Community Window on the Hunters Point Shipyard

Radiation in Our Environment: An Introduction

Introduction

The purpose of this factsheet is to provide some basic information about radiation and radioactivity to inform our discussions about radioactive contamination in the environment and its possible effects on our health.

What are radiation and radioactivity?

Radiation is energy that travels in the form of waves or particles. There are many different kinds of radiation – such as microwaves, visible light, and X-rays – with a wide range of energies [1, 2, 3].

Radioactivity is the property of some atoms to spontaneously give off high-energy radiation in the form of particles or rays [1, 2, 3]. The atoms that make up radioactive materials are the sources of radiation and are called *radionuclides*.

Ionizing & Non-Ionizing Radiation

There are many ways to categorize the different types of radiation. In this factsheet we will refer to non-ionizing radiation and ionizing radiation.

Non-ionizing radiation has enough energy to move atoms in a molecule or to cause them to vibrate, but it does not have enough energy to change them chemically. Visible light and microwaves are examples of non-ionizing radiation [4, 5, 6].

When an unstable atom decays, it can give off enough energy to affect the structure of other atoms and to break chemical bonds. This energy, called *ionizing radiation*, travels in the form of subatomic particles or waves. Ionizing radiation is commonly used to generate electric power, to kill cancer cells, and in many manufacturing processes [4, 5, 6]. When people think of radiation, most often they are thinking of ionizing radiation.

Types of Ionizing Radiation

There are four main kinds of ionizing radiation [2, 5, 6].

Alpha particles have two protons and two neutrons; alpha particles tend to be slow moving and can usually be stopped by a piece of paper or the dead outer layer of skin tissue.

Beta particles are essentially electrons; they are smaller and faster moving than alpha particles and can travel significant distances in air but will usually be stopped or reduced by clothing or a few millimeters of glass or aluminum.

Gamma rays are packets of energy (photons) without mass or charge; most gamma rays can pass through or be absorbed by the human body but will lose most or all of their energy in a few feet of concrete or soil or several inches of lead.

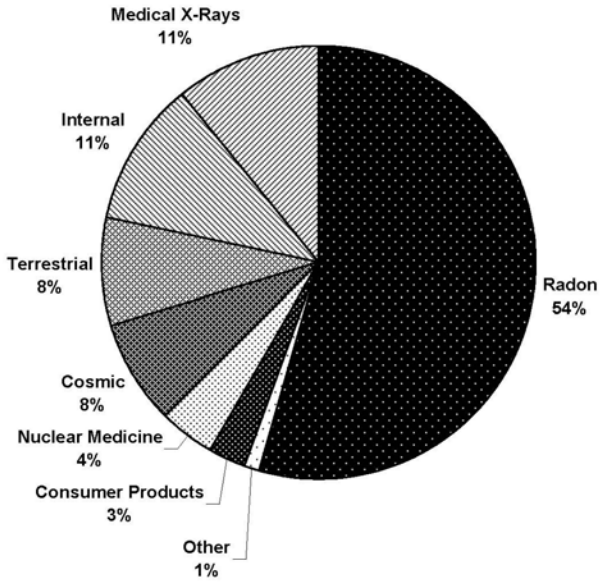
X-rays are like gamma rays but have less energy and are less penetrating; they can usually be stopped by a few millimeters of lead.

Radiation in Our Environment

Radiation is all around us. Some radioactive materials occur naturally, and others are created by humans. Human exposure to naturally-occurring radiation can also be increased by human activities such as mining or air travel.

Many naturally occurring materials in our environment are radioactive [2, 7, 8]. For example, thorium and potassium in the earth's crust are naturally radioactive, and radon is a naturally occurring gas in most soils.

Humans create and use radiation sources in a variety of applications, such as electricity generation, healthcare, scientific research, and food irradiation.



Graph: Annual contribution to average effective radiation exposure for people in the U.S. from different sources. Actual exposure for an individual will vary. [2]

When we talk about human exposure to radiation, we often think of nuclear weapons. Detonation of nuclear weapons exposed people nearby to high doses of radiation, and global background radiation levels increased significantly in the short-term after detonations. Fallout from atmospheric detonation of nuclear weapons peaked in the mid-1960s. The long-term increase in global radiation levels from nuclear bomb detonations, while measurable, is considered to be statistically small [2, 7].

How do radionuclides move though our environment and into our bodies?

Radionuclides can be found in air, water, soil, and rock. They may occur there naturally or may have been released as a result of human activity. Radionuclides can also enter the human food chain through plants and animals. Not all radionuclides move through the environment in the same way [8]. For example, one radionuclide may dissolve in water while another might tend to stick to the surface of soil through which water is moving. Radionuclides may get into our bodies through the skin or an open wound, or when we swallow or inhale them. What happens to the radionuclide once inside the body depends on the specific radionuclide. For example, some may stay in the body for a long time while others might be exhaled or eliminated quickly.

How do we detect ionizing radiation?

As humans we cannot detect ionizing radiation with our senses: we have to use instruments to try to measure radiation. The type of detector depends on the type and location of the radiation. For example, you might use a different instrument to monitor air-borne alpha particles versus gamma rays in the ground [10].

Can ionizing radiation affect your health?

It is currently believed that any exposure to radiation may be harmful. The risk level depends on the type of radiation, the amount of energy absorbed by a person's body, how long a person is exposed for, and how often a person is exposed to the radiation. In addition, the same exposure may affect people differently depending on age and pre-existing health conditions.

Exposure to radiation can cause damage to cells, eventually leading to cancer or other health concerns [2, 5, 6, 9]. Exposure to radiation can also cause damage to a person's genes, potentially causing problems for any offspring. While exposure to high doses of radiation may result in illness and/or death in a few weeks to months, health problems from low or moderate exposure may not show up for months or years. It is believed, however, that the health risks from low-level exposure are very small.

Information Sources

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