

Thorium-232



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Fact Sheet #30

Division of Environmental Health
Office of Radiation Protection



WHO DISCOVERED THORIUM?

Thorium is a naturally occurring, slightly radioactive metal discovered in 1828 by the Swedish chemist Jons Jakob Berzelius, who named it after Thor, the Norse god of war. It is found in small amounts in most rocks and soils, where it is about three times more abundant than uranium. Soil commonly contains an average of around 6 parts per million (ppm) of thorium.

WHAT IS THORIUM-232 USED FOR?

Fertile Materials for Nuclear Fuel: Fertile nuclides are able to absorb a neutron and transform to a nuclide that is able to undergo fission (fissile nuclide). Thorium-232 is a fertile nuclide and is used in combination with a fissile nuclide as a fuel source in types of nuclear reactors known as breeder reactors. Breeder reactors are able to continually generate new fuel as fuel is being consumed. The United States does not operate breed reactors.

Thorium-232 is also used in gas lantern mantles and welding electrodes.

WHERE DOES THORIUM-232 COME FROM AND WHERE IS IT FOUND?

Thorium-232 is a naturally occurring radionuclide that is found in the earth's crust. It is considered a "primordial radionuclide" since it has survived since the origin of the earth.

IS THORIUM-232 HAZARDOUS?

The main pathways of exposure are ingestion and inhalation.

Because of its relative insolubility and low specific activity ^{232}Th is not present in biological materials in significant amounts. Thorium was found to be present in the highest concentrations in the pulmonary lymph nodes and lungs, indicating that the principal source of human exposure is inhalation of suspended soil particles.

PROPERTIES OF THORIUM-232 (^{232}Th)

Half-Life:

Physical: 1.405×10^{10} years

Biological: bone, 8000 days, liver and tissues, 700 days

Sources:

Naturally occurring primordial nuclide

Principal Modes of Decay (MeV):

Alpha 4.01 (77.8%), 3.95 (22.1%)

Gamma 0.0638 (0.267%)

Special Chemical and Biological Characteristics:

Hydroxides and oxides are insoluble; nitrates, sulfates, chlorides, and perchloride salts are readily soluble. Tendency to accumulate on bone surfaces.

Principal Organs:

Bone Surface

Amount of Element in Body:

30 μg

Daily Intake of Element in Food and Fluids:

3 μg

Amount of Nuclide in the Body:

1.3 pCi

Special Ecological Aspects:

Thorium-bearing minerals result in anomalously high natural levels in certain areas in Brazil, India, and China. Depending on type of rock, the concentration of ^{232}Th in the earth's crust is 2–20 $\mu\text{g}/\text{g}$ and about 10 $\mu\text{g}/\text{g}$ for normal soil.

Sources

Environmental Radioactivity, Eisenbud, Merrill & Gesell, Thomas, 1997

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