



Radionuclides in the Ecosystems

An ecosystem is defined as a place having unique physical features, encompassing air, water, and land, and habitats that support plant, animal life and human life. Radioactive elements, called radionuclides, are part of our ecosystem because they are a part of the air we breathe, the water we drink and the food we eat.

An ecosystem is a dynamic and complex whole, interacting as an ecological unit. The organisms in an ecosystem are typically well-balanced with each other and with their environment. Here is the typical life cycle of radionuclides and their interaction with other parts of our ecosystem:

- A tree's root digs down into a crack in the earth, prying the rock apart and turning the rock into soil. The rock contained radionuclides that, through this process, have now been brought to the surface.
- Whether the radionuclides are natural or man-made, they move through the ecosystem and can become part of the food chain. For example, some radionuclides attach to soil particles and migrate immediately into groundwater and streams and become a part of the earth's water cycle (these can get deposited right back into the soil through evaporation and then rain). Other radionuclides attach to soil particulates and end up in the air traveling with the atmospheric cycle. Some radionuclides remain a part of the soil and are taken up by plants.
- Animals consume these plants, drink the water and breathe the air. The radionuclides are now in the animals.
- Humans eat the plants and the animals that ate the plants, drink the water and breathe the air. The radionuclides also are in humans.
- The remains of plants and animals are returned to the Earth and, over time, are crushed and pressured back into rock and the cycle begins again.

Our ecosystems have evolved and thrived in the presence of naturally-occurring radioactive material, which may fluctuate from place to place but which has remained more or less "constant" for many millions of years. While natural radiation is a part of an ecosystem it does have health effects. Over the years, numerous scientific studies have concluded that some portion of the natural incidence of cancer, leukemia, genetic damage, birth defects and other diseases in human and non-human populations, is attributable to background radiation. However, it is unlikely that the viability of our ecosystems will be threatened in a major way, as long as the balance and interactions of radioactive material remain relatively the same.

What is not known is an ecosystem's tolerance for significant changes in the balance and interactions of radiation within the ecosystem. So far, the additions of man-made radioactivity have been a small fraction of background levels. However, a catastrophic radiological incident, such as the 1986 nuclear reactor accident at Chernobyl, can add significant amounts of man-made radiation to an ecosystem in a short period of time.

It is the study of the Chernobyl accident that has provided insights into a valuable natural "cleansing" service provided by an ecosystem. As radioactive material moves through the soil, water and air, trees, plants, and animals, the ecosystem filters excess radioactive material over time. Recent studies on the ecology of the Chernobyl region have shown that, in the last twenty years since the accident, the region's ecosystem is rebounding and beginning to function normally. This means that ecosystems may be able to rid themselves of excess radiation.

Who is protecting you

U.S. Environmental Protection Agency (EPA)

EPA's RadNet monitoring system is a national network of monitoring stations that regularly collects air, precipitation, drinking water, and milk samples for analysis of radioactivity and provides an overview of the overall background levels of the United States ecosystem.

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 air, water, soil and food.

U.S. Department of Agriculture (USDA)

USDA monitors efforts to store radioactive waste that might impact the nation's food chain. USDA works with the U.S. Geological Service and U.S. Fish and Wildlife Service to ensure that radioactive materials are disposed in places that contain the radioactive material and prevent it from interacting with the ecosystem.

U.S. Food and Drug Administration (FDA)

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

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

U.S. Department of Energy (DOE)

The DOE's Department 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 standards.

The States

The 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 can you do to protect yourself

In most cases, the naturally-occurring radionuclides as they interact within an ecosystem pose little threat to your health. They are a part of the air we breathe, the water we drink and the food we eat.

In a radiological emergency 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/ecosystems.htm#resources>

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