IOWA Health and Human Services

Frequently Asked Questions (FAQ)

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What is radiation?

Radiation is energy given off by matter in the form of rays or high-speed particles. All matter is composed of atoms. Atoms are made up of various parts; the nucleus contains minute particles called protons and neutrons, and the atom's outer shell contains other particles called electrons. The nucleus carries a positive electrical charge, while the electrons carry a negative electrical charge. These forces within the atom work toward a strong, stable balance by getting rid of excess atomic energy (radioactivity). In that process, unstable nuclei may emit a quantity of energy, and this spontaneous emission is what we call radiation.

There are many familiar forms of radiation. For example, we use light, heat, and microwaves every day. Doctors use x-rays to see inside our bodies. Radio and television waves bring us our favorite shows. All of these are forms of radiation. Radiation is also naturally present in our environment, as it has been since before the birth of this planet. The sun and stars send a constant stream of cosmic radiation to Earth, much like a steady drizzle of rain. Also, the Earth itself is a source of terrestrial radiation. Radioactive materials (including uranium, thorium, and radium) exist naturally in soil and rock. Essentially all air contains radon, water contains small amounts of dissolved uranium and thorium, and all organic matter (both plant and animal) contains radioactive carbon and potassium. In addition, all people have

internal radiation, mainly from radioactive potassium-40 and carbon-14 inside their bodies from birth and, therefore, are sources of exposure to others. Finally, to a lesser degree, people are also exposed to radiation from the nuclear fuel cycle, from uranium mining and milling to disposal of used (spent) fuel. In addition, the public receives some minimal exposure from the transportation of radioactive materials and fallout from nuclear weapons testing and reactor accidents (such as Chernobyl).

Where does radiation come from?

Radiation is naturally present in our environment, as it has been since before the birth of this planet. In addition, radiation can be produced artificially, as in medical x-rays and microwaves for cooking. Nonetheless, most people are not aware of all the natural and man-made sources of radiation in our environment.

How far does radiation travel?

Travel distance depends on the type of radiation, as does the ability to penetrate other materials. Alpha and beta particles do not travel far at all, and they are easily blocked. By contrast, gamma rays, x-rays, and neutrons travel a significant distance and are much more difficult to block (particularly for large radioactive sources).

How are radioactive materials used?

In medicine, radioactive materials are used for diagnostic and therapeutic purposes. Similarly, in biological and biomedical research, they are used to test new drugs and to study cellular functions and bone formation in mammals. In addition, radioactive materials are used in various industrial applications to protect food and blood supplies, increase the safety of roads and buildings, locate new energy sources, light emergency exits, warn of fires, and more. All users must be licensed by the NRC or by "Agreement States" authorized by the NRC.

What do radioactive sources look like?

Radioactive sources are typically “sealed,” or encased in metal or foil. They are usually very small; their size can vary from tiny "seeds" used in cancer treatment, to the size of the tip of a ballpoint pen or a pencil eraser, to rods up to several inches in length, depending on the material and its configuration.

How can I tell if something is radioactive?

You can’t, without the help of a radiation detector. In addition, it is important to know what type of detector you have and the type of radiation — alpha, beta, gamma, x-ray, and/or neutron — that it can detect. Scanning an object with a typical gamma/x-ray radiation detector will not detect alpha particles, for example.

What is tritium, and what can it do to you?

Tritium (hydrogen-3 or 3H) is a weak radioactive isotope of the element hydrogen, which occurs both naturally and during the operation of nuclear power plants. Tritium is one of the least dangerous radioisotopes because it emits very weak radiation and leaves the body relatively quickly. Nonetheless, exposure to very small amounts of ionizing radiation is thought to minimally increase the risk of developing cancer, and that risk increases as exposure increases. Since tritium is almost always found

as water, if ingested, it goes directly into soft tissues and organs. The dose to these tissues is generally uniform and depends on the tissue's water content.

What kind and how much radiation is produced by a nuclear power plant?

An operating nuclear power plant produces very small amounts of radioactive gases and liquids, as well as small amounts of direct radiation. If you lived within 50 miles of a nuclear power plant, you would receive an average radiation dose of about 0.01 millirem per year. To put this in perspective, the average person in the United States receives an exposure of 300 millirem per year from natural background sources of radiation.

What happens to radiation produced by a plant?

Nuclear power plants sometimes release radioactive gases and liquids into the environment under controlled, monitored conditions to ensure that they pose no danger to the public or the environment. These releases dissipate into the atmosphere or a large water source and, therefore, are diluted to the point where it becomes difficult to measure any radioactivity. By contrast, most of an operating nuclear power plant's direct radiation is blocked by the plant's steel and concrete structures. The remainder dissipates in an area of controlled, uninhabited space around the plant, ensuring that it does not affect any member of the public.

Are nuclear plant workers radioactive themselves?

Nuclear plant workers are no more radioactive than anyone else. Except in unusual circumstances, such as an accident at the plant, workers receive only minimal doses of radiation and rarely become contaminated with radiation. It is important to remember that being exposed to radiation does not make one radioactive, except in very specific circumstances.

How does radiation affect the public?

The exact effect depends on the specific type and intensity of the radiation exposure.

Why do you need to be careful around radiation?

For the same reason we need to be careful around open flame, toxic chemicals, or knives. Used and stored properly, for example, a knife can help us prepare and eat food; misused, it can cause injury and possibly death. Similarly, when handled correctly, radioactive materials have many beneficial uses; misused, however, it can pose a significant danger. Ionization can cause damage within a cell, which could eventually lead to cancer, a mutation in genetic material, or more immediate types of physical harm to humans.

Why shouldn’t you pick up a radioactive source and put it in your pocket?

It really depends on the source. Depending on their size and activity, many sources contain enough energy to cause significant damage to human skin and tissue. In general, you should avoid contact with radioactive sources except in controlled situations — such as a doctor administering radioisotopes for medical diagnosis or treatment.

What is the worst radiation can do to you? How can this be prevented from this happening?

Radiation can kill you (if you are exposed to enough of it) by doing so much damage to your bodily systems that your body can no longer function. The regulatory system for radioactive materials is designed to prevent the possibility that anyone could receive an exposure even close to the levels that might inflict short-term damage.

The simplest preventions against harmful radiation exposure are **time, distance and shielding.** Limit the time you are exposed to the radioactive source; increase the distance between you and the source; and shield yourself by placing objects between you and the source. These concepts form the basis of nuclear regulation so that we may enjoy the beneficial uses of radioactive materials while minimizing the risk to public health and the environment.

If radiation is dangerous, why do we use radioactive material?

One could think of radioactive materials as a knife. Used and stored properly, a knife can help us prepare and eat food; misused, it can cause injury and possibly death. Similarly, when handled correctly, radioactive materials have many beneficial medical, industrial, and academic uses.

How can exposure to radiation be minimized?

Time, distance, and shielding measures minimize your exposure to radiation in much the same way as they would to protect you against overexposure to the sun (as illustrated in the following figure).



How is someone decontaminated if they get radioactive material on them?

Remove contaminated clothes as soon as possible, and place them in a sealed plastic bag. The clothing could be used later to estimate a person's exposure. Gently wash skin to remove any possible contamination, making sure that no radioactive material enters the mouth or is transferred to areas of the face where it could easily be moved to the mouth and swallowed.