# PUBLIC HEALTH STATEMENT
# Trichloroethylene

**Division of Toxicology and Human Health Sciences** **November 2016**

This Public Health Statement is the summary chapter from the Toxicological Profile for trichloroethylene. 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 trichloroethylene.

**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 and Human Health Sciences (DTHHS). A toxicological profile is a thorough review of a hazardous substance.

This toxicological profile examines trichloroethylene. This public health statement summarizes the DTHHS' findings on trichloroethylene, describes the effects of exposure to it, and describes what you can do to limit that exposure.

**Trichloro-ethylene 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 trichloroethylene in at least 1,045 of the 1,699 current or former NPL sites.

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

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**Why a trichloroethylene 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 trichloroethylene, 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 Trichloroethylene

### *Overview*

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

**What is trichloroethylene?**

Trichloroethylene is a colorless, volatile liquid. Liquid trichloroethylene evaporates quickly into the air. It is nonflammable and has a sweet odor.

**How is trichloroethylene used?**

The two major uses of trichloroethylene are as a solvent to remove grease from metal parts and as a chemical that is used to make other chemicals, especially the refrigerant, HFC-134a. Trichloroethylene has also been used as an extraction solvent for greases, oils, fats, waxes, and tars; by the textile processing industry to scour cotton, wool, and other fabrics; in dry cleaning operations; and as a component of adhesives, lubricants, paints, varnishes, paint strippers, pesticides, and cold metal cleaners.

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**Where is trichloro-ethylene found?**

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

| Possible Sources | Outcome |
|---|---|
| **Air:** Trichloroethylene is commonly found in outdoor air at levels far less than 1 part per million (ppm). Trichloroethylene levels of approximately 1–100 ppm have been measured in workplace air at facilities that use trichloroethylene for metal degreasing. Trichloroethylene levels as high as 0.02 ppm have been measured in air inside homes and public places. | Trichloroethylene is broken down quickly in air. People who live near facilities that use trichloroethylene or near hazardous waste sites containing trichloroethylene may have a higher exposure to this substance. |
| **Water:** Trichloroethylene has been found in drinking water samples at many locations in the United States. Levels at these locations are typically less than 30 parts per billion (ppb). | Trichloroethylene breaks down slowly in surface water and is removed mostly through evaporation to air. Trichloroethylene can slowly enter groundwater from contaminated surface water. Trichloroethylene is expected to remain in groundwater for long periods of time since it is not able to readily evaporate from groundwater. |
| **Soil:** Trichloroethylene is found in soil where it can be contacted directly or move through soil and contaminate groundwater or volatilize to air. | Trichloroethylene breaks down slowly in soil and is removed mostly through evaporation to air. Trichloroethylene in soil (and to some extent in groundwater) may evaporate and migrate into air spaces beneath buildings to enter the indoor air, a process termed vapor intrusion. |

## How Trichloroethylene Can Affect Your Health

### *Overview*

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

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**How trichloroethylene enters your body**

Trichloroethylene can enter your body from the air, water, or soil. You are most likely to be exposed to trichloroethylene by drinking trichloroethylene-contaminated water; you may also be exposed by breathing trichloroethylene released to the air from trichloroethylene-contaminated water. If you work in the degreasing industry or other industry where trichloroethylene is used, you may be exposed by breathing in trichloroethylene-contaminated air or by contacting the chemical with your skin.

| Possible Sources | Possible Exposure Pathway |
|---|---|
| **Air** | Trichloroethylene in air can easily enter your body when you breathe. Most of the trichloroethylene that you breathe in will go into your bloodstream and into other organs. A small amount of trichloroethylene in the air can also move through your skin and into your bloodstream. |
| **Water** | When trichloroethylene 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 trichloroethylene that you breathe in or drink will move from your stomach or lungs into your bloodstream. When you touch water containing trichloroethylene (such as showering or bathing with trichloroethylene-contaminated water), some of it can get through your skin into your body. Also, you can be exposed when trichloroethylene in groundwater evaporates and migrates into air spaces beneath buildings to enter the indoor air, a process termed vapor intrusion, and you breathe that contaminated indoor air. |

| | |
|---|---|
| **Soil** | You can be exposed to trichloroethylene 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. You can also be exposed when trichloroethylene in soil evaporates and migrates into air spaces beneath buildings to enter the indoor air, a process termed vapor intrusion, and you breathe that contaminated indoor air. |
| **Food** | Trichloroethylene has been detected in table-ready foods at concentrations generally in the range of 2–100 ppb. |

**What happens to trichloroethylene in your body**

Once in your blood, your liver changes much of the trichloroethylene into other chemicals. When the body absorbs more trichloroethylene than it can break down quickly, some of the trichloroethylene or its breakdown products can be stored in body fat for a brief period. However, once absorption ceases, trichloroethylene and its breakdown products quickly leave the fat.

**How trichloroethylene leaves your body**

You will quickly breathe out much of the trichloroethylene that reaches your bloodstream; most of the trichloroethylene breakdown products leave your body in the urine within a day.

**Trichloroethylene health effects**

The health effects of trichloroethylene depend on how much trichloroethylene you are exposed to and the length of that exposure. Environmental monitoring data suggest that trichloroethylene levels the public might encounter by direct contact or through air, water, food, or soil, are generally much lower than the levels at which adverse effects are elicited in animal studies. However, some drinking water sources and working environments have been found to contain levels of trichloroethylene that may cause health problems.

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**Short-term exposure effects**

Trichloroethylene was once used as an anesthetic for surgery. People who are overexposed to moderate amounts of trichloroethylene may experience headaches, dizziness, and sleepiness; large amounts of trichloroethylene may cause coma and even death. Some people who breathe high levels of trichloroethylene may develop damage to some of the nerves in the face. Other effects seen in people exposed to high levels of trichloroethylene include evidence of nervous system effects related to hearing, seeing, and balance, changes in the rhythm of the heartbeat, liver damage, and evidence of kidney damage. Some people who get concentrated solutions of trichloroethylene on their skin develop rashes.

Relatively short-term exposure of animals to trichloroethylene resulted in harmful effects on the nervous system, liver, respiratory system, kidneys, blood, immune system, heart, and body weight.

**Long-term exposure effects**

Exposure to trichloroethylene in the workplace may cause scleroderma (a systemic autoimmune disease) in some people. Some men occupationally-exposed to trichloroethylene and other chemicals showed decreases in sex drive, sperm quality, and reproductive hormone levels.

Long-term exposure studies in animals have mainly focused on carcinogenicity and relatively insensitive noncancer end points following oral exposure; these studies are not helpful in defining noncancer end points in humans following long-term exposure. However, depressed body weight and evidence of effects on the thymus were reported in one recent study of mice exposed to trichloroethylene via their mothers during gestation and lactation and via the drinking water for up to 12 months thereafter.

**Trichloro-ethylene and cancer**

There is strong evidence that trichloroethylene can cause kidney cancer in people and some evidence that it causes liver cancer and malignant lymphoma (a blood cancer). Lifetime exposure to trichloroethylene resulted in increased liver cancer in mice and increased kidney cancer in rats at relatively high exposure levels. There is some evidence for trichloroethylene-induced testicular cancer and leukemia in rats and lymphomas and lung tumors in mice.

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The National Toxicology Program (NTP) has determined that trichloroethylene is a "known human carcinogen". The EPA and the International Agency for Research on Cancer (IARC) have determined that trichloroethylene is "carcinogenic to humans."

## Children and Trichloroethylene

### *Overview*

This section discusses potential health effects of trichloroethylene 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 generally**

Trichloroethylene is expected to affect children in the same manner as adults. It is not known whether children are more susceptible than adults to the effects of trichloroethylene.

**What about birth defects?**

Some human studies indicate that trichloroethylene may cause developmental effects such as spontaneous abortion, congenital heart defects, central nervous system defects, and small birth weight. However, these people were exposed to other chemicals as well. In some animal studies, exposure to trichloroethylene during development may have caused effects such as decreased body weight, increased incidences of heart defects, functional or structural changes in the developing nervous system, and effects on the immune system.

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## How Can Families Reduce the Risk of Exposure to Trichloroethylene

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

**Drinking water**

Exposure to contaminated drinking water should be limited. Trichloroethylene has been detected in some drinking water supplies. For bottled water, consumers should contact the bottler with specific questions on potential contaminants.

**Contaminated groundwater or soil**

If you live near an industrial site where trichloroethylene is produced or is a byproduct or you live near a hazardous waste site where it has been discarded, there may be high levels of trichloroethylene in the water and soil. If you find your home water supply and/or soil to be contaminated with trichloroethylene, consider using a cleaner source of water and limiting contact with soil (for example, through use of a dense ground cover or thick lawn) to reduce exposure to trichloroethylene. By paying careful attention to dust and dirt control in the home (air filters, frequent cleaning), you can reduce family exposure to contaminated dirt. Some children eat a lot of dirt. You should prevent your children from eating dirt. You should discourage your children from putting objects in their mouths. Make sure that they wash their hands frequently and before eating. Discourage your children from putting their hands in their mouths or from other hand-to-mouth activity.

**Check product labels for trichloroethylene**

Trichloroethylene is widely used as a solvent for extraction, waterless drying, and finishing, and as a general purpose solvent in adhesives, lubricants, paints, varnishes, paint strippers, pesticides, and cold metal cleaners. Follow instructions on product labels to minimize exposure to trichloroethylene.

## Medical Tests to Determine Trichloroethylene Exposure

### *Overview*

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

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**Trichloroethylene can be measured in blood and urine**

Trichloroethylene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of trichloroethylene or its metabolites cannot predict the kind of health effects that might develop from that exposure, partly because exposure to other chemicals can produce byproducts similar to those observed following exposure to trichloroethylene. Because trichloroethylene and its metabolites leave the body fairly rapidly, the tests need to be conducted within a few hours after exposure. Tests for trichloroethylene and its metabolites in the blood or urine require special analytical equipment not readily available at medical facilities.

## 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.

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**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 are not to 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.

Some regulations and recommendations for trichloroethylene include:

| Federal Organization | Regulation or Recommendation |
|---|---|
| U.S. Environmental Protection Agency (U.S. EPA) | EPA set a maximum contaminant level goal (MCLG) of zero as a national primary drinking standard for trichloroethylene; EPA noted liver problems and increased risk of cancer as potential health effects from long-term exposure above the maximum contaminant level (MCL) of 0.005 milligrams per liter (mg/L; 5 ppb). |
| Occupational Safety and Health Administration (OSHA) | OSHA set a permissible exposure limit (PEL) of 100 ppm for trichloroethylene in air averaged over an 8-hour work day, an acceptable ceiling concentration of 200 ppm provided the 8-hour PEL is not exceeded, and an acceptable maximum peak of 300 ppm for a maximum duration of 5 minutes in any 2 hours. |
| National Institute for Occupational Safety and Health (NIOSH) | NIOSH considers trichloroethylene to be a potential occupational carcinogen and established a recommended exposure limit (REL) of 2 ppm (as a 60-minute ceiling) during the usage of trichloroethylene as an anesthetic agent and 25 ppm (as a 10-hour TWA) during all other exposures. |

# Additional Information

## *Overview*

Where to find more information about trichloroethylene.

**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.

**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/