



Radionuclides in Soil

Radiation is everywhere, including in the soil. Radionuclides become a part of the soil in three ways:

- As part of Earth's original crust (primordial radionuclides)
- Produced and deposited by cosmic ray interactions (cosmogenic radionuclides)
- Through man-made releases (man-made radionuclides and activities)

Primordial Radionuclides

Primordial radionuclides are left over from the creation of the Earth. They typically have half-lives of hundreds of millions of years. Examples include uranium-235, uranium-238, thorium-232, and potassium-40. Primordial radionuclides end up in soil as part of the rock cycle, which includes weathering.

Tree or plant roots dig down into cracks in the earth, prying the rock apart and turning it into soil. Natural radioactivity in soil varies on soil type, mineral make up and density. Man-made activities, such as mining, may accelerate the movement of primordial radionuclides into soil.

Cosmogenic Radionuclides

Radionuclides are continuously produced by bombardment of stable nuclides by cosmic rays, primarily in the atmosphere. These cosmogenic radionuclides can have long half-lives, but the majority have shorter half-lives than the primordial radionuclides. Cosmogenic radionuclides include carbon-14, tritium-3, and beryllium-7; worldwide, cosmic radiation is the primary source of these radionuclides.

Another way radionuclides become part of the soil is through natural cosmic radiation, radiation produced in outer space when heavy particles from other galaxies (nuclei of all known natural elements) bombard Earth.

Some of these radionuclides fall to Earth and are deposited on the soil.

Man-made Radionuclides and Activities

The third way radionuclides enter the soil is through man-made activities, such as the fallout from atmospheric testing of nuclear weapons and radiological events like the Chernobyl accident. Deposition studies of these activities indicate that radioactive particles travel around the world on streams of air. The weight of the particle and weather determine how soon they fall to the ground. Sometimes a heavy rain will bring the radioactive particles to the ground quickly. Improper disposal of radioactive material also may contribute to radionuclides in the soil.

Radionuclides in the soil can move into the water, air and even our food supply. Many different agencies are involved in setting standards and monitoring to keep us safe.

Who is protecting you

U.S. Environmental Protection Agency (EPA)

EPA's Federal Radiation Protection Guidance for Exposure of the General Public provides Federal agencies and states a reference for developing rules and regulations to protect the American public from potentially harmful effects of radiation, including those from natural radiation (not including radon).

EPA's RadNet monitoring system is a national network of monitoring stations that regularly collect air, precipitation, drinking water, and milk samples for analysis of radioactivity.

EPA also develops standards for disposal of nuclear waste and in some cases, oversees the disposal of radioactive material.

EPA's Protective Action Guides protect the public in radiological emergencies and including actions to prevent exposure from contaminated soil and food.

U.S. Nuclear Regulatory Commission (NRC)

The NRC monitors the actions of the nuclear power plant to ensure the protective actions are appropriate. Immediately upon becoming aware that an incident has occurred that may result in a radiation dose that exceeds federal government protective action guides, responsible nuclear power plant personnel evaluate plant conditions and then make protective action recommendations (PARs) to the State and local government agencies on how to protect the population.

U.S. Department of Agriculture (USDA)

USDA establishes guidelines for preventing and addressing potentially contaminated crops and livestock during a radiological emergency.

U.S. Food and Drug Administration (FDA)

FDA monitors naturally-occurring and man-made radionuclides in food as part of its Total Diet Studies (TDS).

U.S. Department of Energy (DOE)

DOE's Office of Environmental Management issues regulations related to spills, releases, and cleanup of radiation in the soil on and around DOE facilities. DOE requires its facilities to limit how much radiation may be released, and it ensures that all facility operators comply with these agency standards.

The States

States have a variety of programs relating to the protection of soil, crops and livestock. States apply EPA's Protective Action Guides in the event of a radiological emergency. Some states have created more stringent standards for disposal of radioactive material than the federal limits established by EPA.

What you can do to protect yourself

In most cases the radionuclides in soil are natural and pose little threat to your health.

During a radiological emergency response where food contamination may be an issue, listen for advisories from your Federal, State or local public health officials. Common food processing safety actions can be taken to reduce the amount of radioactive contamination in or on food such as washing, brushing or peeling the surface of the fruits or vegetables.

Resources

You can explore this radiation source further through the resources at the following URL:

<http://www.epa.gov/radtown/soil.html#resources>

We provide these resources on-line rather than here so we can keep the links up-to-date.