Radioactive material (RAM) security continues to be a significant concern. Always be aware of who is in your laboratory and confront any unfamiliar individuals. Keep RAM locked up or under direct observation at all times to prevent an unauthorized person from removing the RAM or gaining access to the RAM. The last person leaving a RAM-use laboratory should ensure the door to the laboratory is either locked or all of the RAM inside the room, including waste, is locked up.

Have you experienced concern when you observed an obviously pregnant female handling radioactive material? If the female is following good radiation safety practices, don’t be.

Like most potential hazardous situations, exposure to any level of radiation is assumed to carry a certain amount of risk. In the absence of scientific certainty regarding the relationship between low dose exposure and health effects, and as a conservative assumption for radiation protection purposes, the scientific community assumes that any exposure to ionizing radiation may result in biological effects and that the likelihood of these effects increases linearly as the dose increases.

Because the embryo/fetus is known to be more susceptible to radiation than an adult, there are established lower dose limits for the embryo/fetus of a declared pregnant worker. The Ohio Department of Health (ODH) and the U.S. Nuclear Regulatory Commission (USNRC) set the dose to the embryo/fetus of a declared pregnant worker at 0.5 rem (500 mrem). The word “declared” is important because the lower limit cannot be applied unless the worker declares her pregnancy in writing to the licensee.

As noted in the previous paragraph, in order for the lower exposure limit to apply, the worker must declare in writing to the licensee. For the University of Cincinnati Radiation Control and Safety Program (RCSP), this means providing the written declaration to the Radiation Safety Officer (RSO). Under the RCSP, a worker declares a pregnancy by completing a Declaration of Pregnancy—RS Form 33 and submits the form to the RSO. Because of regulatory requirements, the form includes the name of individual, the date of declaration and the estimated conception date. Upon receipt of the form, the RSO reviews the worker’s exposure history with emphasis on the last several months of exposure. If requested or deemed necessary, the RSO will meet with the worker to discuss concerns, safety precautions and procedures.
for the worker to keep the dose to the embryo/fetus as low
as reasonably achievable (ALARA). Throughout the preg-
nancy, the RSO continues to monitor the worker's and the
worker's embryo/fetus' dose and will contact the individual
as necessary.

To ensure that the 0.5 rem (500 mrem) limit is not exceeded,
a declared pregnant worker should employ standard safety
measures to keep radiation doses ALARA. Precautions to help
reduce the pregnant worker's and their embryo/fetus' ex-
posure to radiation include reducing the amount of time spent
in radioactive material areas, maximizing distance from all
sources of radiation and using appropriate shielding.

Pregnant workers should also utilize good radiation safety
precautions that ensure no radioactive materials are in-
gested or absorbed into the body. These include:

1. Don't' eat, drink, store food/drink or apply make-up in a
radioactive material use room.
2. Use disposable gloves and change them regularly when
handling radioactive material.
3. Wash hands often and monitor then regularly.
4. Wear lab coats when working near radioactive material.
5. Use a fume hood when handling volatile radionuclides.

The Radiation Safety Office strongly encourages that workers
become educated on the subject of pregnancy and radiation.
Additional information can be obtained from the Radiation
Safety Office, the USNRC and ODH websites, or from the web-
site www.radiationanswers.org.

**RADIOACTIVE WASTE**

One of the Radiation Safety Office (RSOf) services is to pick
up radioactive waste generated under the Radiation Control
and Safety Program (RCSP). While performing this service,
RSOf staff members have observed waste related issues that
indicate some Authorized Users (AU) and their staff have an
opportunity to improve practices.

**Use only approved containers** — Radioactive waste should
only be disposed into RSOf approved containers. The RSOf
provides containers for radioactive waste consolidation and
disposal. Approved containers include durable plastic car-
boys for liquid radioactive waste. Carboy sizes provided by
the RSOf are 2.5-gallon, 2-liter, 1-liter and 0.5 liter. When
generating liquid waste, use an appropriate size of con-
tainer. Avoid placing a small volume of liquid in a large
carboy. Other types of radioactive waste such as combus-
tible dry solids (CS) and non-combustible dry solids (NS)
are to be disposed of in RSOf issued 6-gallon plastic pails
with liners.

**Label waste containers appropriately** - A waste estimate
tag is attached to each container provided by the RSOf.
Use the tag for labeling and identifying the contents of the
containers. Record on the tag the AU name, radionuclide
and start fill date before adding waste to the container.
Record the date of addition and estimated activity onto a
waste log sheet (e.g., radioactive and chemical waste
combined) as the container is being filled. When the con-
tainer is 3/4 filled, it is considered full. Complete the tag
by recording the fill date and total estimated activity. If the
waste is a “mixed waste” (radioactive and chemical), also
include the chemical component names and percentage.
Never write or mark on the waste pails and/or carboys.
Waste pails and carboys are reused. If laboratory staff
write on containers with wax pencils or permanent mark-
ers, the markings must be removed before the containers
can be reused.

**Sharps** — Certain objects have the potential to puncture or
lacerate waste containers and anyone handling the con-
tainer. The Radiation Protection Procedures Manual
(Authorized User Manual) states that sharps, “e.g., pi-
pettes, needles, scalpels, broken glass” must be placed in
a “rigid, puncture-resistant container prior to the place-
ment into the lined plastic pail.” Clearly mark the inner
container with the word “SHARPS”. When short half-life
(half-life ≤ 120 days) combustible solid (CS) and noncom-
bustible solid (NS) waste is transported to the RSOf, it is
stored for at least 10 half-lives (up to 1200 days) in the
RSOf waste storage facility. The bags of waste that have
decayed through 10 half-lives are placed on a large sort-
ing table and each bag is sorted through by hand and sur-
veyed to determine if any item within the bag still indi-
cates the presence of radioactivity. During this process
RSOf staff members have observed uncontained broken
glass, needles, and razorblades, which poses a serious
safety hazard.
Gamma irradiators contain radioactive material in a sealed source which allows for the safe irradiation of cells, tissues, small animals, mechanical components, or blood and blood products. The radioactive sources in an irradiator are generally cesium-137 (Cs-137) or cobalt-60 (Co-60).

Gamma irradiators employ safety features to protect the operator from unnecessary exposure to radiation. Many irradiators are self-contained units in lead shielding. The lead shielding is designed so that external radiation levels are extremely low. Self-contained irradiators also employ interlocks to prevent inadvertent exposure to the operator while opening or closing the chamber door. For example, if the chamber door is opened to add a sample, the radiation source cannot inadvertently be moved into an exposure position. In addition, while the source is irradiating a sample, the irradiation chamber is inaccessible.

Don’t hold on to generated radioactive waste - Ohio regulations limit the amount of time from initial radioactive waste generation to final disposal, to five years. In addition, as time passes individuals forget regulatory needed specifics regarding waste generated. Under the RSCP, all radioactive material (RAM) must be disposed through the RSOF and should be disposed of as soon as practical after generation. This includes short half-life radioactive waste. During radiation safety audits, RSOF personnel inquire about radioactive waste in laboratories. If any radioactive waste container has a start date greater than one year ago, the RSOF urges the laboratory to dispose of the waste ASAP. If waste is discovered with a start date of greater than two years ago, RSOF personnel will assist the laboratory with the immediate transfer of the waste to the RSOF. In situations where the laboratory must keep old RAM for future analysis, (e.g., slides with radioactivity) laboratory staff need to provide justification to the RSOF and obtain written approval from the Radiation Safety Officer (RSO). Decay-in-storage in the laboratory is prohibited unless specifically approved in writing by the RSO and/or the Radiation Safety Committee (RSC).

Accurately complete radioisotope Use Records – Prior to the laboratory requesting a radioactive waste pickup, all preparations for transfer of the waste to the RSOF should be completed. Ensure Radioisotope Use Record cards are completely and accurately filled out. Pay particular attention to the entries for the percentage of original volume or reuse date and that the types of waste generated (e.g., CS or NS) from a use (e.g., each line entry) add up to 100%.

Don’t dispose of liquid into the laboratory sink - All liquid radioactive waste generated in the laboratory must be placed in an approved carboy. Liquid radioactive waste includes all first washes. If laboratory staff suspects the waste may be at background level (e.g., second or third wash), this assumption needs to be confirmed by analyzing a sample of the liquid waste. Analysis needs to be in a liquid scintillation counter (LSC) or a gamma counter. A meter survey of the liquid waste is not adequate. Disposal of radioactive liquid waste into a laboratory sink can create problems such as contaminated pipes. If this were to occur, the pipes must be removed and disposed as radioactive waste when the laboratory is decommissioned. Regulatory violations can also result due to a failure of the University “to maintain complete information regarding sewer disposal.”

Appropriately segregate waste – All radioactive waste must be segregated by half-life classification and physical/chemical form. This segregation should occur at the time of initial disposal. Sometimes RSOF staff members have to “re-segregate” the waste again. The most common occurrences involve scintillation vial waste. Do not place gloves, paper towels, scintillation vials with RAM tape, or eppendorf tubes in the scintillation vial waste.

Once radioactive waste is generated, it is the responsibility of the AU/AU staff to contact the RSO for waste pickup. A waste pickup request may be made by calling the RSOF during normal working hours at 558-4110 or by logging on to the Radiation Safety website at www.uc.edu/radsafety and completing a “Request a Waste Pickup” form.
Another safety feature of an irradiator is in the design of the source. The radioactive material in a gamma irradiator is a “sealed” source which means it is encapsulated inside two stainless steel housings. This design is to prevent radioactive material from leaking out under normal operating conditions.

The University of Cincinnati has irradiators that are licensed for the irradiation of clinical samples, and samples for research and development, including irradiation of small animals, or cell and tissue samples. Before an individual may operate an irradiator, they must be trained in appropriate radiation safety and operational procedures, and be deemed “trustworthy and reliable”. The training includes attending the Basic and Advanced Radiation Worker classes provided by the Radiation Safety Office (RSOf) and documented operator specific training. The elements of the operator specific training include, at a minimum; observation and operation of the irradiator, and irradiator emergency and security procedures.

Why must a person be deemed “trustworthy and reliable”? The Ohio Department of Health (ODH) through the United States Nuclear Regulatory Commission (USNRC) ordered increased controls for irradiators. The increased controls included “trustworthy and reliable” requirements for all individuals allowed unescorted access to a gamma irradiator. How is a person deemed “trustworthy and reliable”? An individual’s trustworthy and reliability status is determined using factors such as the length of employment with the University, verification of past employment, confirmation of education and contact of personnel references. In addition, fingerprinting and an FBI criminal background check are required.

To minimize the number of individuals having to go through the “trustworthy and reliable” and irradiator operator process, the RSOf implemented a service to perform the irradiation for a researcher. Contact the RSOf regarding the irradiation service or for additional details on becoming a “trustworthy and reliable” irradiator operator.

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