Regulations and guidance covering radiation exposure to embryos and fetuses are based on the conservative assumption that regardless of the amount of radiation dose received by an adult, child, or unborn child there is a certain risk associated with that exposure and the likelihood of these effects increases linearly as the dose increases. Studies have indicated an increased sensitivity of the embryo/fetus as compared to an adult; therefore, regulatory agencies have adopted special dose limits for a declared pregnant worker. The special dose limits are designed for protection of the embryo/fetus. After judgments in the lead industry, regulations placed the decision regarding the possible need for protection on the mother and the dose limits only apply if the mother declares her pregnancy. A declared pregnant woman is defined as a woman who has voluntarily informed the licensee, in writing, of her pregnancy and the estimated date of conception. The declaration remains in effect until the declared pregnant woman withdraws the declaration in writing or is no longer pregnant. At the University of Cincinnati (UC), completing Form 33, Declaration of Pregnancy, and submitting it to the Radiation Safety Office (RSOf) accomplishes this declaration.

The following questions and answers are a reiteration of those found in U.S Nuclear Regulatory Commission (NRC), Regulatory Guide 8.13, “Instruction Concerning Prenatal Radiation Exposure”. (References to the NRC regulations have been replaced with the applicable Ohio Department of Health (ODH) rule; the generic term “licensee” has been replaced with UC or the RSOf, as applicable; and UC requirements have been inserted where applicable.)

If I become pregnant, am I required to declare my pregnancy? No. The choice whether to declare your pregnancy is completely voluntary. If you choose to declare your pregnancy, you must do so in writing and a lower radiation dose limit will apply to your embryo/fetus. If you choose not to declare your pregnancy, you and your embryo/fetus will continue to be subject to the same radiation dose limits that apply to other occupational workers.

Can I tell the RSOf orally rather than in writing that I am pregnant? No. The regulations require that the declaration must be in writing to “the licensee”. Under the UC Radiation Control and Safety Program (RCSP) individuals declare their pregnancy in writing to the RSOf. The RSOf is the official "licensee" representative of UC.

If I am planning to become pregnant but am not yet pregnant and I inform the RSOf of that in writing, do the lower dose limits apply? No. The require-
SPECIAL PRE CAUTIONS FOR PREGNANT WOMEN (CONT)

ment for lower limits applies only if you declare in writing that you are already pregnant.

How long is the lower dose limit in effect? The dose to the embryo/fetus, by regulation, must be limited until you withdraw your declaration in writing or you inform the RSOf in writing that you are no longer pregnant. If the declaration is not withdrawn, the written declaration may be considered expired one year after submission.

If I have declared my pregnancy in writing, can I revoke my declaration of pregnancy even if I am still pregnant? Yes. You may. The choice is entirely yours. If you revoke your declaration of pregnancy, the lower dose limit for the embryo/fetus no longer applies.

If I declare my pregnancy in writing, what happens? If you choose to declare your pregnancy in writing, measures should be taken to limit the dose to your embryo/fetus to 0.5 rem (5 mSv) during the entire pregnancy. This is one-tenth of the dose that an occupational worker may receive in one year. If you have already received a dose exceeding 0.45 rem (4.5 mSv) in the period between conception and the declaration of your pregnancy, an additional dose of 0.05 rem (0.5 mSv) is allowed during the remainder of the pregnancy. In addition, Ohio Administrative Code (OAC) 3701:1-38-12, “Occupational Dose Limits,” requires efforts to be made to avoid substantial variation above a uniform monthly dose rate so that all the 0.5 rem (5 mSv) allowed dose does not occur in a short period during the pregnancy.

The doses received by workers under the RCSP are generally much lower than the limits for a declared pregnant worker. A misunderstanding that occasionally happens is the declared pregnant worker believes she must be immediately removed from all work around radiation. This is not the case. The employee’s supervisor may be willing to remove her from radiation work; however, the RSOf cannot demand the supervisor remove her unless the legal dose limits are expected to be or are being approached. Although the dose and risk to the embryo/fetus are small under normal working conditions, the employee, the supervisor, and the RSOf should work together to decide the best methods for minimizing exposure. The Radiation Safety Officer is always available to discuss workplace exposure, the risks associated with exposure to ionizing forms of radiation, dosimetry, procedures to minimize radiation exposure, and dose received during the pregnancy.

PICKUP AND TRANSPORT OF RADIOACTIVE MATERIALS (RAM) PACKAGES

All radioactive material (RAM) packages must be shipped to the Radiation Safety Office (RSOf). After conducting initial inspections and surveys, the RSOf contacts the laboratory and informs the laboratory personnel the RAM package is ready for pick-up. The individual that picks up the package must be the Authorized User (AU) who ordered the RAM or an individual designated in writing by the AU. The designated individual can be one of the following: 1) A radiation worker listed under the AU, 2) A radiation worker under another AU and the ordering AU approved in writing all radiation workers under the other AU, 3) The contact person listed on the Radioactive Material Request (RS Form 14), 4) Any individual designated in writing by the ordering AU. (Because the RAM is inside a transportation package, the individual picking up a RAM package does not have to be a RAM radiation worker.)

Individuals are limited to transporting RAM packages to the laboratory by hand or with the assistance of non-motorized equipment, e.g., cart. Individuals transporting RAM must remember to obey all pedestrian traffic laws, e.g., crossing only at crosswalks and crossing only with the traffic light where applicable. The RAM should be transported in its original packaging. Original packaging is safe to handle without wearing PPE because it is Department of Transportation (DOT) approved packaging, and contamination and radiation levels are confirmed to be within DOT limits before pickup. RAM packages labeled as “Yellow II” or “Yellow III” with measurable external radiation levels should be transported on a cart or be held away from the body to keep radiation exposure ALARA. RAM packages should be taken directly to an approved RAM-use laboratory and opened in a timely manner to ensure the ordered RAM is received and there are no problems with the order. Wear a lab coat and gloves while opening the RAM package. Use a RAM-designated fume hood, if one is available.
If RAM must be transported to another approved RAM-use laboratory after it is removed from its original packaging, transport the RAM in a strong, tight container to prevent spills or leakage. Precautions should be taken to prevent potential contamination should the RAM be dropped. If the RAM is in liquid form, secondary containment is required. Containers should be labeled with the radionuclide, activity, an emergency contact person and a phone number in case an accident occurs during transport. Any incidents that involve RAM outside an area specifically approved for RAM use must immediately be reported to the RSOf. If there is any possibility of a RAM spill or if there is any package damage that could result in a spill, the transporter should secure the potentially contaminated areas until RSOf personnel arrive.

It is important to adhere to the policies within the Radiation Control and Safety Program when transporting RAM packages from the RSOf to the laboratory and between laboratories. Requirements for picking up RAM packages and transporting RAM are covered in Radiation Safety Committee (RSC) Policy 98-1 (Pickup of Radioactive Material Packages) and RSC Policy 98-4 (Guidance for Transport of Radioactive Material). The requirements are reiterated in section 6 (RAM Control “Cradle-to-Grave”) of the Radiation Protection Procedures (Authorized Users Manual). RSOf staff members are available to answer any questions and to assist with the transport of RAM if it is beyond the capability of laboratory personnel.

**Luminescence in LSC**

Luminescence in liquid scintillation (LSC) counting is described as the emission of light photons as the result of energy absorption and molecular excitation from a source other than nuclear radiation. The two types of luminescence commonly discussed are photo- and chemi-luminescence.

**Photoluminescence.** In liquid scintillation counting, photoluminescence is the production of light as the result of the introduction of a light source (e.g., sunlight or UV light) to the sample medium. Depending upon the specific type of photoluminescence (fluoro- or phosphorescence), the length of time between excitation and de-excitation will vary. Samples excited by fluorescence have lifetimes in the $10^{-8}$ to $10^{-4}$ second range. Fluorescence generally will not present a problem because of the length of time samples spend in the relative dark environment of the counter prior to being counted. Phosphorescence generally has a much longer time between excitation and de-excitation of the sample. Simply storing the sample in a dark environment for approximately 30 minutes should eliminate the problem of phosphorescence.

**Chemiluminescence.** Chemiluminescence can be the source of frequent interferences when counting samples. The cause is a chemical reaction in which the end product produces light. A key indicator that chemiluminescence is occurring within a sample is abnormally high counts within the $0 - 6$ keV range. If this is the case, simply monitor the counting rate over a period of an hour or two. If count rates decrease significantly, allow the sample to stabilize over a 24-hour period before the final count is performed. Heating or cooling samples suspected of chemiluminescence may also eliminate the interference.

Whether your sample exhibits photo- or chemiluminescence interference, adjusting the lower counting region settings will often eliminate the problem and is a method of minimizing luminescence when counting mid- to high-energy beta emitting radionuclides. Setting the count region to begin at 10 keV should eliminate the counts contributed by luminescence. Significantly adjusting the lower counting region is not acceptable when counting tritium. Tritium emits a very low energy beta ($E_{\text{max}}=18.6$ keV) and its spectrum overlaps that of luminescence. For tritium, setting the count region to begin at 3 keV should satisfactorily minimize luminescence without seriously affecting the counting efficiency.

Knowing how to interpret the results of abnormally high counts on wipe tests can determine which course of action to take. Once luminescence is identified as a possible problem, simple steps can be taken to eliminate and compensate for the problem. Contact the Radiation Safety Office if liquid scintillation counting assistance is needed.
The Authorized User (AU) Manual requires all areas where unsealed radioactive material is used be surveyed for removable contamination at least monthly. All survey results shall be documented on an Authorized User Routine Survey Report (RS Form 12) or its equivalent.

If no use occurs during a month, “no use” may be documented in lieu of a survey being conducted. Minimum documentation for “no use” is date of last clean survey, date of last use, and date of documentation of “no use”. “No use” documentation may be recorded on an RS Form 12. “No use” documentation is not applicable in areas where radioactive material is stored, but not used. (Storage is considered a use of radioactive material.) If the only “use” is storage, an abbreviated survey may be conducted. The abbreviated survey may be limited to the storage area and area immediately surrounding the storage area. For example, if a room has stock radioactive material vials stored in a refrigerator and radioactive waste stored in containers on the floor, wipe surveys must be performed of the refrigerator, floor in front of the refrigerator, the waste containers, and the floor surrounding the waste containers.

Ensuring 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.

Isotope Factsheet Link:
http://researchcompliance.uc.edu/RadSafety/Isotope.aspx

Manuals, QMP and Policies:
http://researchcompliance.uc.edu/RadSafety/Manuals.aspx

Newsletters:

Frequently Asked Questions:
http://researchcompliance.uc.edu/RadSafety/FAQ.aspx

RSC Approved Forms:
http://researchcompliance.uc.edu/RadSafety/Approved.aspx

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