Personnel monitoring of occupational exposure to radiation

Personnel monitoring of occupational exposure to radiation is required by regulations when the employees may be receiving greater than ten percent of any applicable radiation dose limit. Personnel monitoring normally means the issuing of a dosimeter to an employee to track the dose received. It is often difficult to ensure that an employee has not exceeded the ten percent level under any foreseeable circumstances, therefore, dosimeters are widely used. Film and thermoluminescent dosimeters are two devices commonly used for monitoring exposure. Either device, if worn and processed properly, is capable of providing an accurate assessment of the dose received from a variety of radiation sources.

Annual occupational dose limits (reference 10 CFR 20.1201, 20.1207, 20.1208) are established for different parts of the body as follows:

Whole Body (Deep Dose Equivalent or DDE)	5,000 mrem
Lens of the Eye (Eye Dose Equivalent or EDE)	15,000 mrem
Skin (Shallow Dose Equivalent or SDE)	50,000 mrem
Extremities (Shallow Dose Equivalent or SDE)	50,000 mrem
Fetus of a Declared Pregnant Radiation Worker	500 mrem (for the entire pregnancy)
Dose Limits for Minors	10% of adult limits

(All doses are in units of millirems (mrem) of dose that may be received in a calendar year)

The “whole body” refers to the head and trunk of the body; including the arms above the elbows, the legs above the knees, and the reproductive organs. The “skin” refers to the skin anywhere on the body. The “extremities” refer to the arms below the elbow and legs below the knees. (Reference 10 CFR 20.1003)

Dosimetry reports provided by Thermo Fisher Scientific provide the doses in units of millirem. When the dosimeter is worn on the body, a deep, shallow, and eye dose will be reported. Deep dose is the measurement of external exposure received at a tissue depth of 1.0 centimeter, and is reported in columns 10 and 11 on our report. Shallow dose is the measurement of external exposure received at a tissue depth of 0.007 centimeters and is reported in column 13 on our report. Dose to the lens of the eye is the measurement of the exposure received at a tissue depth of 0.3 centimeters and is reported in column 12 on our report.

Extremity dose is monitored using ring or wrist dosimeters. Only a shallow dose measurement is provided for extremity monitoring and is reported in column 13 on our report.

Organizations using radiation sources are also required to control those sources so that no member of the public receives more than 100 millirem per year. Also, radiation doses in unrestricted areas may not exceed 2 mrem in any one hour. Dosimeters can be helpful in demonstrating compliance with these limits. Dosimeters used as “area monitors” are posted at fixed locations to monitor local area doses. Environmental dosimeters are sealed in weather-resistant packaging so they can be posted outside. (Reference 10 CFR 20. 1302)

Occupational dose does not include the dose from natural background, medical or dental diagnosis, or medical therapy. For comparison, NCRP Report 93, 1987 shows that the average annual exposure to individuals to be 360 mrem from natural and manmade sources, including routine medical procedures. An individual will typically receive approximately 5 mrem of radiation exposure on a coast-to-coast airline flight, 8 to 20 mrem from a chest x-ray, 10 mrem from a dental x-ray, or 22 mrem from a cervical spine x-ray.

For information on regulatory requirements, refer to the Nuclear Regulatory Commission regulations in Title 10 of the Code of Federal Regulations, Part 20, of the radiation protection regulations of your state.

Find out more at **thermofisher.com/dosimetryservices**

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