EPA Facts about Iodine

What is Iodine?

Iodine is a metal found throughout the environment in a stable form, iodine-127, and as unstable radioactive isotopes of iodine. These radioactive forms include iodine-129 and iodine-131. Iodine-129 is produced naturally in the upper atmosphere. Iodine-129 and iodine-131 are also produced in nuclear explosions. In addition, iodine-129 is released at very low levels into the environment from facilities that separate and reprocess nuclear reactor fuels and from waste storage facilities.

What are the uses of iodine?

Stable iodine-127 is used as a dietary supplement for thyroid deficiencies. In addition, iodine-131, iodine-125, and iodine-123 are used for imaging, and iodine-131 is used for therapy for treatment of various thyroid conditions.

How does iodine change in the environment?

Iodine-129 and 131 are two of the more common radioactive forms of iodine. Both iodine-129 and iodine-131 release radiation during the decay process by emitting a beta particle and gamma radiation. The time required for a radioactive substance to lose 50 percent of its radioactivity by decay is known as the half-life. The half life of iodine-131 is relatively short, at 8 days, while the half life of iodine-129 is much longer, at more than 15 million years.

How are people exposed to iodine?

People can be exposed to all forms of iodine through the food chain. However, current environmental levels of radioactive iodine are low. In addition fish, bread, milk, and iodized salt contain stable iodine.

Large quantities of radioactive iodine-131 have been released into the environment by nuclear weapons testing and the Chernobyl and Fukushima nuclear power plant accidents; however, the current level of iodine 131 in the environment is very low. The reason is that iodine-131 has a very short half life. Iodine-129 is naturally occurring in the environment, and it has also been produced by nuclear weapons testing. The amount of iodine-129 produced by nuclear weapons testing is less than the inventory of naturally occurring iodine-129. Iodine-129 is found in radioactive wastes from defense-related government facilities and nuclear fuel cycle facilities.

How does iodine get into the body?

Iodine is soluble in water, which allows it to move easily from the atmosphere into living organisms. For this reason, iodine can be concentrated in marine organisms. Iodine can also be concentrated in grass, where it then can be ingested by cows and incorporated into their milk. Iodine can be found on leafy vegetables and then consumed directly by humans. Once iodine is ingested into the human body, a portion of it is concentrated in the thyroid gland

and the rest is excreted. The most probable means of exposure to radioactive iodine is from a patient who has been recently administered radioactive iodine for imaging or therapeutic purposes.

The uptake of radioactive iodine by the thyroid is inversely related to the intake of stable iodine. For this reason, protection from radioactive iodine after an emergency release is accomplished by ingesting large doses of stable iodine. It should be noted that large doses of stable iodine can be a health hazard and should not be taken except in an emergency and when directed by the appropriate emergency response officials.

Is there a medical test to determine exposure to iodine?

Since iodine is concentrated in the thyroid gland, radioassay of the thyroid is used to determine the exposure level from iodine. Whole body counts that measure iodine gamma radiation can also be used to measure iodine in the body.

How can iodine affect people's health?

The predominant health concern for radioactive iodine is in the thyroid gland, where it may induce nodules or thyroid cancer. This health effect is of particular concern for children and pregnant women. High doses of iodine are used to treat thyroid cancer. Lower doses of radioactive iodine will result in reducing the activity of the thyroid gland, which in turn will result in lower hormone production in the gland. There is a fine balance when treating thyroid problems with radioactive iodine. These treatments are administered only when the benefits outweigh the risks. As with any radioactive material, there is an incremental chance that a cancer can result from that incremental exposure to radioactive materials.

What recommendations has the U.S. Environmental Protection Agency made to protect human health?

Please note that the information in this section is limited to recommendations EPA has made to protect human health from exposure to iodine-131. General recommendations EPA has made to protect human health at Superfund sites (the 10^{-4} to 10^{-6} cancer risk range), which cover all radionuclides including iodine-131, are summarized in the fact sheet "Primer on Radionuclides Commonly Found at Superfund Sites."

EPA has established a Maximum Contaminant Level (MCL) of 4 millirems per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of iodine-131, which is assumed to yield 4 millirems per year, is 3 picoCuries per liter (pCi/L). If other radionuclides that emit beta particles and photon radioactivity are present in addition to iodine-131, the sum of the annual dose from all the radionuclides cannot exceed 4 millirems/year.

For more information about how EPA addresses iodine at Superfund sites
Contact Stuart Walker of EPA:
(703) 603-8748 or walker.stuart@epa.gov,
or visit EPA's Superfund Radiation Webpage:
http://www.epa.gov/superfund/resources/radiation