

Thorium - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about thorium. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Thorium is a radioactive substance that occurs naturally in the environment. Thorium does not appear to cause cancer, except when intentionally injected intravenously. This chemical has been found in at least 16 of the 1,177 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is thorium?

Pronounced (thô'-rê-m) Thorium is a naturally occurring, radioactive substance. In the environment, thorium exists in combination with other minerals, such as silica. Small amounts of thorium are present in all rocks, soil, water, plants, and animals. Soil contains an average of about 6 parts of thorium per million parts of soil (6 ppm). More than 99% of natural thorium exists in the form of thorium-232. It breaks down into two parts—a small part called “alpha” radiation and a large part called the decay product. The decay product is also not stable and continues to break down through a series of decay products until a stable product is formed. During these decay processes, radioactive substances are produced. These include radium and radon. These substances give off radiation, including alpha and beta particles, and gamma radiation. Some rocks in underground mines contain thorium in a more concentrated form. After these rocks are mined, thorium is usually concentrated and changed into thorium dioxide or other chemical forms. After most of the thorium is removed, the rocks are called “depleted” ore or tailings. Thorium is used to make ceramics, gas lantern mantles, and metals used in the aerospace industry and in nuclear reactions. Thorium can also be used as a fuel for generating nuclear energy. Thorium-227 (a form of thorium that comes from the decay of uranium) has been proposed to treat skeletal pain associated with cancers so as to improve the quality of life. Measuring the ratio of two radioactive forms of thorium have been used to determine if ivory from African elephant tusks was poached since 1976 when a European Union law went into effect.

What happens to thorium when it enters the environment?

- Thorium is a natural part of the environment.
- Thorium changes extremely slowly into other radioactive substances.
- It takes about 14 billion years for half of the thorium-232 to change into new forms.
- As rocks are broken up by wind and water, the thorium and all other components of the rocks become part of the soil.
- Thorium in soil can be washed into rivers and lakes.
- Windblown dust and volcanic eruptions are natural sources of thorium in the air.
- Burning coal may release small amounts of thorium into the air.
- Mining thorium or making products that contain it may also release thorium into the environment.

How might I be exposed to thorium?

- Just by being alive, everyone is exposed to small amounts of thorium in air, water, and food.
- by breathing air near facilities where uranium, phosphate, or tin ore is processed.
- by living in homes built on soil with high levels of thorium.
- by working in the uranium, thorium, tin, and phosphate mining, and gas mantle production industries.
- by living near radioactive waste disposal sites where thorium can enter the environment.

Thorium

How likely is thorium to affect my health?

Studies on thorium workers have shown that breathing dust containing thorium and other substances may damage the lung many years after being exposed. Sufficiently high exposure may also change the genetic material of those body cells where the thorium is deposited. However, thorium is not known to cause birth defects or to affect the ability to have children. One study showed that working in a thorium plant increased the chance of death in males but decreased the chance of death in females. Increasing the amount of thorium in your environment could increase your exposure to radium and radon. Health effects from those substances and other radioactive materials are the subjects of separate toxicological profiles prepared by ATSDR.

Thorium was once thought to cause cancer in mine and mill workers, but it was later concluded that thorium likely had no significant impact on their cancer risk. Cancers in those workers were likely due to their cigarette smoking and inhaling silica dust. Exposure to thorium has produced lung tumors in animals. Thorium is mildly radioactive (has a very long half-life) so health effects from exposure may be partly from the chemical itself and partly from the radiation it emits. The International Agency for Research on Cancer (IARC) has not found sufficient evidence to classify thorium in mines and mills as carcinogenic.

IARC and the National Toxicology Program (NTP) have determined that medical thorium (a colloid form used until 1955) did cause cancer. People who had large amounts of thorium injected into their blood for special medical x-ray tests had more than the usual number of cancers, particularly of the liver, gall bladder, and leukemia. Also, medical thorium has been found to cause liver cirrhosis and chromosome damage. When improperly injected, medical thorium caused cancer, fibrosis, nerve damage, pain, and blood vessel changes in those areas where thorium had leaked out of the blood vessel. NTP also considers that thorium dioxide can cause cancer if it is injected into the body, as in a medical procedure.

Is there a medical test to show whether I've been exposed to thorium?

Special tests that measure the level of radioactivity from thorium in your urine and feces, and radon gas in the air you exhale can determine if you have been exposed to high levels of thorium. These tests are only useful if done within several days to a week after exposure. The tests cannot tell you if your health will be affected by the exposure. They require special equipment and are probably not available at your local clinic or hospital.

Has the federal government made recommendations to protect human health?

The EPA has set a drinking water limit of 15 picocuries per liter of water (15 pCi/L) for gross alpha particle activity and 4 millirems per year for beta particles and photon activity (for example, gamma radiation and x-rays). These values apply to all radioactive materials and are not specific only to thorium.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1990. Toxicological Profile for Thorium. Atlanta, GA: U.S. Department of Health and Human Services.

Agency for Toxic Substances and Disease Registry (ATSDR). 2014. Addendum to the Toxicological Profile for Thorium. Atlanta, GA: U.S. Department of Health and Human Services.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is <http://www.atsdr.cdc.gov/toxfaqs/index.asp>.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.