



# PUBLIC HEALTH STATEMENT

## TOLUENE

CAS#: 108-88-3

Division of Toxicology

May 1994

This Public Health Statement is the summary chapter from the Toxicological Profile for Toluene. 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 1-888-422-8737.

This Statement was prepared to give you information about toluene and to emphasize the human health effects that may result from exposure to it.

The Environmental Protection Agency (EPA) has identified 1,350 hazardous waste sites as the most serious in the nation. These sites comprise the "National Priorities List" (NPL): Those sites which are targeted for long-term federal cleanup activities. Toluene has been found in at least 851 of the sites on the NPL. However, the number of NPL sites evaluated for toluene is not known. As EPA evaluates more sites, the number of sites at which toluene is found may increase. This information is important because exposure to toluene may cause harmful health effects and because these sites are potential or actual sources of human exposure to toluene.

When a substance 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. This release does not always lead to exposure. You can

be exposed to a substance only when you come in contact with it. You can be exposed by breathing, eating, drinking, or through skin contact with substances containing toluene.

If you are exposed to a substance such as toluene, many factors will determine whether harmful health effects will occur and what the type and severity of those health effects will be. These factors include the dose (how much), the duration (how long), the route or pathway by which you are exposed (breathing, eating, drinking, or skin contact), the other chemicals to which you are exposed, and your individual characteristics such as age, gender, nutritional status, family traits, life-style, and state of health.

### 1.1 WHAT IS TOLUENE?

Toluene is a clear, colorless liquid with a distinctive smell. It is added to gasoline along with benzene and toluenylene. Toluene occurs naturally in crude oil and in the tolu tree. It is produced in the process of making gasoline and other fuels from crude oil, in making coke from coal, and as a by-product in the manufacture of styrene. Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. It is disposed of at hazardous waste sites as used solvent (a substance that can dissolve other substances) or at landfills where it is present in discarded paints, paint thinners, and fingernail polish. You can begin to smell toluene in the air at a concentration of 8 parts of toluene per million parts of air (ppm), and taste it in your water at a concentration of 0.04–1 ppm. (One part per million is equivalent to 1 minute in 2 years.)

DEPARTMENT of HEALTH AND HUMAN SERVICES, Public Health Service  
Agency for Toxic Substances and Disease Registry

[www.atsdr.cdc.gov/](http://www.atsdr.cdc.gov/)

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### 1.2 HAPPENS TO TOLUENE WHEN IT ENTERS THE ENVIRONMENT?

Toluene enters the environment when you use materials that contain it, such as paints, paint thinners, adhesives, fingernail polish, and gasoline. As you work with these materials, the toluene evaporates and becomes mixed with the air you breathe. Toluene enters surface water and groundwater (wells) from spills of solvents and petroleum products as well as from leaking underground storage tanks at gasoline stations and other facilities. Leaking underground storage tanks also contaminate the soil with toluene and other petroleum-product components.

When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil and water near the waste site. Toluene does not usually stay in the environment; it is readily broken down to other chemicals by microorganisms in soil and evaporates from surface water and surface soils. Toluene dissolved in well water does not break down quickly while the water is under the ground because there are few microorganisms in underground water. Once the water is brought to the surface, the toluene will evaporate into the air. Windows and doors in rooms where toluene-containing products are used should be opened to allow the toluene gas to escape. (When not in use, toluene- products should be tightly covered to prevent evaporation into the air.) The toluene in the air will combine with oxygen and form benzaldehyde and cresol. These compounds can be harmful to humans.

Toluene can be taken up into fish and shellfish, plants, and animals living in water containing

toluene, but it does not concentrate or build up to high levels because most animal species can make the toluene into other compounds that are excreted.

### 1.3 HOW MIGHT I BE EXPOSED TO TOLUENE?

You may be exposed to toluene from many sources, including drinking water, food, air, and consumer products. You may also be exposed to toluene through breathing the chemical in the workplace or during deliberate glue sniffing or solvent abuse. Automobile exhaust can also put toluene into the air. People who work with gasoline, kerosene, heating oil, paints, and lacquers are at the greatest risk of exposure. Printers are also exposed to toluene in the workplace. Because toluene is a common solvent and is found in many consumer products, you can be exposed to toluene at home and outdoors while using gasoline, nail polish, cosmetics, rubber cement, paints, paintbrush cleaners, stain removers, fabric dyes, inks, and adhesives. Smokers are exposed to small amounts of toluene from cigarette smoke.

You can be exposed to toluene at some hazardous waste sites. EPA reported in 1991 that toluene was found in well water, surface water, or soil at 63% of the hazardous waste sites surveyed. If you live near a waste site and get your drinking water from a well, you might find toluene in the water. Toluene vapors might also be present in the air.

Federal and state surveys do not show toluene to be a common impurity in drinking water supplies. Toluene was found in about 1% of the groundwater sources (wells) at amounts lower than 2 parts per billion (ppb). (This is like 1 second in 32 years). It

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was found more frequently in surface water samples at similar concentrations. If toluene is in your drinking water you can be exposed by drinking the water or by eating cold foods prepared with the water. Evaporation during cooking tends to decrease the amount of toluene found in hot foods or water. Additional exposure will occur when you breathe in the toluene that evaporates from water while you shower, bathe, clean, or cook with the water.

The toluene level in the air outside your home is usually less than 1 ppm in cities and suburbs that are not close to industry. The toluene inside your house is also likely to be less than 1 ppm. The amount of toluene in food has not been reported, but is likely to be low. Traces of toluene were found in eggs that were stored in polystyrene containers containing toluene.

Unless you smoke cigarettes or work with toluene-containing products, you are probably only exposed to about 300 micrograms ( $\mu\text{g}$ ) of toluene a day. A microgram is one one-millionth of a gram. If you smoke a pack of cigarettes per day, you add another 1,000  $\mu\text{g}$  to your exposure. People who work in places where toluene-containing products are used can be exposed to 1,000 milligrams of toluene a day when the average air concentration is 50 ppm and they breathe at a normal rate and volume. A milligram is one-thousandth of a gram.

### 1.4 HOW CAN TOLUENE ENTER AND LEAVE MY BODY?

Toluene can enter your body when you breathe its vapors or eat or drink contaminated food or water. When you work with toluene-containing paints or

paint thinners, the toluene can also pass through your skin into your bloodstream. You are exposed to toluene when you breathe air containing toluene. When this occurs the toluene is taken directly into your blood from your lungs. Where you live, work, and travel and what you eat affects your daily exposure to toluene. Factors such as your age, sex, body composition, and health status affect what happens to toluene once it is in your body. After being taken into your body, more than 75% of the toluene is removed within 12 hours. It may leave your body unchanged in the air you breathe out or in your urine after some of it has been chemically changed to make it more water soluble. Generally, your body turns toluene into less harmful chemicals such as hippuric acid.

### 1.5 HOW CAN TOLUENE AFFECT MY HEALTH?

A serious health concern is that toluene may have an effect on your brain. Toluene can cause headaches, confusion, and memory loss. Whether or not toluene does this to you depends on the amount you take in and how long you are exposed. Low-to-moderate, day-after-day exposure in your workplace can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure is stopped. Researchers do not know if the low levels of toluene you breathe at work will cause any permanent effects on your brain or body after many years. You may experience some hearing loss after long-term daily exposure to toluene in the workplace.

If you are exposed to a large amount of toluene in a short time because you deliberately sniff paint or

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glue, you will first feel light-headed. If exposure continues, you can become dizzy, sleepy, or unconscious. You might even die. Toluene causes death by interfering with the way you breathe and the way your heart beats. When exposure is stopped, the sleepiness and dizziness will go away and you will feel normal again.

If you choose to repeatedly breathe in toluene from glue or paint thinners, you may permanently damage your brain. You may also experience problems with your speech, vision, or hearing, have loss of muscle control, loss of memory, poor balance, and decreased mental ability. Some of these changes may be permanent.

Toluene may change the way your kidneys work, but in most cases, the kidneys will return to normal after exposure stops. If you drink alcohol and are exposed to toluene, the combination can affect your liver more than either compound alone. This phenomenon is called synergism. Combinations of toluene and some common medicines like aspirin and acetaminophen may increase the effects of toluene on your hearing.

In animals, the main effect of toluene is on the nervous system. Animals exposed to moderate or high levels of toluene may also show slightly adverse effects in their liver, kidneys, and lungs.

Several studies have shown that unborn animals were harmed when high levels of toluene were breathed in by their mothers. When the mothers were fed high levels of toluene, the unborn animals did not show any structural birth defects, although

some effects on behavior were noted. We do not know if toluene would harm your unborn child if you drink water or breathe air containing low levels of toluene, because studies in people are not comprehensive enough to measure this effect. However, if you deliberately breathe in large amounts of toluene during your pregnancy, your baby can have neurological problems and retarded growth and development.

Studies in workers and in animals exposed to toluene indicate that toluene does not cause cancer. The International Agency for Research on Cancer (IARC) and the Department of Health and Human Services (DHHS) have not classified toluene for carcinogenic effects. The EPA has determined that toluene is not classifiable as to its human carcinogenicity.

### **1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO TOLUENE?**

You can find out been exposed to toluene by having your exhaled air, blood, and urine tested for toluene and/or its breakdown products. These tests may not be available at a doctor's office, but are easily done by special laboratories. To determine if you have been exposed to toluene, your blood and urine must be checked within 12 hours of exposure for the presence of toluene breakdown products. Several other chemicals are also changed to the same breakdown products as toluene in the body, so these tests are not specific for toluene. Other factors, such as your weight and body fat, your sex, and the exposure conditions, may also influence the amount of the chemicals in your urine.

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### 1.7 WHAT RECOMMENDATIONS HAS THE FEDERAL GOVERNMENT MADE TO PROTECT HUMAN HEALTH?

The federal government has developed regulatory standards and guidelines to protect you from the possible health effects of toluene in the environment. The Occupational Safety and Health Administration (OSHA) has set a limit of 100 ppm of toluene for air in the workplace, averaged for an 8-hour exposure per day over a 40-hour work week. The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute for Occupational Safety and Health (NIOSH) have recommended that toluene in workplace air not exceed 100 ppm (as an average level over 8 hours).

EPA recommends that drinking water should not contain more than 20 ppm for 1 day, 3 ppm for 10 days, or 1 ppm for lifetime consumption. Any release of more than 1,000 pounds of this chemical to the environment must be reported to the National Response Center.

### 1.8 WHERE CAN I GET MORE INFORMATION?

If you have any more questions or concerns, please contact your community or state health or environmental quality department or:

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road NE, Mailstop F-32  
Atlanta, GA 30333

### Information line and technical assistance:

Phone: 888-422-8737  
FAX: (770)-488-4178

ATSDR can also tell you the location of occupational and environmental health clinics. These clinics specialize in recognizing, evaluating, and treating illnesses resulting from exposure to hazardous substances.

### To order toxicological profiles, contact:

National Technical Information Service  
5285 Port Royal Road  
Springfield, VA 22161  
Phone: 800-553-6847 or 703-605-6000

### Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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