Chemical And Radiation Protection

Lab Safety Spectrum

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UW - Madison Safety Department Chemical and Radiation Protection
30 N. Murray St. 262-8769 http://www.fpm.wisc.edu/safety

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"Do you feel lucky?"

The 1971 movie, Dirty Harry, starring Clint Eastwood as detective inspector Harry Callahan, had the memorable quote, "I know what you're thinking. 'Did he fire six shots or only five?' Well, to tell you the truth, in all this excitement I kind of lost track myself. But being as this is a .44 Magnum, the most powerful handgun in the world, and would blow your head clean off, you've got to ask yourself a question: 'Do I feel lucky?' Well, do ya, punk?"

I recalled this quote when I was asked about the extra paperwork required for particularly hazardous substances. The issues were that the lab did a good job working with chemicals and it didn't appear that any other lab was doing this additional paperwork.

Safety is not about "luck"; it is about applying sound principles to reduce the worker risk of exposure to either physical hazards or toxic substances. Most workers understand the basic precautions for handling hazardous materials. You don't want to reach into a container of hazardous liquids with your gloved hand, rather you use tongs. You wear protective clothing to protect yourself from dropped containers or splatters and always wear safety glasses and appropriate protective gloves. You handle volatile chemicals in a fume hood.

Particularly hazardous substances are a class of substances which are either carcinogens (known, probably, or possible), reproductive toxins or substances with a high degree of acute toxicity. The problem with some particularly hazardous substances is that the relationship between "cause" and "effect" is blurred. This is not the case for substances with a high degree of acute toxicity. The result of exposure to carcinogens, however, may not be manifested for 20 or 30 years post-exposure.

Some people may say "the exposure is too small to be harmful" or "this compound couldn't possibly get airborne," or "we used to use 10 times that amount 20 years ago." Remember, individual sensitivity varies. The effect of exposure is also complicated by other exposures which may act synergistically so that causality becomes blurred. In radiation, the safety concept is to "Keep Exposures as Low as Reasonably Achievable" and consists of knowing your hazard and insuring you are not needlessly exposed.

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The safety program for particularly hazardous substances is discussed in Appendix D of the UW's Laboratory Safety Guide and consists of: 1) identifying the substance, 2) understanding the routes of exposure, 3) designating and labeling a suitable workplace to protect you from exposure, 4) preparing for emergencies, 5) planning for collection and disposal of wastes, and 6) using appropriate precautions such as containment and personal protective equipment.

An easy way to insure these factors are addressed is to complete a Particularly Hazardous Substance Approval Form

http://www2.fpm.wisc.edu/chemsafety/parthazs.pdf

from our Chemical Safety web site. Annex 2-2 of the Laboratory Safety Guide has several forms to help in assessing risk from your chemicals. Have the Particularly Hazardous Substance Form reviewed and approved by your lab's / department's Chemical Hygiene Officer and keep the form on file in your lab's Chemical Hygiene Plan. You should also forward a copy to the Safety Department for feedback on appropriate handling precautions. This will insure that if the form is misplaced, a back-up will be available.

Work with particularly hazardous substances includes working in a "Designated Area" that is marked with a Designated Area sign

http://www2.fpm.wisc.edu/chemsafety/phssign.doc

The purpose of signage is to alert others in the area of your work and reduce traffic in your work area reducing the risk of the substance being made airborne by turbulence. Other signs identifying specific hazards (e.g., carcinogens) serve to provide additional hazard communication.

As noted, safety is not a matter of luck. Each worker needs to understand the hazards of all the material they are working with and apply proper safety principles to protect themselves and others in both the short and long term.

See the archive of our newsletters

http://www2.fpm.wisc.edu/safety/Radiation/news.html

for other newsletters addressing particularly hazardous substances.

CORD Holiday Schedule

CORD will be closed on Friday 23 and 30 December as well as on Monday 26 December and 2 January. Phone orders will not be taken during the period Thursday, 22 December through 2 January. CORD orders can be placed through our web site

http://www2.fpm.wisc.edu/safety/Radiation/radreq.html

These will be placed with the vendors. Remember, the vendors will also be closed during some of these dates as well. Material will be delivered to labs when it is received. The Annex, Room 62 Biochemistry, will also be closed during this period (Thursday, 22 December through Monday, 2 January). Please call Safety at 5-5518 for assistance or to make an appointment.

Radiation Safety Limits

Work with radiation and radioactive materials is regulated by the State of Wisconsin Radiation Protection Section in the Department of Health and Family Services (HFS). Rules and regulations governing radiation work are promulgated in HFS 157. The Safety Department reviews these rules and applies a safety margin to UW rules and regulations to insure that, even if the UW limits are exceeded, the rules in HFS 157 will still be met. Lets look at a few limits to see how they are related to the state standard.

Meter (measure at 1 cm)	Removable Contamination (LSC)	
	^{3}H, ^{14}C, ^{33}P, ^{35}S, ^{45}Ca	All other nuclides
650 cpm	770 cpm per wipe	230 cpm per wipe

Contamination can be fixed or removable. When you do a monthly survey, the first step is to use a survey meter / geiger counter (i.e., GM) and meter the entire area to see what the radiation levels are. This metering is done with the detector about 1 cm from the surface, moving about 2 inches per second. The UW meter action limit is 650 cpm above background. Levels above this must be mitigated before progressing to the removable contamination survey. For this survey, you try to remove contamination using moistened wipes (e.g., cotton tip applicators, gauze, filter paper). Moistened wipes are believed to remove more contamination than dry wipes. You should wipe an area at least 100 cm^2 (4" x 4") and preferably larger. These samples are often counted in liquid scintillation counters. We have two action limits for removable contamination; for low energy beta emitters (^{3}H, ^{14}C, ^{33}P, ^{35}S, ^{45}Ca) we allow 770 cpm per wipe while for all other nuclides the limit is 230 cpm per wipe. Notice that we are using units of (cpm) counts per minute. This is to make your job a bit easier. State rules are based upon activity (decays per minute - dpm). This is obtained from cpm by dividing by the efficiency of the counter system. The detection efficiency for ^{35}S will be lower than the efficiency for ^{32}P because it is lower in energy (0.167 MeV versus 1.710 MeV). To state your results in "activity" units would require that you first identify the nuclide and apply the appropriate efficiency. To take this liberty, we assume a minimum LSC efficiency of about 30%. Even with this assumption, our activity limits are still at least 50% lower than the limits published in HFS 157.

Skin contamination is also an issue. We recommend that workers wear two pair of disposable gloves and check the outer pair frequently, changing them if contaminated. When you finish your work, wash your hands and check for contamination. As noted above, the meter action limit is 650 cpm. What does that mean for skin dose? For low energy beta emitters (^{3}H, ^{14}C, ^{33}P, ^{35}S, ^{45}Ca), these beta particles do not have enough energy to penetrate the skin and there is no dose. What about ^{32}P? This is a high-energy beta emitter and easily detected, however the beta particle will not penetrate deeper than 7 mm into tissue (about 1/4 inch). The skin dose limit is 50 rem per year. A 1 microcurie (1 μCi) drop of ^{32}P left on the skin for 1 hour will produce an exposure of 6 rem. One microcurie is 2,220,000 decays per minute. If your GM has a 30% efficiency for ^{32}P, your survey meter would read about 740,000 cpm. Thus, our 650 cpm limit is about 1/1000 this level and would give a dose of about 0.006 rem (6 mrem) if left uncleaned for 1 hour.

Dosimeters are the devices we use to monitor worker whole body exposure to high energy beta emitters (e.g., ^{32}P) and x-/gamma-rays. The allowable limit is 5 rem per year. These devices are changed out about every 90 days. The Safety Department gets a listing of these results. Our action limit is 200 mrem (0.2 rem). One reason we selected this value is that the average annual exposure of UW radiation workers is about 20 mrem per year (versus the limit of 5000 mrem per year). Most workers will have exposures well below 100 mrem per year. A very few may receive exposures on the order of 400 - 600 mrem per year. We believe that all exposures above 200 mrem should be investigated to see if more protection (e.g., shielding) could be employed to reduce the exposures.

Note, beginning in January, 2006, the schedule is changing. More Radiation classes will be offered in the AM [indicated by ** in the schedule] and the morning Radiation classes will begin at 9 AM.

Radiation and Chemical Safety training classes are offered weekly at Union South; each class satisfies either OSHA or NRC training requirements. There is also a **Transportation training class** if you ship or receive (directly from the carrier -- e.g., FedEx) hazardous materials. The schedule for each of these classes is in the table below. On dates when the Chemical training is in the morning, Chemical and Radiation training will begin at 9:30 AM and 12:30 PM, respectively. On dates when the Radiation training is in the morning (**), Radiation and chemical training will begin at 9 AM and 1 PM, respectively. Transportation training is either 1 hour, basic, or 3 hour, shipping specific, training (visit our web site for more information).

Friday	**Jan 6****	**Wednesday**	**Feb 15**	**Tuesday**	**Apr 4****
Thursday	**Jan 12**	**Thursday**	**Feb 23****	**Wednesday**	**Apr 12**
Wednesday	**Jan 18****	**Thursday**	**Mar 9****	**Thursday**	**Apr 20****
Tuesday	**Jan 24**	**Wednesday**	**Mar 15**	**Friday**	**Apr 28**
Wednesday	**Feb 1**	**Tuesday**	**Mar 21****	**Thursday**	**May 4****
Tuesday	**Feb 7****	**Monday**	**Mar 27**	**Wednesday**	**May 10**

**** Chemical training on these dates begins at 1 PM; Radiation at 9 AM**

Transportation Training -- Shipping Hazardous Material (monthly)
11 AM - 3 PM Thursday Jan 26 || 11 AM - 3 PM Friday Mar 24
9 AM - 1 PM Wednesday Feb 22 || 9 AM - 1 PM Monday Apr 17

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