

IV. *Exposure Monitoring*

A. **Radiation Exposure Limits**

The goal of the Radiation Safety Program is to keep radiation workers and members of the public exposure to radiation As Low as Reasonably Achievable (ALARA). The occupational exposure reports are reviewed monthly and/or quarterly by ORS. A summary of the occupational exposures is reported to the RSC at the regularly scheduled meetings. The following table lists exposure limits as contained in 10 CFR 20.

Exposure Type	Annual Limit (mrem)		ALARA Level I		ALARA Level II	
	Radiation Workers	Minors	Quarterly Average (mrem)	Monthly Average (mrem)	Quarterly Average (mrem)	Monthly Average (mrem)
Whole Body	5,000	500	125	40	375	125
Extremity or Skin*	50,000	5,000	1,875	625	5,625	1,825
Individual Internal Organs	50,000	5,000				
Lens of the Eye	15,000	1,500				
Embryo/Fetus	500					

* Extremity is defined as: hand, elbow, arm below the elbow, foot, knee, or leg below the knee. Skin dose, measured at 0.007 cm, averaged over 1 cm².

B. **Radiation Exposure During Pregnancy**

Pregnant women occupationally exposed to radiation have the option of limiting radiation exposure to their embryo/fetus to 500 mrem during pregnancy. To do so, the woman must voluntarily notify ORS in writing of her pregnancy and the estimated date of conception (month and year only).

Declared pregnant woman means a woman who has voluntarily informed the FMLH Radiation Safety Office, 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.

Declaration of Pregnancy – ORS will make available a form letter for the purposes of declaring pregnancy. The employee may choose to use the form letter, or provide her own written notification. The declaration must contain, at a minimum, the name of the

employee, a statement that she is pregnant, her estimated date of conception (month and year only) and the department/service of employment.

The Declaration may be sent to the employee's immediate supervisor, or to ORS. If the immediate supervisor is notified, the supervisor must promptly notify ORS.

ORS will provide information to the Declared Pregnant Woman concerning the health effects/risks associated with exposure of the fetus during pregnancy, and methods of maintaining radiation exposure within the dose limits, and As Low As Reasonably Achievable. ORS will evaluate the working conditions to determine compliance with fetus/embryo radiation exposure limits.

C. Dosimeters

Types

Dosimeters are devices worn by radiation workers to measure actual occupational dose. Three types of dosimeters are commonly available through commercial vendors that meet State accreditation requirements:

Film badges

Thermoluminescent Dosimeters (TLD's)

Optically-Stimulated Luminescent (OSL) Dosimeters

The use of other dosimeter devices for measurement of occupational dose must be approved on a case-by-case basis by ORS.

Requirements

ORS assigns dosimeters, at a minimum, according to the following criteria:

1. Adults likely to receive, in one year from sources external to the body, a dose in excess of 10% of the radiation dose limits.
2. Minors who are at risk of receiving over 10% of the radiation dose limits.
3. Declared pregnant women likely to receive, in one year from sources external to the body, a dose in excess of 100 mrem.
4. An individual entering a high or very high radiation area.
5. An individual working within 6 feet of operating medical fluoroscopic equipment.

Monitoring devices shall be individually assigned and not shared.

Recommendation

ORS recommends that dosimeters be worn by radiation workers who handle beta-emitting isotopes, where the maximum beta energy is greater than 1 MeV, and more than 1 mCi is used per process.

Obtaining a Dosimeter

To request a dosimeter, complete and forward a Personnel Dosimetry Application to ORS. Forms are available at ORS or the ORS website.

General Instruction

To properly use a dosimeter, follow these rules:

Body Dosimeters – film or TLD badges are to be worn at collar level near the neck. If a lead apron is worn, the film badge is to be worn at collar level near the neck outside of the apron.

Extremity Dosimeters – finger TLD rings are to be worn on the finger of the hand where the greatest exposure is anticipated. It is important to wear the ring inside lab gloves, to prevent contamination. When monitoring for beta-emitters, be sure the TLD chip is on the palm side of the hand.

- Wear the dosimeter while in the proximity of ionizing radiation.
- When leaving the work area for the day, leave the dosimeter(s) in a low background area.
- Do not tamper with the dosimeter. Protect it from damage.
- Exchange the dosimeter as directed by ORS.
- Notify ORS as soon as practical of any lost or damaged dosimeter.
- Notify ORS as soon as practical of any suspected overexposure or contamination of the dosimeter.
- Do not wear a dosimeter assigned to another individual nor let another individual wear your dosimeter.

Upon termination of employment or if the dosimeter is no longer required, return the dosimeter to the ORS. If you would like a copy of your radiation exposure history while working at MCW, submit a signed request that includes your name, social security number, department, dates of employment, and the address to where you want the report released.

D. Internal Monitoring

In some cases, monitoring for the ingestion or inhalation of RAM may be required. Measurements of internal radionuclides, sometimes called *bioassays*, are generally taken *in vivo*, by direct measurement, or *in vitro*, by measurement of biological samples.

The requirement for bioassays is as follows:

1. Adults likely to receive, in one year, an intake in excess of 10% of the applicable ALI in HFS 157.

2. Minors likely to receive, in one year, a committed effective dose equivalent in excess of 100 mrem.
3. Declared pregnant women likely to receive, during the entire pregnancy, a committed dose equivalent in excess of 100 mrem.

To determine when bioassays are necessary, based on the quantity of RAM and the process involved, the methodology described in ANSI HPS N13.39-2001 is referenced. Additionally, a procedure for bioassay analysis is available from ORS.