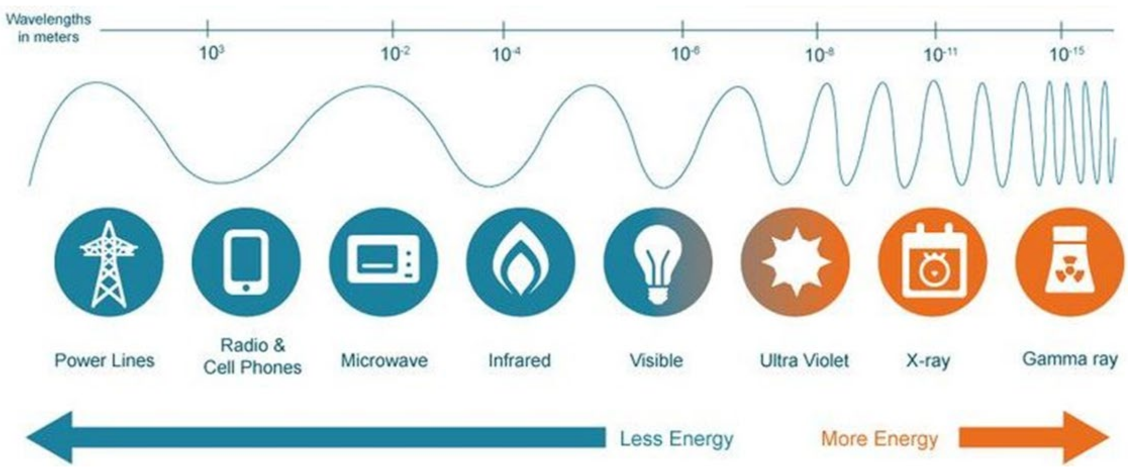
ENVIRONMENTAL HEALTH & SAFETY
UNIVERSITY of WASHINGTON

RADIATION AND RELATIVE RISK



WHAT IS RADIATION?

Radiation is energy. It can come from unstable atoms that undergo radioactive decay, or it can be produced by machines. Radiation travels in the form of energy waves or energized particles. Everyone receives a small amount of radiation every day called *background radiation*. This radiation is natural and comes from space, air, water, soil, rocks, and the food we eat.

Types of radiation include electromagnetic radiation, such as radio waves, microwaves, x-rays, and gamma rays, and particulate radiation such as alpha and beta particles.

Geiger Mueller counter, Source: Wikipedia

HOW IS RADIATION DETECTED AND MEASURED?

Radiation is detected with different types of instruments, depending on the type of radiation emitted. One of the most common hand-held detectors is the Geiger-Mueller counter (see photo). Radioactive material can also be collected on wipes or by using air monitors that collect particles in a filter, which can then be analyzed for radioactivity.

Radioactivity is reported in terms of the amount of energy being given off over time, such as counts (or decays) per minute or amount of charge collected.

HOW IS RADIATION USED AT THE UNIVERSITY?

Radiation is used at the University for scientific and biomedical research. UW Medicine uses radiation in medical diagnostic imaging (e.g., x-rays and CT scans), and for the therapeutic treatment of disease. Radiation is used in these ways throughout the nation and world.

WHAT IS RADIATION DOSE?

Effective dose is the amount of radiation absorbed by an individual, adjusted for the type of radiation and for various radio-sensitivities of any affected organs or tissues. It can be used to assess the potential for cancer later in life. Effective dose is a numerical value presented in units rem or millirem **(1 rem = 1,000 millirems).**

HOW MUCH RADIATION IS AROUND US?

According to the National Council on Radiation Protection and Measurements, the **average annual effective dose per person in the U.S. is 620 millirem**, which includes:

- 311 millirem of *background* radiation
- 309 millirem of *man-made* radiation

Background radiation includes radiation from space, air, water, soil, rocks, and the food we eat.

Sources of man-made radiation include x-rays, nuclear medicine radiopharmaceuticals, industrial sources, and consumer goods.

Dose limits are set by the U.S. Nuclear Regulatory Commission.

TYPICAL DOSES:

5,000 millirem	**Annual dose limit for a radiation worker**
1,000 millirem	**Whole body CT scan**
311 millirem	**Background radiation in the environment**
100 millirem	**Annual dose limit for the public**
42 millirem	**Mammogram**
10 millirem	**Chest X-ray**
3 millirem	**Round-trip airline flight from New York to Los Angeles**

WHAT IS THE RISK TO HUMANS FROM NATURAL AND MAN-MADE RADIATION?

The annual effective dose per person of 620 millirem has not been shown to cause humans any harm. In fact, negative health effects are not observable for people exposed to doses up to 10,000 millirem (10 rem).

At very high levels of radiation dose delivered in a very short period of time (e.g., survivors of Hiroshima and Nagasaki atomic bombs), Acute Radiation Syndrome or "radiation sickness" is a serious illness that can occur. Symptoms include loss of appetite, fatigue, fever, nausea, vomiting, diarrhea, and possibly even seizures and coma. These events are very rare.

WHAT IS THE RISK TO A FETUS OF A PREGNANT WOMAN EXPOSED TO RADIATION?

A developing fetus is more sensitive to radiation exposure than an adult; radiation dose limits for pregnant workers should be observed to ensure the safety of the fetus. For more information, read the University's occupational dose limits for pregnant workers.

REFERENCES

1. Environmental Protection Agency https://www.epa.gov/radiation/radiation-basics
2. Nuclear Regulatory Commission https://www.nrc.gov/about-nrc/radiation/health-effects/info.html
3. ICRP publication 84, 2000 http://www.icrp.org/docs/ICRP_84_Pregnancy_s.pps

Please contact EH&S's Radiation Safety team at radsaf@uw.edu or call 206.543.0463 for more information.