Americium-241
(^{241}Am)

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Fact Sheet #23

Division of Environmental Health
Office of Radiation Protection

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WHO DISCOVERED AMERICIUM?

The discovery of element number 95 was announced on an American children's radio program called Quiz Kids in November 1945 by Glenn Seaborg, the chemist who worked on the Manhattan Project and co-discovered ten elements including plutonium. The first sample of americium was produced by bombarding plutonium-239, an isotope of plutonium, with high-energy neutrons. This formed plutonium-240, which was itself bombarded with neutrons. The plutonium-240 changed into plutonium-241, which then decayed into americium-241 through a process known as beta decay. This work was carried out at the University of Chicago's Metallurgical Laboratory, now known as Argonne National Laboratory. The new element did not receive its name, chosen by Seaborg in honor of the continent where it was discovered, until 1946.

Americium, symbol Am, has atomic number 95 and atomic weight 243. Metallic americium is a silvery metal, which tarnishes slowly in air and is soluble in acid. Its most stable isotope, americium-243, has a half-life of over 7,500 years, although americium-241, with a half-life of 470 years, was the first isotope to be isolated.

WHAT IS AMERICIUM-241 USED FOR?

Americium-241 is used as a neutron source in non-destructive testing of machinery and equipment, and as a thickness gauge in the glass industry. However, its most common application is as an ionization source in smoke detectors, and most of the several kilograms of americium made each year are used in this way.

Smoke detectors rely on alpha radiation from americium-241, which ionizes the air in a gap between two electrodes, causing a very small electrical current to flow between

them. When smoke enters the space between the electrodes, the alpha radiation is absorbed by soot particles, the current drops, and the alarm is sounded.

The alpha particles from the smoke detector do not themselves pose a health hazard, as they are absorbed in approximately an inch of air or by the structure of the detector.

Americium-241 is also used in backscatter gauges, fill height detectors and in measuring the ash content in coal.

WHERE DOES AMERICIUM-241 COME FROM AND WHERE IS IT FOUND?

^{241}Pu was once found naturally and decayed to form a natural supply of ^{241}Am. Due to the short half-life of ^{241}Pu (14 years) the original, naturally formed supply has not survived. Since there is no longer a natural source of ^{241}Pu, ^{241}Am is not being formed naturally. The natural supplies of ^{241}Am have since decayed and are no longer remaining.

Today, americium-241 is produced artificially from the decay of ^{241}Pu. Americium-241 is a by-product of nuclear weapons detonations (decay of ^{241}Pu) and is found in the environment due to the fallout of ^{241}Pu from nuclear weapons testing.

IS AMERICIUM-241 HAZARDOUS?

The main pathways of exposure from Amercium-241 are inhalation and ingestion. Americium-241 is a potentially dangerous isotope if it is taken into the body in soluble form. It decays by both alpha activity and gamma emissions and it would concentrate in the skeleton and liver. However, swallowing the radioactive material from a smoke detector would not lead to significant internal absorption of Am-241, since the dioxide form is insoluble. It will pass through the digestive tract, without delivering a significant radiation dose.

The highest dose from external (gamma) radiation is reported to be 0.014 mrem to an individual sleeping 6 ft from the detector for 8 hours per day. The average annual individual dose equivalent to a smoke detector user is 8 μrem per year.

PROPERTIES OF AMERICIUM-241 (^{241}Am)

Half-Life:

Physical:	432.2 years
Biological:	Bone 50 years Liver 20 years Gonads, Considered Permanent

Principal Modes of Decay (MeV):

Alpha 5.49 (84.5%), 5.44 (13%)

Gamma 0.0595 (35.9%), 0.0263 (2.4%)

Special Chemical and Biological Characteristics:

Oxides and Hydroxides of Am (III) are relatively insoluble

Principal Organs:

Bone surfaces, Liver

Amount of Element in Body:

Trace

Sources

Jefferson Lab, http://education.jlab.org/itselemental/ele095.html
Environmental Radioactivity, Eisenbud, Merril & Gesell, Thomas, 1997

Links to external resources are provided as a public service and do not imply endorsement by the Washington State Department of Health.