PNNL Radiologically Posted Area Information for Visitors

Radiation Safety

Radiation is energy that is emitted from an unstable atom. It can be in the form of a particle (alpha, beta, or neutron radiation) or a ray (gamma or X-ray).observation and auditing activities unless further training is obtained.

Some facilities and areas contain radiological hazards that are invisible and not normally dealt with in everyday life. This section describes the basics of radiological hazards and the protective measures we take to minimize any risk. The DOE, PNNL, and Hanford Site contractors are firmly committed to maintaining a Radiological Control Program of the highest quality.

- Do not bring sealed or unsealed radioactive sources into PNNL facilities without prior approval of the PNNL Radiological Control organization.
- Do not enter a radiological area or work with any hazardous materials without specific authorization and training. Visitors are limited to
- Keep your exposure "As Low As Reasonably Achievable"

Basic Radiation Concepts—What is Radiation?

Radiation is energy that is emitted from an unstable atom. It can be in the form of a particle (alpha, beta, or neutron radiation) or a ray (gamma or X-ray).

Radiation also can be classified as ionizing or non-ionizing. Ionizing radiation has enough energy to remove electrons from the atoms through which it passes. This section of the booklet covers ionizing radiation. Non-ionizing radiation lacks the energy to remove any electrons from neighboring atoms. Examples of non-ionizing radiation are radio waves, lasers, and microwaves.

Another term associated with radiation is radioactive contamination. In simple terms, radioactive contamination is having radioactive material in an unwanted location. Radioactive contamination areas are strictly controlled to prevent the spread of contamination.

What About Radiation Exposure?

Everyone is exposed to naturally occurring radiation every day. This exposure is expressed as a dose equivalent. The unit of its measure is called "rem." The vast majority of exposure here is measured in millirem or "mrem," which is 1/1000 of a rem. In the United States, the average person receives a radiation dose of approximately 360 mrem each year from naturally occurring background radiation and manufactured sources.

All radiological hazards are easily identifiable by the use of the international sign for radiation—a black or magenta trefoil on a yellow background with the words "Caution" or "Danger." Entry into any of

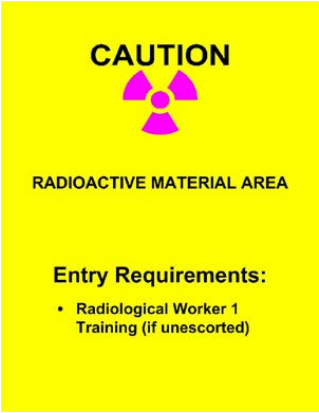
these areas requires specific training and strict compliance with access requirements. Yellow plastic wrapping and designated storage areas for radiological materials are additional controls that are used to warn the worker of the presence of radioactive materials in the area.

How do I Identify Radiological Hazards?

Any area in which there is a potential for exposure above background to radioactive materials is strictly controlled. A combination of special training, administrative controls, and physical controls (including radiological postings, signs, and barriers) is used to restrict access to these areas.

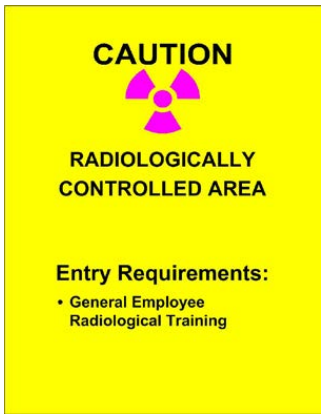
Examples of these areas are:

- fixed contamination areas
- underground radioactive material areas
- radioactive material areas
- radiological areas.



Material Area

Buffer Area



Controlled Area

ALARA

The main ALARA measures are:

- reduce TIME near the hazard
- increase the DISTANCE from the hazard
- increase the SHIELDING between you and the hazard
- reduce the amount of radioactive material (e.g., decontamination).

Radiation Risks

Exposure to ionizing radiation may increase your chances of developing cancer. Although the scientific community lacks consensus on how much exposure is acceptable, current regulations require us to maintain your exposure As Low As Reasonably Achievable (ALARA).

Remember that it is difficult to prevent your exposure to naturally occurring sources of radiation exposure. However, you can more easily control your exposure to manufactured sources of radiation.

The following data address the expected effect on the average life span of the large population of individuals subjected to the listed risk factor or behavior. The subsequent average loss of life expectancy is expressed in days.

Chronic exposure occurs when an individual receives a dose of radiation (typically a low dose) over an extended period of time (usually months to years). Exposure to naturally occurring background radiation is an example of chronic exposure.

Acute exposure occurs when an individual receives a high dose of radiation in a short period of time (seconds to days). Firefighters at the Chernobyl plant in the Ukraine received acute doses of radiation.

Heritable effects are passed from one generation to the next. High levels of radiation exposure to animals have been demonstrated to produce such effects. A developing embryo or fetus is more sensitive to environmental factors such as radiation. Possible effects may include slower growth, inhibited mental development, or childhood cancer. However, no heritable effects have been observed in humans as a result of radiation exposure.

Is There a "Safe" Dose of Ionizing Radiation?

The scientific community has not developed a definitive answer to this question. The potential risk of working with or around radioactive materials can be compared to other accepted risks in our everyday lives.

In summary, the estimated risk associated with radiation exposures, when compared to other risks, is considered to be within the normal range of the public's risk tolerance.

How are Radiological Risks Managed?

The key to managing radiological risks is to keep exposures to radiation and other hazardous materials ALARA. The cornerstone of the ALARA philosophy is to not commensurate benefit. This is accomplished by evaluating all hazards before operations begin and designing appropriate controls into the project.

What are the Radiological Controls?

Engineered and administrative controls keep radiation exposures ALARA.

Engineered controls are physical or mechanical devices used to reduce the risk from hazards (e.g., radiation, chemical, etc.). Engineered controls are the primary means of controlling radiation exposure. They include:

- shielding
- proper ventilation
- containment devices, such as glove boxes
- interlocks on enclosures.

Administrative controls are procedures and policies used to minimize the risk from hazards. Administrative controls supplement engineered controls to provide a safer workplace. Administrative controls include:

- warning signs (e.g., radiological postings)
- safety procedures
- radiological work permits.

In addition, administrative control levels are used to keep your annual exposure well below the legal dose limits. Visitors are limited to 100 mrem/year. General employees are expected to receive less than 100 mrem/year. Trained radiological workers are administratively limited to 500 mrem/year.

What About Pregnant Women?

If you are pregnant and have any concerns regarding radiation exposure, talk to your host or escort, who will contact the Radiation Protection organization to discuss radiation effects during pregnancy. Radiological workers who are pregnant are limited to 500 mrem by DOE for the duration of the gestation period. The PNNL limit is 450 mrem per gestation period and no greater than 50 mrem per month.

Will I Have to Wear a Dosimeter?

A dosimeter is a device used to measure an individual's exposure to external radiation. Typically, most employees do not receive a measurable occupational dose. Radiological workers wear dosimeters to measure their dose. Most likely, you will not be entering areas that require dosimeters to be worn. You will be issued a dosimeter if you will be entering areas where dosimeters are required, or if you have the potential to receive a dose that requires dosimetry. For additional information on dosimeters, see the link on the

Personnel Surveys

Personnel contamination monitors and hand and foot monitors are located at many exits of facilities on the Hanford Site and PNNL. You are required to use these monitors upon exiting the radiological area. DO NOT use hand-held portable instruments. If needed, the survey will be performed by a Radiological Control Technician.