Iodine-131
(^{131}I)

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Fact Sheet 320-085

Division of Environmental Health
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WHO DISCOVERED IODINE?

Iodine was discovered by the French chemist Barnard Courtois in 1811. Courtois was extracting sodium and potassium compounds from seaweed ash. Once these compounds were removed, he added sulfuric acid (H_2SO_4) to further process the ash. He accidentally added too much acid and a violet colored cloud erupted from the mass. The gas condensed on metal objects in the room, creating solid iodine. Today, iodine is chiefly obtained from deposits of sodium iodate ($NaIO_3$) and sodium periodate ($NaIO_4$) in Chile and Bolivia. The human body requires trace amounts of iodine. Iodine is part of thyroxin, a hormone produc ed by the thyroid gland that controls the body's rate of physical and mental development. A lack of iodine can also cause a goiter, a swelling of the thyroid gland. Iodine is added to salt (iodized salt) to prevent these diseases.

WHAT IS IODINE-131 USED FOR?

Iodine-131 is used to treat some diseases of the thyroid gland. Iodine-131 is widely used in imaging the thyroid and in treating thyroid cancer and other abnormal conditions such as hyperthyroidism. It also used to diagnose abnormal liver function, renal (kidney) blood flow and urinary tract obstruction. Iodine-131 is a strong gamma emitter but is used for beta therapy.

WHERE DOES IODINE-131 COME FROM AND WHERE IS IT FOUND?

Iodine-131 is an artificially produced fission by-product resulting from nuclear weapons, above-ground nuclear testing, and nuclear reactor operations. Iodine-131 is found in the gaseous and liquid waste streams of nuclear power plants, but is not released to the environment during normal reactor operations.

IS IODINE-131 HAZARDOUS?

The principal route of human absorption is ingestion via fresh milk by the grass $\rightarrow$ cow $\rightarrow$ milk $\rightarrow$ human food chain, with rapid distribution of milk being a primary consideration. Concentration of radionuclides in milk reaches a peak days after deposition on forage. Iodine-131 can also cause exposure by ingestion (consumption of green leafy vegetables, drinking water, fish and shellfish), as well as exposure by inhalation and external exposure from ground deposition.

Iodine-131 is a major concern in any kind of radiation release from a nuclear accident because it is volatile and because it is highly radioactive, having an 8-day half-life. It is of further concern in the human body because iodine is quickly swept up by the thyroid, so that the total intake of iodine becomes concentrated. The thyroid has a maximum uptake of iodine. Ingesting Potassium Iodide tables (KI) will afford protection against the uptake of radioactive iodine-131 released in an accident by saturating the thyroid with KI.

PROPERTIES OF IODINE-131 (^{131}I)

Half-Life:

Physical: 8.04 days

Biological: thyroid, 120 days; rest of tissue 12 days

Principal Modes of Decay (MeV):

Beta-average 0.0694 maximum 0.248 (2.1%)

Beta-average 0.0966 maximum 0.334 (7.27%)

Beta-average 0.192 maximum 0.606 (89.9%)

Gamma 0.0802 (2.62%), 0.284 (6.14%), 0.365 (81.7%), 0.637 (7.17%)

Principal Organ:

Thyroid

Amount of Element in Body:

11 mg

Daily Intake of Element in Food and Fluids:

200 μg

Sources

Jefferson Lab, http://education.jlab.org/itselemental/ele053.html
Environmental Radioactivity, Eisenbud, Merril & Gesell, Thomas, 1997
HyperPhysics, http://hyperphysics.phy-astr.gsu.edu/hbase/nucene/fisfrag.html#c1