Radioactive Materials

Naturally Occurring or Artificial

Radionuclides	Radiation being emitted	Half-life
Thorium-232 (Th-232)	α, γ	14.1 billion years
Uranium-238 (U-238)	α, γ	4.5 billion years
Potassium-40 (K-40)	β, γ	1.3 billion years
Plutonium-239 (Pu-239)	α, γ	24,000 years
Carbon-14 (C-14)	β	5,730 years
Cesium-137 (Cs-137)	β, γ	30 years
Strontium-90 (Sr-90)	β	29 years
Tritium (H-3)	β	12.3 years
Cesium-134 (Cs-134)	β, γ	2.1 years
Iodine-131 (I-131)	β, γ	8 days
Radon-222 (Rn-222)	α, γ	3.8 days

Artificial radionuclides are shown in red letters.

α: α (alpha) particles, β: β (beta) particles, γ: γ (gamma)-rays

Radionuclides with long half-lives, such as Thorium-232 in the thorium series, Uranium-238 in the uranium series, and Potassium-40, were created in the universe in the distant past and taken into the earth when the earth was born.

Thorium-232 and Uranium-238 transform into various radionuclides by emitting α (alpha)-particles, β (beta)-particles, and γ (gamma)-rays before transforming into Lead-208 and Lead-206, respectively.

Carbon-14, which is also a naturally occurring radionuclide, is created when nitrogen that accounts for 78% of the atmosphere is hit by a neutron created as a result of collisions of cosmic rays and the atmosphere. Carbon-14 returns to nitrogen by emitting β-particles.

Cesium-134, Cesium-137, Strontium-90, Iodine-131, and Plutonium-239 can be released into the environment in the event of a nuclear plant accident. Some artificial radionuclides, such as Plutonium-239, have very long half-lives.

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