



PUBLIC HEALTH STATEMENT

Tetrachloroethylene

Division of Toxicology and Human Health Sciences

October 2014

This Public Health Statement is the summary chapter from the Toxicological Profile for Tetrachloroethylene. It is one in a series of Public Health Statements about hazardous substances and their health effects. A shorter version, the ToxFAQs™, is also available. This information is important 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. For more information, call the ATSDR Information Center at 1-800-232-4636.

Overview

We define a public health statement and show how it can help you learn about tetrachloroethylene.

Introduction

A public health statement summarizes information about a hazardous substance. The information is taken from a toxicological profile developed by the Agency for Toxic Substances and Disease Registry's (ATSDR's) Division of Toxicology. A toxicological profile is a thorough review of a hazardous substance.

This toxicological profile examines tetrachloroethylene. This public health statement summarizes the Division of Toxicology and Human Health Science's findings on tetrachloroethylene, describes the effects of exposure to it, and describes what you can do to limit that exposure.

Tetrachloroethylene at hazardous waste sites

The U.S. Environmental Protection Agency (U.S. EPA) identifies the most serious hazardous waste sites in the nation. U.S. EPA then includes these sites the National Priorities List (NPL) and targets it for federal clean-up activities. U.S. EPA has found tetrachloroethylene in at least 945 of the 1,699 current or former NPL sites.

The total number of NPL sites evaluated for tetrachloroethylene is not known. But the possibility remains that as more sites are evaluated, the number of sites at which tetrachloroethylene is found may increase. This information is important; these future sites may be sources of exposure, and exposure to tetrachloroethylene may be harmful.

Tetrachloroethylene is present in many other non-NPL sites due to air, water, and soil contamination. The concern for tetrachloroethylene in non-NPL sites is greater

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than that of the NPL sites; the NPL sites represent a small fraction of the total hazardous waste sites that have been contaminated with tetrachloroethylene.

Why a tetrachloroethylene release can be harmful

When a contaminant is released from a large area such as an industrial plant or from a container such as a drum or bottle, it enters the environment. But such a release doesn't always lead to exposure. You can only be exposed to a contaminant when you come in contact with it. That contact—and therefore that exposure—can occur when you breathe, eat, or drink the contaminant, or when it touches your skin.

Even if you're exposed to tetrachloroethylene, you might not be harmed. Whether you are harmed will depend on such factors as the dose (how much), the duration (how long), and how you are exposed. Harm might also depend on whether you've been exposed to any other chemicals, as well as your age, sex, diet, family traits, lifestyle, and state of health.

A Closer Look at Tetrachloroethylene

Overview

This section describes tetrachloroethylene in detail and how you can be exposed to it.

What is tetrachloroethylene?

Tetrachloroethylene is a nonflammable colorless liquid. Other names for tetrachloroethylene include perchloroethylene, PCE, PERC, tetrachloroethene, and perchlor. Most people can smell tetrachloroethylene when it is present in the air at a level of 1 part in 1 million parts of air (ppm) or more.

How is tetrachloroethylene used?

Tetrachloroethylene is used as a dry cleaning agent and metal degreasing solvent. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products.

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How does tetrachloroethylene enter the environment?

Tetrachloroethylene can be released into the air, water, and soil at places where it is produced or used.

Exposure Sources or Pathways	Outcome
Air: Most releases of tetrachloroethylene during its use are directly to the atmosphere. Much of the tetrachloroethylene released into the air comes from the dry cleaning industry. Some Tetrachloroethylene may be released from dry-cleaned or consumer products.	Tetrachloroethylene breaks down very slowly in the air and so it can be transported long distances in the air. The average concentration of tetrachloroethylene in the air of the United States is typically less than 1 microgram per cubic meter of air.
Water: A variety of industries that use tetrachloroethylene (such as metal degreasing and dry cleaning) produce liquid wastes that contain the compound, which may then end up at waste treatment facilities.	Tetrachloroethylene evaporates quickly from water into air, although some tetrachloroethylene may remain in the water. It is generally slow to break down in water. Tetrachloroethylene can migrate through groundwater (or soil) up into the air of homes and buildings through vapor intrusion.
Soil: Contamination of soil can occur when tetrachloroethylene at a waste disposal site seeps out of the waste and into the soil.	Tetrachloroethylene may evaporate quickly from shallow soils or may filter through the soil and into the groundwater below. It is generally slow to break down in soil.

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How Tetrachloroethylene Can Affect Your Health

Overview

This section looks at how tetrachloroethylene enters your body and potential tetrachloroethylene health effects found in human and animal studies.

How tetrachloroethylene enters your body

Tetrachloroethylene can enter your body from the air, water, or soil.

Possible Sources	Possible Exposure Pathway
Air	Tetrachloroethylene in air can easily enter your body when you breathe it in. Most of the tetrachloroethylene that you breathe in will go into your bloodstream and into other organs. A small amount of tetrachloroethylene in the air can also move through your skin and into your bloodstream.
Water	When tetrachloroethylene is found in water, it can enter your body when you drink or touch the water or when you breathe in steam from the water. Most of the tetrachloroethylene that you breathe in or drink will move from your stomach or lungs into your bloodstream. When you touch water containing tetrachloroethylene, some of it can get through your skin into your body, but not as much as when you breathe or swallow it.
Soil	You can be exposed to tetrachloroethylene in soil when small amounts of soil are transferred to your mouth accidentally, when your skin touches the soil, or when you breathe air or dust coming from the soil.

What happens to tetrachloroethylene in your body

A small amount of tetrachloroethylene in your blood may get changed into other chemicals. If you are exposed over and over again to tetrachloroethylene, some of it may be stored in body fat and the amount can build up over time. When the exposure stops, your body will slowly get rid of the tetrachloroethylene stored in fat.

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How tetrachloroethylene leaves your body

If you have tetrachloroethylene in your blood, you will breathe most of it out very quickly. A small amount of tetrachloroethylene in your blood may get changed into other chemicals that leave your body in urine.

Tetrachloroethylene health effects

Tetrachloroethylene exposure may harm the nervous system, liver, kidneys, and reproductive system, and may be harmful to unborn children. If you are exposed to tetrachloroethylene, you may also be at a higher risk of getting certain types of cancer.

Short-term exposure effects

If you breathe in air containing a lot of tetrachloroethylene, you may become dizzy or sleepy, develop headaches, and become uncoordinated; exposure to very large amounts in the air can cause unconsciousness. Some people have died after being exposed in tanks or other small spaces, or after intentionally breathing in a large amount of tetrachloroethylene.

Long-term exposure effects

People who are exposed for longer periods of time to lower levels of tetrachloroethylene in air may have changes in mood, memory, attention, reaction time, or vision. Studies in animals exposed to tetrachloroethylene have shown liver and kidney effects, and changes in brain chemistry, but we do not know what these findings mean for humans.

Tetrachloroethylene may have effects on pregnancy and unborn children. Studies in people are not clear on this subject, but studies in animals show problems with pregnancy (such as miscarriage, birth defects, and slowed growth of the baby) after oral and inhalation exposure.

Tetrachloroethylene and cancer

Exposure to tetrachloroethylene for a long time may lead to a higher risk of getting cancer, but the type of cancer that may occur is not well-understood. Studies in humans suggest that exposure to tetrachloroethylene might lead to a higher risk of getting bladder cancer, multiple myeloma, or non-Hodgkin's lymphoma, but the evidence is not very strong. In animals, tetrachloroethylene has been shown to cause cancers of the liver, kidney, and blood system. It is not clear whether these effects might also occur in humans, because humans and animals differ in how their bodies handle tetrachloroethylene.

The EPA considers tetrachloroethylene to be "likely to be carcinogenic to humans by all routes of exposure" based on suggestive evidence in human studies and clear

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evidence of mononuclear cell leukemia in rats and liver tumors in mice exposed for 2 years by inhalation or stomach tube.

The International Agency for Research on Cancer considers tetrachloroethylene “probably carcinogenic to humans” based on limited evidence in humans and sufficient evidence in animals.

The National Toxicology Program considers tetrachloroethylene to be “reasonably anticipated to be a human carcinogen.”

Children and Tetrachloroethylene

Overview

This section discusses potential health effects of tetrachloroethylene exposure in humans from when they're first conceived to 18 years of age, and how you might protect against such effects.

Exposure effects for children

It is not known whether children are more susceptible than adults to the effects of tetrachloroethylene. There are very few studies available to answer this question, and many more studies are needed.

What about birth defects?

We do not know for sure whether tetrachloroethylene can cause birth defects in humans. A few studies in humans have suggested that exposure to tetrachloroethylene increased the numbers of babies with heart, oral cleft, or neural tube defects, but these studies were not large enough to clearly answer the question. Studies in animals exposed by inhalation or stomach tube have not shown clear evidence of specific birth defects.

How Can Families Reduce the Risk of Exposure to Tetrachloroethylene

If your doctor finds that you have been exposed to significant amounts of tetrachloroethylene, ask whether your children might also be exposed. Your doctor might need to ask your state health department to investigate.

Food

Tetrachloroethylene has the potential to contaminate foods, although the levels found in food are generally low.

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Drinking water Contact local drinking water authorities and follow their advice if you have any concerns about the presence of tetrachloroethylene in your tap water.

Air Tetrachloroethylene can be present in the indoor air of homes and apartments above dry cleaning facilities. To minimize risks associated with breathing in contaminated vapors, ensure that the area is well ventilated.

Contaminated groundwater or soil Tetrachloroethylene can also be present in groundwater and soil underneath a building or a home, resulting in above-ground vapors through vapor intrusion (movement of vapors from groundwater or soil into air). If you think that you may have groundwater contaminated with tetrachloroethylene, contact your local state health department. In addition, a depressurization system, an increase in the air exchange rate between indoor and outdoor air, or vapor barriers can reduce exposure to tetrachloroethylene from vapor intrusion. Prevent children from playing in dirt or eating dirt if you live near a waste site that has tetrachloroethylene.

Check product labels for tetrachloroethylene Tetrachloroethylene is widely used as a scouring solvent that removes oils from fabrics, as a carrier solvent, as a fabric finish or water repellent, and as a metal degreaser/cleaner. Follow instructions on product labels to minimize exposure to tetrachloroethylene. Storing these items in a shed or an outside location may reduce exposure and decrease the impact on indoor air.

Medical Tests to Determine Tetrachloroethylene Exposure

Overview

We identify medical tests that can detect whether tetrachloroethylene is in your body, and we recommend safe toxic-substance practices.

Tetrachloroethylene can be measured in blood and urine Tetrachloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of tetrachloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because tetrachloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure.

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Federal Government Recommendations to Protect Human Health

Overview

One way the federal government promotes public health is by regulating toxic substances or recommending ways to handle or to avoid toxic substances.

The federal government regulates toxic substances

Regulations are enforceable by law. The U.S. EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that have adopted toxic substances regulations.

The federal government recommends safe toxic substance practices

The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) have made recommendations about toxic substances. Unlike enforceable regulations, these recommendations are advisory only.

Toxic substance regulations

Regulations and recommendations can be expressed as “not-to-exceed” levels; that is, levels of a toxic substance in air, water, soil, or food that do not exceed a critical value usually based on levels that affect animals; levels are then adjusted to help protect humans. Sometimes these not-to-exceed levels differ among federal organizations. Different organizations use different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or emphasize some factors over others, depending on their mission.

Recommendations and regulations are also updated periodically as more information becomes available. For the most current information, check with the federal agency or organization that issued the regulation or recommendation.

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Some regulations and recommendations for tetrachloroethylene include:

Federal Organization	Regulation or Recommendation
U.S. Environmental Protection Agency (U.S. EPA)	EPA set a maximum contaminant level (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb) as a national primary drinking standard for tetrachloroethylene and noted liver problems and increased risk of cancer as potential health effects from long-term exposure above the MCL.
Occupational Safety and Health Administration (OSHA)	OSHA has set an 8-hour time-weighted average permissible exposure limit of 100 ppm, an acceptable ceiling exposure limit of 200 ppm, and a maximum peak of 300 ppm (not to be exceeded for more than 5 minutes of any 3-hour period).
National Institute for Occupational Safety and Health (NIOSH)	NIOSH recommends that workplace exposure to tetrachloroethylene be minimized due to concerns about its carcinogenicity.

Additional Information

Overview

Where to find more information about tetrachloroethylene:

Who to contact If you have any more questions or concerns, please contact your community or state health or environmental quality department, or contact ATSDR at the address and phone number below.

Additional information from ATSDR ATSDR can provide publically available information regarding medical specialists with expertise and experience recognizing, evaluating, treating, and managing patients exposed to hazardous substances.

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**Where to
obtain
toxicological
profile copies**

Toxicological profiles are also available online at www.atsdr.cdc.gov. For more information:

- Call the toll-free information and technical assistance number at 1-800-CDCINFO (1-800-232-4636) or
- Write to:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences
1600 Clifton Road NE
Mailstop F-57
Atlanta, GA 30333

For-profit organizations should request final toxicological profile copies from:

National Technical Information Service (NTIS)
5285 Port Royal Road
Springfield, VA 22161
Phone: 1-800-553-6847 or 1-703-605-6000
Web site: <http://www.ntis.gov/>

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