); and 0.144 millicuries (14 June).

Decay-in-Storage is a program where you package your waste, hold it for 10 half-lives, measure the radiation levels on the box and, if less than 100 cpm, you may dispose of the box in the ordinary trash. For P-32, you must hold the box at least 143 days. After holding for 143 days, you still have to send a Waste Disposal Form to CORD indicating Method # 1 (Decay) to get the material removed.

The reason we do not encourage either is that the NRC interprets all reported Decays on CORD to be part of a Decay-in-Storage program and they want to see appropriate log books that the lab completed indicating dates started / ended; radionuclide, initial activity; meter used; background; meter count rate on box; etc.

We would prefer that you do neither; simply dispose of all your radioactivity without bothering to decay it. Report the activity in your waste as if no decay had occurred. We hold all waste for 10 half-lives AFTER we receive it. We have more space and the ability to do the paperwork properly.

Training

Chemical and Radiation Protection has two training classes. The Chemical Safety Training class begins at 9:30 (with a quiz about 11 AM) on the same day as the Radiation Safety Training class which begins at 12:30. The training schedule from 1 July through 19 September (all classes are held at Union South) July 3, 9, 17, 25; August 2, 10, 16, 22; and September 4, 13, 19. Note, the schedule flips for 2 additional classes. On **31 August** and **7 September**, the Radiation Class begins at 8 AM and the Chemical Safety begins at 1:30 PM. There is no sign-up; merely show up on one of the scheduled class dates. Booklets and schedules can be picked up at room 19, Bio-chemistry from 11 - 2:30. The quiz used to document training is given the last hour of the class and usually begins about 11 AM for Chemical and 3:15 PM for Radiation. See our Web site <http://www.fpm.wisc.edu/safety/Radiation/schedu.html> for a complete schedule.



Yes, we do that (Laser / X-ray)

Do you have a new device in your lab capable of producing x-rays (e.g., electron microscope, x-ray diffraction, bone densitometer, cabinet x-ray machine)?

Chapter 10 in the Radiation Safety for Radiation Workers discusses x-ray sources. The State requires that all such devices be registered with the Department of Health and Family Services. Contact Arnold Jansen, 2-9608. He will do the paperwork and will perform any radiation surveys you desire.

Lasers produce very narrow, intense monochromatic (i.e., one color) and coherent (i.e., in phase) beams of light. Today, laser devices are commonly found in many work areas. Properly emplaced and operated, laser devices can be of great benefit. Lasers are regulated by the Food & Drug Administration and OSHA. The FDA attempts to insure marketed lasers can be operated safely. However, even when operated properly, some lasers are capable of causing injury. Chapter 15 in the Radiation Safety for Radiation Workers manual addresses laser safety. We have a Health Physicist with special training in laser safety. If you have questions about the lasers in your lab, need special training in laser safety, etc., call Arne Jansen at 2-9608.



Free Chemicals

The Safety Department collects waste and surplus chemicals from researchers. Some of these surplus chemicals have never been opened and are still factory sealed. As part of the University's waste minimization program, surplus chemicals are redistributed. Chemicals offered for redistribution are listed at <http://www.fpm.wisc.edu/chemsafety/>. Follow the link to LabSCAN. Call Greg Zukowski, 5-5519 or email him at gzukowski@fpm.wisc.edu to place an order or get more information.

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