COMMENTARY

Radioactive pollution in environment

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The numerous applications of radioisotopes for industrial, medicinal, and power generation invariably result in the release of some of those radioisotopes into the environment. These releases can be classified as either planned releases that are a typical element of the technology's application or unplanned or uncontrolled discharges that are linked with incidents. In the case of routine environmental discharges, each activity is examined to ensure that the advantages outweigh the drawbacks and that the health risks are insignificant. When it comes to accidental leaks, government officials utilize action levels to assess when clean-up efforts are necessary to protect the public's health.

Radioactive contamination is caused by the release of radionuclides into the environment by nuclear power plants, military bases, research institutions, hospitals, and general industry. Furthermore, historical nuclear weapons testing in the atmosphere and underground, nuclear and radioactive accidents, and the intentional discharge of radioactive wastes from nuclear and other establishments are sources of radioactive contamination. Such radionuclides have the potential to migrate from the atmosphere and the oceans to the ground and into the food chain. In the form of natural radiation, radiation is widespread on Earth.

Radiation from a variety of sources is always present in all living organisms. The pioneering work of Roentgen and Becquerel in understanding radiation and its impact on humans and the environment extends back nearly a century. The Curies developed the first pure radioactive materials less than 40 years later, and scientists split the atom within a decade of this finding. Radiation has since been utilized to diagnose and treat medical problems, to generate power, and in a variety of other industrial, agricultural, and research uses. Pollution is one of humanity's major challenges; it occurs when a substance is released into the environment in a way or quantity that prevents the ecology from adequately processing it, resulting in negative impacts on the ecosystem.

Both governments and individuals have placed a high priority on protecting the environment from the effects of radioactive pollution. The atom is the fundamental building block of matter; it is composed of a small heavy nucleus surrounded by an electron cloud. Positively charged protons and neutrally charged neutrons make up the nucleus. If the nucleus has too many neutrons or protons, the forces between them become imbalanced, resulting in an unstable nucleus. An unstable nucleus will vibrate incessantly and attempt to achieve stability by radioactive decay. Alpha particles, beta particles, gamma rays, and neutron radiation are the most common forms of radiation emitted during radioactive decay. Alpha particles are positively charged and energetic helium nuclei made up of two protons and two neutrons.

The emission of these particles is uncommon in nuclides lighter than lead, but widespread in heavier nuclides like uranium-238, radium-226, and polonium-210. Despite their enormous energy, these particles travel slowly through air due to their high mass, and they can be totally absorbed by paper or skin. Beta particles are electrons that move quickly and are emitted from the nucleus during radioactive decay. There are two types of beta decays. One proton is converted into a neutron in the initial + decay, and a positron and neutrino are emitted. In the second decay, a neutron transforms into a proton, and an antineutrino is emitted. Humans are exposed to beta particles from both manmade and natural sources of radiation. Tritium, carbon-14, and strontium-90 are examples of common radionuclides that emit considerable beta radiation.

Beta particles are more permeable than alpha particles, and can be totally absorbed by plastic, glass, or metal sheets. Gamma rays are weightless energy packets known as photons, which are a type of high frequency electromagnetic radiation. Naturally occurring potassium-40, which is present in the human body, is one source of gamma rays in the environment. Cobalt-60 and cesium-137 are two artificial sources. Gamma rays are extremely penetrating, and only thick materials such as lead may provide adequate shielding. Gamma rays can easily travel through the human body, with only a small fraction being absorbed by tissue. Neutron radiation is defined as a neutron emitted by an unstable nucleus, which frequently fissions and fuses. Neutrons are extremely penetrating; when they interact with substance or tissue, they emit and radiations.

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