

1. PUBLIC HEALTH STATEMENT

This public health statement tells you about xylene and the effects of exposure to it.

The Environmental Protection Agency (EPA) identifies the most serious hazardous waste sites in the nation. These sites are then placed on the National Priorities List (NPL) and are targeted for long-term federal clean-up activities. Xylene has been found in at least 840 of the 1,684 current or former NPL sites. Although the total number of NPL sites evaluated for this substance is not known, the possibility exists that the number of sites at which xylene is found may increase in the future as more sites are evaluated. This information is important because these sites may be sources of exposure and exposure to this substance may harm you.

When a substance is released either from a large area, such as an industrial plant, or from a container, such as a drum or bottle, it enters the environment. Such a release does not always lead to exposure. You can be exposed to a substance only when you come in contact with it. You may be exposed by breathing, eating, or drinking the substance, or by skin contact.

If you are exposed to xylene, many factors will determine whether you will be harmed. These factors include the dose (how much), the duration (how long), and how you come in contact with it. You must also consider any other chemicals you are exposed to and your age, sex, diet, family traits, lifestyle, and state of health.

1.1 WHAT IS XYLENE?

In this report, the terms xylene, xylenes, and total xylenes will be used interchangeably. There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers. Drawings of the three different isomers are shown in Chapter 4. The term total xylenes refers to all three isomers of xylene (*m*-, *o*-, and *p*-xylene). Mixed xylene is a mixture of the three isomers and usually also contains 6–15% ethylbenzene. Xylene is also known as xylol or dimethylbenzene. Xylene is primarily a synthetic chemical. Chemical industries produce xylene

1. PUBLIC HEALTH STATEMENT

from petroleum. Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires, to a small extent. It is a colorless, flammable liquid with a sweet odor.

Xylene is one of the top 30 chemicals produced in the United States in terms of volume. It is primarily used as a solvent (a liquid that can dissolve other substances) in the printing, rubber, and leather industries. Along with other solvents, xylene is also widely used as a cleaning agent, a thinner for paint, and in varnishes. Xylene is used, to a lesser extent, as a material in the chemical, plastics, and synthetic fiber industries and as an ingredient in the coating of fabrics and papers. Isomers of xylene are used in the manufacture of certain polymers (chemical compounds), such as plastics. Xylene is found in small amounts in airplane fuel and gasoline.

Xylene evaporates and burns easily. Xylene does not mix well with water; however, it does mix with alcohol and many other chemicals. Most people begin to smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and in water at 0.53–1.1 ppm. Additional information regarding chemical and physical properties and use of xylene can be found in Chapters 4 and 5.

1.2 WHAT HAPPENS TO XYLENE WHEN IT ENTERS THE ENVIRONMENT?

Xylene is a liquid, and it can leak into soil, surface water (creeks, streams, rivers), or groundwater. Xylene can enter the environment when it is made, packaged, shipped, or used. Most xylene that is accidentally released evaporates into the air, although some is released into rivers or lakes. Xylene can also enter soil, water, or air in large amounts after an accidental spill or as a result of an environmental leak during storage or burial at a waste site.

Since xylene evaporates easily, most xylene that gets into soil and water (if not trapped underground) is expected to go into the air where it is broken down by sunlight into other less harmful chemicals within a couple of days. For this reason, xylene is rarely found in high concentrations in topsoil or surface water (river, creeks) unless there has been a recent spill or continuing source of contamination. Any xylene that does not evaporate quickly from soil or

1. PUBLIC HEALTH STATEMENT

water is broken down by small organisms. Only very small amounts are taken up by plants, fish, and birds.

Xylene below the soil surface may travel down through the soil and enter underground water (groundwater). Xylene may remain in groundwater for several months before it is finally broken down by small organisms. If a large amount of xylene enters soil from an accidental spill, a hazardous waste site, or a landfill, it may travel through the soil and contaminate drinking water wells. More information on what happens to xylene in the environment can be found in Chapters 5 and 6.

1.3 HOW MIGHT I BE EXPOSED TO XYLENE?

Xylene is primarily released from industrial sources, in automobile exhaust, and during its use as a solvent. Hazardous waste disposal sites and spills of xylene into the environment are also possible sources of exposure. You are most likely to be exposed to xylene by breathing it in contaminated air. Typical levels of xylene measured in outdoor air in the United States range from 1 to 30 parts of xylene per billion parts of air (a part per billion [ppb] is one thousandth of a part per million [ppm]; one ppm equals 1,000 ppb). Typical levels of xylene measured in indoor air range from 1 to 10 ppb.

Xylene is sometimes released into water and soil as a result of the use, storage, and transport of petroleum products. Little information exists about the amount of xylene in surface water and soil. However, levels of xylene in contaminated groundwater have been reported to be as high as 10,000 ppb.

You may be exposed to xylene by drinking or eating xylene-contaminated water or food. Xylene is not commonly found in drinking water. When it is, the levels of xylene are typically below 2 ppb. Xylene has been found in many types of foods at levels ranging from 1 to 100 ppb.

You may also come in contact with xylene from a variety of consumer products, including gasoline, paint, varnish, shellac, rust preventives, and cigarette smoke. Breathing vapors from

1. PUBLIC HEALTH STATEMENT

these types of products can expose you to xylene. In some cases, indoor levels of xylene can be higher than outdoor levels, especially in buildings with poor ventilation. Skin contact with products containing xylene, such as solvents, lacquers, paint thinners and removers, and pesticides may also expose you to xylene.

Besides painters and paint industry workers, others who may be exposed to xylene include biomedical laboratory workers, distillers of xylene, wood processing plant workers, automobile garage workers, metal workers, and furniture refinishers. Workers who routinely come in contact with xylene-containing solvents in the workplace are the population most likely to be exposed to high levels of xylene. Additional information on the potential for human exposure can be found in Chapter 6.

1.4 HOW CAN XYLENE ENTER AND LEAVE MY BODY?

Xylene is most likely to enter your body when you breathe xylene vapors. Xylene may also enter your body if eat or drink xylene-contaminated food or water. Less often, xylene enters the body through the skin following direct contact. Xylene is rapidly absorbed by your lungs after you breathe air containing it. The amount of xylene retained ranges from 50 to 75% of the amount of xylene that you inhale. Physical exercise increases the amount of xylene absorbed by the lungs. Absorption of xylene in the gut after eating food or drinking water containing it is both rapid and complete. Absorption of liquid xylene through the skin also occurs rapidly following direct contact with xylene, but absorption of xylene vapor through the skin is only about 12% of the amount absorbed by the lungs. At hazardous waste sites, the most likely ways you can be exposed are: breathing xylene vapors, drinking well water contaminated with xylene, and direct contact of the skin with xylene. Xylene passes into the blood soon after entering the body.

In people and laboratory animals, xylene is chemically changed, primarily in the liver, into a different form that is more water soluble and is rapidly removed from the body in urine. Some unchanged xylene also leaves in the breath from the lungs within a few seconds after xylene is absorbed. Small amounts of breakdown products of xylene have appeared in the urine of people

1. PUBLIC HEALTH STATEMENT

as soon as 2 hours after breathing air containing xylene. Usually, most of the xylene that is taken in leaves the body within 18 hours after exposure ends. About 4–10% of absorbed xylene may be stored in fat, which may prolong the time needed for xylene to leave the body. Additional information on how xylene can enter and leave your body can be found in Chapter 3.

1.5 HOW CAN XYLENE AFFECT MY HEALTH?

Scientists use many tests to protect the public from harmful effects of toxic chemicals and to find ways for treating persons who have been harmed.

One way to learn whether a chemical will harm people is to determine how the body absorbs, uses, and releases the chemical. For some chemicals, animal testing may be necessary. Animal testing may also help identify health effects such as cancer or birth defects. Without laboratory animals, scientists would lose a basic method for getting information needed to make wise decisions that protect public health. Scientists have the responsibility to treat research animals with care and compassion. Scientists must comply with strict animal care guidelines because laws today protect the welfare of research animals.

Scientists have found that the three forms of xylene have very similar effects on health. No health effects have been noted at the background levels that people are exposed to on a daily basis. Short-term exposure of people to high levels of xylene can cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; impaired function of the lungs; delayed response to a visual stimulus; impaired memory; stomach discomfort; and possible changes in the liver and kidneys. Both short- and long-term exposure to high concentrations of xylene can also cause a number of effects on the nervous system, such as headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Some people exposed to very high levels of xylene for a short period of time have died. Most of the information on health effects in humans exposed for long periods of time is from studies of workers employed in industries that make or use xylene. Those workers were exposed to levels of xylene in air far greater than the levels normally encountered by the general population. Many of the effects seen after their

1. PUBLIC HEALTH STATEMENT

exposure to xylene could have been caused by exposure to other chemicals that were in the air with xylene.

Results of studies in animals indicate that large amounts of xylene can cause changes in the liver and harmful effects on the kidneys, lungs, heart, and nervous system. Short-term exposure to very high concentrations of xylene causes death in animals, as well as muscular spasms, incoordination, hearing loss, changes in behavior, changes in organ weights, and changes in enzyme activity. Animals that were exposed to xylene on their skin had irritation and inflammation of the skin. Long-term exposure of animals to low concentrations of xylene has not been well studied, but there is some information that long-term exposure of animals can cause harmful effects on the kidney (with oral exposure) or on the nervous system (with inhalation exposure).

Information from animal studies is not adequate to determine whether or not xylene causes cancer in humans. Both the International Agency for Research on Cancer (IARC) and EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic and consider xylene not classifiable as to its human carcinogenicity.

Additional information regarding the health effects of xylene can be found in Chapters 2 and 3.

1.6 HOW CAN XYLENE AFFECT CHILDREN?

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

The effects of xylenes have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more vulnerable if the surrounding tissue became swollen. (One study suggested that the narrower airway in women compared to men could be the reason women had more breathing difficulty than men after breathing xylene.)

1. PUBLIC HEALTH STATEMENT

Although there are no conclusive studies in humans, it is possible that exposure of pregnant women to high levels of xylene may cause harmful effects to the fetus. Animal studies showed that xylene absorbed by the mother can cross the placenta and reach the fetus. The unborn animals may have reduced body weight and delayed bone mineralization if the level of xylene is high enough to be toxic to the mother. Some animal studies have shown that newborn babies that were exposed to xylene during pregnancy have problems after birth with motor coordination and the ability to orient themselves in their surroundings. In general, these developmental effects occur at exposure levels much higher than those typically seen in the background environment, levels high enough to also harm the mother.

1.7 HOW CAN FAMILIES REDUCE THE RISK OF EXPOSURE TO XYLENE?

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

Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored out of the reach of small children.

Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.

If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

1.8 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO XYLENE?

Medical tests are available to determine if you have been exposed to xylene at higher-than-normal levels. After xylene has been absorbed, some of its breakdown products can be measured in the urine. However, a urine sample must be provided very soon (within hours) after exposure

1. PUBLIC HEALTH STATEMENT

ends because xylene quickly leaves the body. These tests may be available in certain doctors' offices. Available tests can only indicate exposure to xylene; they cannot be used to predict which health effects, if any, will develop. More information about xylene detection can be found in Chapters 3 and 7.

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. The EPA, the Occupational Safety and Health Administration (OSHA), and the Food and Drug Administration (FDA) are some federal agencies that develop regulations for toxic substances. Recommendations provide valuable guidelines to protect public health, but *cannot* be enforced by law. The Agency for Toxic Substances and Disease Registry (ATSDR) and the National Institute for Occupational Safety and Health (NIOSH) are two federal organizations that develop recommendations for toxic substances.

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 that is usually based on levels that affect animals; they are then adjusted to levels that will help protect humans. Sometimes these not-to-exceed levels differ among federal organizations because they used different exposure times (an 8-hour workday or a 24-hour day), different animal studies, or other factors.

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 provides it. Some regulations and recommendations for xylene include the following:

To protect people from the potential harmful health effects of xylene, EPA regulates xylene in the environment.

1. PUBLIC HEALTH STATEMENT

The EPA estimates that, for an adult of average weight who drinks 2 L of water each day for a lifetime (70 years), exposure to 7 ppm xylene in drinking water is unlikely to result in harmful noncancerous health effects.

Exposure to 40 ppm xylene in water for 1 or 10 days is unlikely to present a health risk to a small child.

The EPA has set a legally enforceable maximum level of 10 ppm of xylene in water that is delivered to any user of a public water system.

OSHA regulates levels of xylene in the workplace. The maximum allowable amount of xylene in workroom air during an 8-hour workday in a 40-hour workweek is 100 ppm.

More information on government regulations for xylene can be found in Chapter 8.

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 contact ATSDR at the address and phone number below.

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

Toxicological profiles are also available on-line at www.atsdr.cdc.gov and on CD-ROM. You may request a copy of the ATSDR ToxProfiles™ CD-ROM by calling the toll-free information

1. PUBLIC HEALTH STATEMENT

and technical assistance number at 1-800-CDCINFO (1-800-232-4636), by e-mail at cdcinfo@cdc.gov, or by writing to:

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Environmental Medicine
1600 Clifton Road NE
Mailstop F-32
Atlanta, GA 30333
Fax: 1-770-488-4178

Organizations for-profit may request copies of final Toxicological Profiles from the following:

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/>