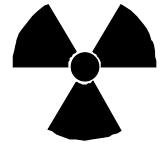




RADIATION REVIEW



UW - Madison Safety Department

Radiation Safety Program

30 N. Murray St.

262-8769

November 1999

**<http://www.wisc.edu/safety>
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NRC License: 48-09843-18

Laser Safety

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 may be capable of causing injury. Chapter 14 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.

Winter Waste Reminder

Winter in Wisconsin is cold. Although some of our waste cabinets are inside buildings, several of our waste cabinets are still located outside. Aqueous liquids freeze rapidly below 32°F (0°C) and we often experience -20°F (-29°C)

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temperatures. To prevent your liquid waste from freezing and breaking the container, fill containers only $\frac{3}{4}$ full and place liquid wastes in outside cabinets between 11:30 AM and 12:30 on the pickup day (Monday and Wednesday).

NEN/Dupont Handling Fee

NEN/Dupont has added a new handling fee for each item ordered from them effective July 1, 1999. We have postponed the University having to pay the fee until November 1, 1999. After that date any NEN/Dupont order's RSR will have a one-dollar fee in the "Other Charge" area on the form to cover the new charge.

P-32 Users

Amersham has changed the date of delivery for their P-32 fresh lot. Amersham P-32 fresh lots will now be available for delivery on Friday (i.e., fresh Thursday, delivered Friday), the same as DuPont and ICN.

Radiation Skin Effects?

You just started working with 250 μCi of ^{32}P and notice that after a while your hands have developed red spots that itch. You know ^{32}P is a beta-emitter and wonder if the skin effects could be from the ^{32}P ?

Based on cause and effect analysis, you start working with radiation and skin changes occur, ergo the changes are caused by the radiation. Probably not. The most likely explanation is an allergic reaction to the protective gloves or some other chemical / compound in the lab. Many persons develop an allergic reaction to the most common (yellow-colored) disposable gloves. Workers may wear gloves continually for many hours and the physical stress to their hands may cause a reaction. Many workers become fixated with a need to wash thoroughly after removing the gloves; the strong soap/continual washing also irritates the hands. Using a mild soap and hand lotion may reduce irritation.

What about radiation effects? First, if you wear disposable gloves, only about 10% of the beta particles from low energy beta emitters (e.g., ^3H , ^{14}C , ^{33}P , ^{35}S , ^{45}Ca) have enough energy to penetrate a single pair of gloves. Essentially none of these beta particles can penetrate a double pair of disposable gloves. Therefore, the only beta particle emitters to be concerned with will be those with energies exceeding 300 keV. Even for high energy beta emitters (e.g., ^{32}P / ^{86}Rb), 48% of the energy is absorbed within the first millimeter of tissue.

Second, the acute dose to cause any physically noticeable (i.e., itching, etc.) hand effects is probably between 500 rad (5 Gy) and 1000 rad (10 Gy). The NRC annual limit for hand exposures is 50 rad/yr and the skin dose rate (rad/hr) from ^{32}P is 6 rad/hr per microcurie. Thus, a droplet of 8 microcurie of ^{32}P left on a finger for one hour would result in an absorbed dose which exceeds the NRC limit but not produce skin effects.

Actual physical effects would probably not begin to occur at levels below 150 rad or 24 microcurie left for over one hour. For that reason, Radiation Safety cautions workers to always have an operating radiation meter when they are working with a high-energy beta emitter (e.g., ^{32}P / ^{86}Rb), to check their fingers routinely and change gloves when contaminated or between tasks.

I reviewed an article [Low-Beer BU: External use of radioactive phosphorus: Erythema studies. *Radiology* 47:213-222, 1946]. While the research techniques used are not recommended, the data of this study are interesting. Using a Na_2HPO_4 solution, Dr. Low-Beer absorbed various microcurie activities onto thin, 2.5 cm diameter pads and taped the pads on forearms of volunteers. He then looked at skin effects based upon dose rate and total dose. Three different end points were investigated: erythema threshold; dry, scaly epidermitis; and bullous, wet epidermitis.

Skin Reaction	Dose (rad)
Threshold erythema	143 rad
Frank erythema	159 rad
Dry, scaly epidermitis	7,200 rad
Bullous, wet epidermitis	17,000 rad



Skin Effects? (Cont.)

The table demonstrates total doses to each end point.

For exposures which produced discernible effects, essentially the skin response followed a bell-shaped curve. Usually there was a several day latent period before any noticeable effects appeared. For acute low doses (< 1100 rads) erythema began to appear about 3 - 5 days after the start of irradiation; for acute high doses (> 1500 rads) the latent period was only 3 - 4 days. The actual effects (e.g., itching, reddening, scaling, etc.) thereafter increased in magnitude (e.g., increased redness) through about 14 - 23 days (i.e., the higher the dose, the longer and more intense the effect) before decreasing and, in instances of total dose less than 1100 rads, disappearing with no distinguishing marks after about 60 days. Exposures which produced dry or wet epidermitis (i.e., dose > 1500 rad) appeared to leave an area with a slightly depigmented center ringed by a hyperpigmented edge. A biopsy of the bullous epidermolysis showed that, even in such a severe injury, tissue damage only extended to a depth of 5 mm.

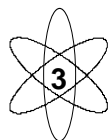
Thus, while ^{32}P skin effects are possible, there are no immediate effects. In fact, I have not read of any ^{32}P skin incidences occurring among researchers in the US.

That is the reason we suggest that if you experience a response when working with

^{32}P , you should suspect a cause other than radiation. However, when working with radioactive material, always have a survey meter turned on and frequently check your gloves for small amounts of contamination.

The UW provides dosimetry for persons who may work with stock vials containing more than 1 mCi of a high-energy emitter (e.g., ^{32}P , ^{51}Cr , ^{86}Rb , ^{125}I , etc.). Low-energy beta emitters (e.g., ^3H , ^{14}C , ^{33}P , ^{35}S , ^{45}Ca), are not detectable with dosimeters. Workers need only use protective clothing to keep doses from low-energy beta at zero. A ring dosimeter may also be issued to monitor the exposure to the fingers from high-energy betas. Because a dosimeter is a passive device, you will not be notified of your exposure for at least 6 weeks after you exchange your dosimeter.

On the positive side: most radionuclide work is done with relatively small quantities of radioactive material that have already been compounded. Workers at the UW receive very little radiation exposure. The average whole body dose in 1998 (for the 3222 workers monitored) was 0.009 rem/yr and the hand dose was about 0.027 rem - 0.030 rem. Remember the allowable limits for whole body exposure is 5 rem/yr and for hands it is 50 rem. Thus, by using meters, gloves, and other protective devices, worker exposures are kept as low as reasonably achievable.



CORD Holiday Hours

CORD will be closed for business the following days in November and December: November 25, 26; December 24, 1999 through January 3, 2000. Telephone orders will not be taken, however we will process orders received via our web page (wiscinfo.doit.wisc.edu/safety) and deliver the material when received. (Note that vendors will also be closed several of these seasonal days; e.g., shipments on November 24, December 22 and December 30 are for the following Monday).

Annex Holiday Hours

The Annex, Room 19 Biochemistry will be closed December 23 through January 3, 2000. Call 2-8769 to make an appointment.

Winter Training Schedule

The training schedule from 15 October through 1 March includes 2 morning (8 AM) classes at Union South (21 Jan, 4 Feb). The remainder of the classes are held at Union South beginning at 12:30 on October 21, 29; November 4, 10, 16, 22; December 7, 15, 21; January 7, 13, 18, 31; and February 10, 16, 22, 28. There is no sign-up; merely show up on one of the class dates, booklets can be picked up at room 19, Biochemistry from 11 - 2:30. (See "Annex Holiday Hours"). The quiz is given the last hour of the class (usually beginning about 3:45 PM).

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