ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

PERCHLORATES

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Division of Toxicology and Environmental Medicine ToxFAQs™ September 2005

This fact sheet answers the most frequently asked health questions (FAQs) about perchlorates. 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 is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration of exposure, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Solid perchlorates are very reactive chemicals that are used mainly in fireworks, explosives, and rocket motors. The general population may be exposed to perchlorate from contaminated drinking water, food, and milk. High levels of perchlorate can affect the thyroid gland, which in turn can alter the function of many organs in the body. Developing organisms can be especially susceptible. The Environmental Protection Agency (EPA) reported that perchlorate has been found in 40 of the 1547 National Priority List sites.

What are perchlorates?

Perchlorates are colorless salts that have no odor. There are five perchlorate salts that are manufactured in large amounts: magnesium perchlorate, potassium perchlorate, ammonium perchlorate, sodium perchlorate, and lithium perchlorate. Perchlorate salts are solids that dissolve easily in water.

The health effects of perchlorate salts are due to the perchlorate itself and not to the other component (i.e., magnesium, ammonium, potassium, etc.).

One place where perchlorate occurs naturally is in saltpeter deposits in Chile, where the saltpeter is used to make fertilizer. In the past, the United States used a lot of this fertilizer on tobacco plants, but now uses very little. Perchlorates are very reactive chemicals that are used mainly in explosives, fireworks, and rocket motors. The solid booster rocket of the space shuttle is almost 70% ammonium perchlorate.

Perchlorates are also used for making other chemicals. Many years ago, perchlorate was used as a medication to treat an over-reactive thyroid gland.

What happens to perchlorate when it enters the environment?

❑ Normally, perchlorate does not remain in soil because it washes away with rain water. However, in arid environments, it may remain in soil to provide a potential for dermal exposure.

❑ Perchlorate will eventually end up in ground water.

❑ We do not know exactly how long perchlorate will last in water and soil, but the information available indicates that it is a very long time, that is, many years.

❑ Perchlorates have been found in milk and food.

How might I be exposed to perchlorate?

Perchlorates entered the environment where rockets were made, tested, and taken apart. Factories that make or use perchlorates may also release them to soil and water.

❑ Drinking water that is contaminated with perchlorate. Most contaminated water supplies are found near sites where perchlorate has been found.

❑ Eating food, including milk, contaminated with perchlorate.

❑ Living near factories that make fireworks, flares, or other explosive devices, or living near a waste site or a rocket manufacturing or testing facility.

❑ Smoking or chewing tobacco may expose you to perchlorates because a variety of tobacco products contain perchlorate.

How can perchlorate affect my health?

Perchlorate affects the ability of the thyroid gland to take up iodine. Iodine is needed to make thyroid hormones that regulate many body functions after they are released into the blood. Perchlorate's inhibition of iodine uptake must be great enough to affect the thyroid before it is considered harmful. Healthy volunteers who took about 35 milligrams (35 mg) of perchlorate every day for 14 days showed no signs of abnormal functioning of their thyroid gland or any other health problem; however, it did inhibit iodide uptake by the thyroid. Studies of workers exposed for years to approximately the same amount of perchlorate found no evidence of alterations in the worker's

thyroids, livers, kidneys, or blood. However, there is concern that exposure of people to higher amounts of perchlorate for a long time may lower the level of thyroid activity leading to hypothyroidism. Low levels of thyroid hormones in the blood may lead to adverse effects on the skin, cardiovascular system, pulmonary system, kidneys, gastrointestinal tract, liver, blood, neuromuscular system, nervous system, skeleton, male and female reproductive system, and numerous endocrine organs. Studies in animals also have shown that the thyroid gland is the main target of toxicity for perchlorate. Animal studies provided inconclusive results regarding effects of perchlorate on the immune system. Perchlorate did not affect reproduction in a study in rats.

How likely is perchlorate to cause cancer?

There are no adequate studies of exposure to perchlorate and cancer in humans. Long-term exposure to perchlorate induced thyroid cancer in rats and mice, but there are reasons to believe that humans are less likely than rodents to develop this type of cancer. The National Academy of Sciences (NAS) concluded that based on the understanding of the biology of human and rodent thyroid tumors, it is unlikely that perchlorate poses a risk of thyroid cancer in humans. Perchlorate has not been classified for carcinogenic effects by the Department of Health and Human Services (DHHS), the EPA, or the International Agency for Research on Cancer (IARC).

How can perchlorate affect children?

Children are more likely to be affected by perchlorate than adults because thyroid hormones are essential for normal growth and development.

Perchlorate has been found in breast milk. Limited studies of thyroid function of babies and young children whose mothers were exposed to perchlorate in their drinking water have not indicated thyroid abnormalities associated with perchlorate. Studies in animals have shown that perchlorate can alter the thyroid gland in the newborn animals. Studies in rats also found alterations in the brain from pups born to rats exposed to perchlorate while pregnant; however, as rats are more sensitive to agents that disturb thyroid function than are humans, the relevance of rat studies to humans is limited.

How can families reduce the risk of exposure to perchlorate?

- ❑ It is very unlikely that perchlorate is present in the average home or apartment.
- ❑ Use bottled water if you live near an area where perchlorate has been found and you have concerns about the presence of perchlorate in your tap water.
- ❑ Prevent children from playing in dirt or eating dirt if you live near a waste site that has perchlorates.
- ❑ Contact local water purveyors, health agencies, state environmental agencies, or EPA regional offices if you have any questions.

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

There are no routine medical tests to measure perchlorate in the body, but it can be measured in the urine with special tests. Because perchlorate leaves the body fairly rapidly, perchlorate in urine only indicates recent exposure and is not an indication of any adverse health effects.

Has the federal government made recommendations to protect human health?

The EPA is currently evaluating whether regulation of perchlorate in drinking water would be appropriate for reducing risks to human health. Also, other federal agencies, including the United States Department of Agriculture, the Food and Drug Administration, and the Department of Defense, are also working on this.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Perchlorates (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. 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.