



# RADIATION REVIEW



**UW - Madison Safety Department**

**30 N. Murray St.**

**<http://www.wisc.edu/safety>  
18**

**Radiation Safety Program**

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## **What is a Radiation Worker?**

A person at the training class mentioned that his boss told him he didn't need to take the test. I replied that I didn't know what his job was but if he were going to use a survey meter, handle waste, keep inventories, etc., then he was a Radiation Worker and the only way to become a radiation worker was to attend training and take the quiz.

Our license requires that all persons who handle radioactivity be trained. This includes Authorized Users/Principal Investigators. The quiz documents that training. Consequently, all persons attending the training take the quiz; or in the future they will have to take the training and quiz to become radiation workers.

We understand that there may be students rotating through the labs essentially "sampling" the research opportunities of the department. Until these students receive training and pass the exam, they should not be working alone with radioactive materials and should not be working with stock vial concentrations.

Occasionally parents bring their children into labs. Children are not radiation workers and should be under close supervision. Parents should insure that there is never an opportunity for them to be exposed to either radioactive materials or chemicals.

## **Nobody Home**

I got this voice message the other day, all it said was, "Guess there are no live bodies at the Safety Department." Obviously his concept of the Safety Department is 40 people waiting for him to call. However, the fact is that there are no safety hazards nor incidents at the Safety Department. All of the safety issues are on campus. I have told my staff that they should be on campus assisting researchers. What are your options to contact Safety?

1. For a true emergency (fire, injury, etc.) call 911 for immediate assistance.
2. For short questions, or if you are not sure who to call, contact our front office (2-8769). If our Program Assistant is not available, leave a message in the message center (pick #1) with your name and phone number. These messages are checked at least hourly during the work day.
3. For complex questions or if you know who to contact, send an email or phone and leave a voice message with the appropriate person. Email addressing is available through our web site ([www.wisc.edu/safety](http://www.wisc.edu/safety)). The person will respond as soon as they can.

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4. For radiation issues, our annex (Room 19, Biochemistry) is open from 11 AM to 2:30 PM daily, simply call 5-5241 and you can talk to a member of the Radiation Safety Office.
5. For radiation issues after hours, every lab has posted Radiation Safety professional staff members' home phone numbers.

### **CORD is a Pretty Good Deal**

I went to a conference with other University Radiation Safety Officers (RSO). After talking to them, I can guarantee that the UW is head-and-shoulders better and more efficient than most of the universities in the US. True, there are impediments and things may not be done as you would want them to be done; but we are trying to improve and are open for suggestions.

UCSC uses a commercial inventory program (one that we are investigating using). The inventory sheet generated is a unique (yellow) color. We could color our forms if you desire.

For you who desire to be at NIH: They currently charge \$55 an order. They mandate security with a 3-strike and you're out/down policy. It is a large bureaucracy all funded by research.

The University of Chicago charges by the isotope. Short lived items like P-32 may carry a charge of about \$45 while longer lived nuclides like C-14 / H-3 may have charges of \$75 or more.

One university RSO noted that he has streamlined ordering. Researchers can send in orders by e-mail and he forwards these on to the necessary purchasing / administrative approval persons. This new system usually gets orders approved within 2 - 3 days (unless someone in the e-mail chain is absent).

UCLA and several other large colleges allow researchers to establish accounts with vendors. They notify

Safety of an order and require that all deliveries go to Safety.

CORD is a purchasing agent. The UW has only one radioactive materials account per vendor. This means we get a discount because the vendor needs to set up only 1 account (i.e., billing is easier) and with 2000 or so orders per vendor, we get a volume discount.

CORD also maintains the UW inventory by PI and nuclide. The CORD computer does not decay isotopes. Decay would probably lead to as many inventory problems as it would solve. Each PI is responsible for disposing of the activity recorded on the CORD delivery slip. This is usually the quantity ordered, uncorrected for reference date. The inventory difficulties arise from having many workers handling different vials. We would like labs to make an honest effort and we will insure that minor differences are easily corrected in your inventory so the CORD computer is kept up-to-date.

Remember, if you have a question or a concern, give us a call or come to our annex (see "Nobody Home," above). Our job is to make your job easier.

### **Radiochemical Storage**

You say the tritiated leucine you bought for \$1500 in 1985 and put in the freezer is nearly as good as it was when you placed it there 10 years ago? Not likely.

Chemical decomposition occurs naturally during storage of compounds. However, compounds labeled with radioisotopes typically decompose faster than their unlabelled counterparts. The *shelf-life*, the time during which a labeled compound may be used with confidence and safety, is important to both the user



and the supplier. The purity at which a radiolabeled compound ceases to be of use depends greatly on the application. With radiochemical decomposition, it is important to consider the molar specific activity (e.g., MBq/mmol or mCi/mmol) because the molar specific activity gives an appreciation of the extent of labeling of a compound. Decomposition may be accelerated by free radicals produced from the radioactive decay energy and the observed decomposition rates of radiochemicals are more pronounced with compounds of high molar specific activity.

Recommended storage conditions are normally included in the leaflet accompanying each item. Even slight deviations from these conditions may result in more rapid decomposition. In general, compounds should be stored at low temperatures in the dark and liquid solutions should be stored unfrozen at concentrations less than 37 MBq/ml (1 mCi/ml). Where instability dictates that solutions be stored frozen, it is best to avoid freeze-thaw cycles.

Isotope	Typical Observed Decomposition Rates
$^3\text{H}$	1 - 3 % per month
$^{14}\text{C}$	1 - 3 % per year
$^{32}\text{P}$	1 - 2 % per week
$^{35}\text{S}$	2 - 3 % per month
$^{125}\text{I}$	5 % per month

#### Radiochemical Decomposition Rates

Amersham Pharmacia Biotech has a very interesting publication, "Guide to the Self-decomposition of Radiochemicals". This newsletter will review some of this guide, focusing primarily

more on the decomposition because these nuclides have long half-lives which may

encourage users to store them for long times.

Radiochemicals can decompose by at least 4 modes: (1) Natural decay is most likely the least important for  $^3\text{H}$  and  $^{14}\text{C}$  decomposition simply because the percent of radioactive atoms decaying per month is so small. (2) In primary decomposition, the ionizing radiation interacts with molecules of labeled compound surrounding the decaying nucleus. Here the higher the specific activity, the greater the primary decomposition. One can add unlabelled (carrier) or other solvent to reduce the specific activity or increase the number of non-labeled molecules near each labeled molecule. (3) Secondary decomposition arises from the interaction of (for example) free radicals created by the radiation with labeled molecules. This is the most difficult decomposition mode to control and is easily influenced by environmental conditions. (4) Chemical and microbial decomposition also act on a radiochemical independently of radioactive decay.

While every radiochemical is shipped with specific storage instructions, there are a few principal guides that will help minimize decomposition.

1. Optimize storage conditions for chemical stability - storage conditions suitable for good chemical stability (e.g., correct pH, storage under inert gas, etc.). As much as possible, keep radiochemicals in the dark and protected from the adverse effects of any nearby chemicals.
2. Store at low temperatures - Solutions of radiochemicals should be stored cold but unfrozen (e.g., aqueous solutions at  $+2^\circ\text{C}$ , ethanol solutions at  $-20^\circ\text{C}$ ).



Compounds of very low chemical stability should be stored at  $-140^{\circ}\text{C}$  (the vapor above liquid nitrogen); compounds in their natural physical state should normally be stored at  $-20^{\circ}\text{C}$ .

3. Dilute the specific activity - a compound at high specific activity will decompose faster than at lower specific activity.

4. Store as solutions - this effectively disperses the labeled molecules, decreasing the effect of secondary decomposition

5. Add radical scavengers or other stabilizers - when compatible with the use, adding a radical scavenger (e.g., 2 - 3% ethanol added to an aqueous solution) can lead to an increased shelf-life.

6. Avoid reopening of vials, and warming/cooling cycles - If a radiochemical is to be used over several weeks/months, it is best to have it subaliquoted in a number of vials, keeping those to be used later in the refrigerator or freezer until required.

### Semester Training Schedule

The training schedule from 20 January through 24 May includes 2 morning (8 AM) classes at Union South on 21 Jan and 4 Feb. The remainder of the classes are held at Union South beginning at 12:30 on January 31, February 10, 16, 22, 28; March 9, 15, 21, 27; April 13, 19, 25; and May 1, 12, 18, 24. 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, Biochemistry from 11 - 2:30. The quiz is given the last hour of the class and usually begins about 3:45 PM.

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