Strontium-90
(^{90}Sr)

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Office of Radiation Protection

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WHO DISCOVERED STRONTIUM?

Strontium was discovered by Adair Crawford, an Irish chemist, in 1790 while studying the mineral witherite ($BaCO_3$). When he mixed witherite with hydrochloric acid (HCl) he did not get the results he expected. He assumed that his sample of witherite was contaminated with an unknown mineral, a mineral he named strontianite (SrCO3). Strontium was first isolated by Sir Humphry Davy, a British chemist, in 1808 through the electrolysis of a mixture of strontium chloride (SrCl2) and mercuric oxide (HgO). Today, strontium is obtained from two of its most common ores, celestite (SrSO4) and strontianite (SrCO3), by treating them with hydrochloric acid, forming strontium chloride. The strontium chloride, usually mixed with potassium chloride (KCl), is then melted and electrolyzed, forming strontium and chlorine gas (Cl2).

WHAT IS STRONTIUM-90 USED FOR?

Many radioactive sealed sources, such as ^{137}Cs, ^{192}Ir, ^{90}Sr, and ^{125}I, are used to treat cancer. Strontium-90 also has some uses in luminous signs, nuclear batteries and industrial gauging.

WHERE DOES STRONTIUM-90 COME FROM AND WHERE IS IT FOUND?

Stronium-90 is an artificially produced fission by-product resulting from nuclear bombs, above-ground nuclear testing, nuclear reactor operations and nuclear accidents. Strontium-90 is found in the liquid waste stream of nuclear reactors, but is not released to the environment during normal nuclear reactor operations. It is not as likely as cesium-137 to be released as a part of a nuclear reactor accident because it is much less volatile, but it is probably the most dangerous components of the radioactive fallout from a nuclear weapon.

In addition to the great destructive power of fission bombs, highly radioactive fission byproducts are released into the atmosphere and spread over a wide area. Radioactive fallout in the form of fine particulate matter is particularly dangerous because it can be ingested, bringing beta emitters into the body where they can do much more damage. One of the most serious components of the fallout from weapons testing in the deserts of Arizona and Utah was strontium-90.

As a result of atmospheric nuclear tests, strontium-90 is dispersed in varying concentrations throughout the earth's atmosphere and soil.

IS STRONTIUM-90 HAZARDOUS?

The main pathways of exposure are ingestion and inhalation. The principal ecological pathway is grass $\rightarrow$ cow $\rightarrow$ milk $\rightarrow$ human food chain. The short-lived decay product ^{90}Y, Beta-decays with an average energy of 0.93 MeV (2.28 Mev max.) that contributes to the internal dose of ^{90}Sr.

Because of strontium-90's chemical similarity to calcium, it is re adily taken up in the tissues of plants and animals; it may enter the human food supply, mainly in milk. It is particularly dangerous for growing children as it is easily deposited in the bones and is believed to induce bone cancer and leukemia.

PROPERTIES OF STRONTIUM-90 (^{90}Sr)

Half-Life:

Physical: 28.78 years

Biological: Retention is described by a complicated power function equation (ICRP Publication 20, 1973)

Principal Modes of Decay (MeV):

Beta-average 0.196, maximum 0.546 (100%)

Special Chemical and Biological Characteristics:

Alkaline earth element, with tendency to concentrate throughout the mineralized bone volume

Principal Organs:

Mineralized Bone Volume

Amount of Element in Body:

320 mg

Daily Intake of Element in Food and Fluids:

1.9 mg

Sources

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