Cesium-137
(^{137}Cs)

January 2003
Fact Sheet 320-077

Division of Environmental Health
Office of Radiation Protection

Washington State Department of Health

WHO DISCOVERED CESIUM?

In 1860, R. W. Bunsen and G. R. Kirchoff discovered the element (the first to be discovered by the use of the spectroscope) and named it for the two bright blue lines characteristic of its spectrum. It was first isolated by Carl Sefferburg in 1881 by electrolysis of its salts.

WHAT IS CESIUM-137 USED FOR?

Cesium-137, was used in intracavitary brachytherapy radiation therapy for the treatment of cancer, and now, as a sealed source, is used in the treatment of cancer. It is also used as a radiotracer for the identification of sources of soil erosion and deposition, in density and fill height level switches, in atomic clocks and in food irradiation.

WHERE DOES CESIUM-137 COME FROM AND WHERE IS IT FOUND?

On 16 July 1945 at 1230 Greenwich Civil Time, nuclear weapon tests were begun that have released ^{137}Cs and other radioactive nuclides into the environment, where they have been dispersed over wide areas. Over the 50 years since this first test, much research has been done to understand the movement and fate of ^{137}Cs in the environment.

Cesium-137 is an artificially produced fission by-product resulting from nuclear bombs, above-ground nuclear testing, nuclear reactor operations and nuclear accidents.

Cesium-137 is found in the liquid and airborne waste stream of nuclear reactors, but is not released to the environment, beyond trace levels in the liquid effluent, during normal nuclear reactor operations. It is likely to be released as a part of a nuclear reactor accident due to its volatility.

IS CESIUM-137 HAZARDOUS?

Because it is so tightly bound to clay soils root uptake is slight, so foliar absorption is, therefore the main portal of entry into the food chain during periods of active fallout. Besides its persistence and high activity, cesium-137 has the further insidious property of being mistaken for potassium by living organisms and taken up as part of the fluid electrolytes. This means that it is passed up the food chain and reconcentrated from the environment by that process. Cesium is readily absorbed in the GI tract.

The principal ecological pathway is grass $\rightarrow$ cow $\rightarrow$ milk $\rightarrow$ human food chain and it is the single largest contributor of cesium-137 to the U.S. adult diet. Grain products, meat (grass $\rightarrow$ cattle $\rightarrow$ meat $\rightarrow$ human food chain), fruit and vegetables combined contribute about 2/3 to the dietary intake of cesium-137. The other pathways of exposure are ingestion (drinking water and fish consumption), inhalation and external exposure from ground deposition. When ingested about 80% is deposited in the muscle and about 85% in the bone.

Due to fallout it is estimated that the current dose r eceived by cesium-137 is less than 1 mrem per year.

PROPERTIES OF CESIUM-137 (^{137}Cs)

Half-Life:

Physical: 30.17 years

Biological: 110 days

Principal Modes of Decay (MeV):

Beta-average 0.17, maximum 0.514 (94.4%)

Beta-average 0.417, maximum 1.18 (5.6%)

Gamma 0.662 (85.1%) from Daughter Product ^{137m}Ba

Special Chemical and Biological Characteristics:

Metabolism resembles potassium (K) and distributes uniformly throughout the body. Convenient to express concentration in biological material relative to the K content.

Principal Organ:

Whole body

Amount of Element in Body:

1.5 mg

Daily Intake of Element in Food and Fluids:

10 µ

Sources

InfoPlease, http://www.infoplease.com/ce6/sci/A0811167.html
United States Department of Agriculture, http://hydrolab.arsusda.gov/cesium137bib.htm
HyperPhysics, http://hyperphysics.phy-astr.gsu.edu/hbase/nucene/fisfrag.html#c4
Environmental Radioactivity, Eisenbud, Merril & Gesell, Thomas, 1997

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