



# PUBLIC HEALTH STATEMENT

## TOLUENE

CAS#: 108-88-3

Division of Toxicology and Environmental Medicine

September 2000

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 1-800-232-4737.

### 1.1 WHAT IS TOLUENE?

Toluene is a clear, colorless liquid with a distinctive smell. It is a good solvent (a substance that can dissolve other substances). It is added to gasoline along with benzene and xylene. 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 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 between 0.04 and 1 ppm.

### 1.2 WHAT 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.

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 break down the toluene into other compounds that are excreted.

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### 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 also puts 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, adhesives, carburetor cleaners, and lacquer thinners. Smokers are exposed to small amounts of toluene in cigarette smoke.

You can be exposed to toluene at some hazardous waste sites. EPA reported in 1998 that toluene was found in well water or surface water at 99% of the hazardous waste sites surveyed and in soil at 77% of the sites surveyed. If you live near a waste site and get your drinking water from a well, toluene may be in the water. Toluene vapors might also be present in the air.

Federal and state surveys do not show toluene to be commonly found in drinking water supplies. Toluene was found in about 1% of the groundwater sources (wells) at amounts lower than 2 parts per billion (ppb). It 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 exposed to only about 300 micrograms ( $\mu\text{g}$ ) of toluene a day. A microgram is 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 contaminated food or drink contaminated water. When you work with toluene-containing paints or paint thinners, or use nail polish or nail polish remover containing toluene, the toluene can also pass through your skin into your bloodstream. You are exposed to toluene when you

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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 changed to other chemicals. Generally, your body turns toluene into less harmful chemicals such as hippuric acid.

### 1.5 HOW CAN TOLUENE AFFECT MY HEALTH?

To protect the public from the harmful effects of toxic chemicals and to find ways to treat people who have been harmed, scientists use many tests.

One way to see if a chemical will hurt people is to learn how the chemical is absorbed, used, and released by the body; for some chemicals, animal testing may be necessary. Animal testing may also be used to identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method to get information needed to make wise decisions to protect public health. Scientists have the responsibility to treat research animals with care and compassion. Laws today protect the welfare of research animals, and scientists must comply with strict animal care guidelines.

A serious health concern is that toluene may have an effect on your brain. Toluene can cause headaches and sleepiness, and can impair your

ability to think clearly. Whether or not toluene does this to you depends on the amount you take in, how long you are exposed, and your genetic susceptibility and age. 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. You may experience some hearing and color vision loss after long-term daily exposure to toluene in the workplace. 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.

If you are exposed to a large amount of toluene in a short time because you deliberately sniff paint or 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 (at high levels) could possibly damage your kidneys. If you drink alcohol and are exposed to toluene, the combination can affect your liver more than either compound alone. Combinations of toluene and some common medicines like aspirin and acetaminophen may increase the effects of

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toluene on your hearing.

Some studies in people have shown reproductive effects, such as an increased risk of spontaneous abortions, from exposure to toluene in the workplace. However, other factors, such as exposure to other chemicals, smoking and alcohol use, may have affected the results of the studies, so it is not possible to say whether toluene has reproductive effects in people.

The effects of toluene on animals are similar to those seen in humans. The main effect of toluene is on the brain and nervous system, but animals exposed to moderate or high levels of toluene may also show harmful effects in their liver, kidneys, and lungs.

Studies in workers and animals exposed to toluene generally 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 HOW CAN TOLUENE AFFECT CHILDREN?

This section discusses potential health effects from exposures during the period from conception to maturity at 18 years of age in humans.

Children may breathe air contaminated with toluene by family use of glues, paints, or cleaning solvents, or by accidents involving products containing toluene. Toluene vapors are heavier than air and

since young children are closer to the ground or floor because of their height, they may breathe more toluene than adults during accidental exposures. Older children and adolescents may be exposed to toluene if they breathe household products containing it to get high. Nursing mothers who breathe toluene in workplace air may transfer some toluene in breast milk to their infants. Toluene is not stored in the body. Toluene in the body either rapidly leaves or is turned into less harmful chemicals. Thus, nursing mothers, who do not currently work in jobs with toluene and who do not deliberately breathe large amounts of toluene, are expected to transfer very little toluene in breast milk.

The effects of toluene on children have not been studied very much, but toluene is likely to produce the same types of effects on the brain and nervous system in children as it does in adults. Some older children and adolescents who have repeatedly breathed large amounts of toluene to get high have developed loss of muscle control, loss of memory, poor balance, and decreased mental ability. Some of these changes may last for a long time after toluene has left the body. Young animals exposed to toluene have shown changes in behavior, hearing loss, and chemical changes in their brains.

Human fetuses and newborn babies may be more sensitive to toluene than adults, because their bodies may not be as able to turn toluene into less harmful chemicals. Some animal studies suggest that young animals might be more susceptible to toluene effects on health, but, shortly after birth, human babies begin to develop the ability to turn toluene into less harmful chemicals. By the time children are 1–3 years of age, they may be equal to adults in

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this ability.

Some mothers who breathed large amounts of toluene during pregnancy to get high have had children with birth defects, including retardation of mental abilities and growth. Results from animal studies have found similar effects in new born animals that had mothers that breathed large amounts of toluene during pregnancy. However, when the animal mothers breathed small amounts of toluene during pregnancy, no birth defects were found in their newborn animals. When pregnant animals breathe small amounts of toluene during pregnancy, studies show that very little toluene reaches the developing fetus.

### **1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO TOLUENE?**

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

Families can reduce their risk of exposure to toluene by only using consumer products containing it (such as paints, glues, inks, and stain removers) in well ventilated areas. When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air. Household chemicals should be stored out of reach of young children to prevent accidental poisonings. Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles. Keep your Poison Control Center's number next to the phone.

Sometimes older children sniff household chemicals in an attempt to get high. Your children may be exposed to toluene by inhaling products containing it. Talk with your children about the dangers of sniffing chemicals.

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

You can find out if you have been exposed to toluene by having your exhaled air, blood, and urine tested for toluene 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 or its breakdown products. Several other chemicals are also changed to the same breakdown products as toluene in the body, so some of 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.

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

The federal government develops regulations and recommendations to protect public health. Regulations can be enforced by law. Federal agencies that develop regulations for toxic substances include the Environmental Protection Agency (EPA), the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA). Recommendations provide

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valuable guidelines to protect public health but cannot be enforced by law. Federal organizations that develop recommendations for toxic substances include the Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH).

Regulations and recommendations can be expressed in not-to-exceed levels in air, water, soil, or food that are usually based on levels that affect animals; then they are adjusted to help protect people. Sometimes these not-to-exceed levels differ among federal organizations because of different exposure times (an 8 hour workday or a 24 hour day), the use of different animal studies, or other factors.

Recommendations and regulations are also periodically updated as more information becomes available. For the most current information, check with the federal agency or organization that provides it. Some regulations and recommendations for toluene include the following:

The federal government has developed regulatory standards and guidelines to protect you from the possible health effects of toluene in the environment. OSHA has set a limit of 200 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) recommends that toluene in workplace air not exceed 50 ppm, and NIOSH recommends that toluene in workplace air not exceed 100 ppm (both as average levels over 8 hours).

EPA has set a maximum contaminant level (MCL)

for toluene in drinking water of 1 milligram per liter of water (1 mg/L). Any release of more than 1,000 pounds of this chemical to the environment must be reported to the National Response Center.

### **1.10 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 and Environmental  
Medicine  
1600 Clifton Road NE, Mailstop F-32  
Atlanta, GA 30333

\* Information line and technical assistance

Phone: 1-800-CDC-INFO (1-800-232-4636)  
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

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