



EPA Facts About Tritium

July 2002

What is Tritium?

Tritium is a form of hydrogen that is radioactive, and like hydrogen it reacts with oxygen to form water. Tritium is produced naturally in the upper atmosphere when cosmic rays strike atmospheric gases. Tritium can also be produced by man during nuclear weapon explosions, in reactors intended to produce tritium for nuclear weapons, and by reactors producing electricity.

What are the uses of tritium?

Tritium has been produced in large quantities by the nuclear military program. It is also used to make luminous dials and as a source of light for safety signs. Tritium is used as a tracer for biochemical research, animal metabolism studies and ground water transport measurements.

How does tritium change in the environment?

Tritium is not a stable element. Tritium decays by emitting a beta particle and turning into helium. The release of radiation during this decay process causes concern about the safety of tritium and all other radioactive substances. The radiation from the decay of tritium is in the form of beta particles which are of very low energy. Because of this the particles cannot pass through the skin surface.

Tritium is the only radioactive isotope of hydrogen and like hydrogen it reacts with oxygen to form water. The transformation of tritium to tritiated water is a complex and slow process. Tritium is a colorless, odorless gas with a half-life of 12.3 years. Tritiated water moves through the environment like ordinary water.

How are people exposed to tritium?

Although large quantities of tritium have been released into the environment, the dose to humans is small. Tritium was dispersed throughout the world by atmospheric nuclear weapons tests that took place from the mid 1950s

to the early 1960s. The inventory of tritium in the atmosphere peaked in 1963 and has been decreasing rapidly since then. Levels of naturally occurring tritium in the atmosphere produced by cosmic rays are constant, and it is projected that levels of manmade tritium will be comparable to natural tritium by 2030.

Tritium is currently produced by reactors producing electricity. However, releases of tritium from these facilities are at fractions of the natural background production rates. Other sources of tritium include government plants which have reprocessed reactor fuels. Individuals can also be exposed to tritium broken exit signs and luminous dial items that contain tritium.

Since tritium reacts similarly to ordinary hydrogen it is incorporated into the body easily in the form of water.

Overall, since current world wide levels of tritium in the environment from man-made and natural sources are low, the risk to the average person from tritium is typically not significant. Accidental exposure from elevated levels of tritium from broken exit signs or other concentrated sources, however can pose a health risk to individuals.

How does tritium get into the body?

Most tritium in the environment is in the form of tritiated water which is dispersed throughout the environment in the atmosphere, streams, lakes, and oceans. Tritium in the environment can enter the human body as a gas or as a liquid by ingestion and inhalation, and through the skin by absorption. Once entered into the body, tritium tends to disperse quickly so that it is uniformly distributed throughout the body. The tritium distribution in tissue is dependent on the amount of water contained in the tissues. Tritium is rapidly excreted over a month or two after ingestion.

Is there a medical test to determine exposure to tritium?

Since tritium is distributed throughout the body within a few hours after ingestion, levels within the body are measured by collecting a urine sample and analyzing it for tritium.

D-44

How can tritium affect people's health?

With respect to chemical reactions, tritium reacts similarly to ordinary hydrogen. Tritium therefore dilutes through the body as ordinary water. Tritium concentration in soft tissue and the associated dose to these tissues is generally uniform and dependent on the water content of the tissue. Because the water content in the body turns over frequently, tritium is rapidly cleared from tissues.

What recommendations has the 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 tritium. General recommendations EPA has made to protect human health, which cover all radionuclides including tritium, are summarized in the Introduction section of this booklet.

EPA has established a Maximum Contaminant Level (MCL) of 4 millirem per year for beta particle and photon radioactivity from man-made radionuclides in drinking water. The average concentration of tritium which is assumed to yield 4 millirem per year is 20,000 picocuries (pCi/l). If other radionuclides which emit beta particles and photon radioactivity are present in addition to tritium, the sum of the annual dose from all the radionuclides shall not exceed 4 millirem/year.

For more information about how EPA addresses tritium at Superfund sites, please contact either:

EPA's Superfund Hotline
1-800-424-9346 or 1-800-535-0202
or EPA's Superfund Radiation Webpage
[http://www.epa.gov/superfund/resources/radiation/
index.htm](http://www.epa.gov/superfund/resources/radiation/index.htm)