

## 1. PUBLIC HEALTH STATEMENT

This Statement was prepared to give you information about styrene and to emphasize the human health effects that may result from exposure to it. The Environmental Protection Agency (EPA) has identified 1,177 sites on its National Priorities List (NPL). Styrene has been found in at least 52 of these sites. However, we do not know how many of the 1,177 NPL sites have been evaluated for styrene. As EPA evaluates more sites, the number of sites at which styrene is found may change. This information is important for you to know because styrene may cause harmful health effects and because these sites are potential or actual sources of human exposure to styrene.

When a chemical 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 as a chemical emission. This emission, which is also called a release, does not always lead to exposure. You can be exposed to a chemical only when you come into contact with the chemical. You may be exposed to it in the environment by breathing, eating, or drinking substances containing the chemical or from skin contact with it.

If you are exposed to a hazardous chemical such as styrene, several 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, sex, nutritional status, family traits, life style, and state of health.

### 1.1 WHAT IS STYRENE?

Pure styrene is a colorless liquid that evaporates easily and has a sweet smell. However, styrene often contains other chemicals that give it a sharp, unpleasant smell. Styrene dissolves in some liquids, but dissolves only slightly in water.

Styrene is used mostly to make rubber and plastics. Billions of pounds of styrene are produced for this purpose each year in the United States. Products produced from styrene include packaging, insulation (electrical and thermal), fiberglass, pipes, automobile parts, drinking cups and other "fooduse" items, and carpet backing. These products mainly contain styrene linked together in long chains (polystyrene). However, most of these products also contain a residue of unlinked styrene. Styrene is also present in combustion products such as cigarette smoke and automobile exhaust.

Low levels of styrene occur naturally in a variety of foods, such as fruits, vegetables, nuts, beverages, and meats. Styrene can be found in air, soil, and water after release from the manufacture, use, and disposal of styrene-based products.

## 1. PUBLIC HEALTH STATEMENT

Styrene is quickly broken down in the air, usually within 1-2 days. Styrene evaporates from shallow soils and surface water. Styrene that remains in soil or water may be broken down by bacteria. More information about the chemical and physical properties of styrene can be found in Chapter 3. More information about styrene's occurrence and what happens to it in the environment can be found in Chapter 5.

### 1.2 HOW MIGHT I BE EXPOSED TO STYRENE?

The major way you can be exposed to styrene is by breathing air containing it. Styrene is found in city air and indoor air. Styrene is released into the air from industries that make and use styrene. It is also released from automobile exhaust, cigarette smoke, building materials, and consumer products (polystyrene products such as packaging materials, toys, housewares and appliances that may contain residual amounts of unlinked styrene). Accidental spills and hazardous waste disposal sites are also sources of styrene in air. Usually indoor air that has less movement contains higher levels of styrene than does outdoor air. Rural or suburban air generally contains lower concentrations of styrene than city air.

Styrene is not usually found in drinking water. When it is found in water, the main source is usually industrial waste discharge from factories and coal gasification plants. Also styrene may leach into groundwater around hazardous waste sites. Soil may become contaminated with styrene by spills, landfilling with wastes, and industrial discharges. Styrene can be a natural part of some foods, or can be transferred to food from polystyrene packaging material. For more information on human exposure to styrene see Chapter 5.

### 1.3 HOW CAN STYRENE ENTER AND LEAVE MY BODY?

Styrene can enter your body through your lungs if you breathe contaminated air or through your stomach and intestines if you eat or drink contaminated food or water. Styrene can also pass through the skin into your body. Studies on humans show that styrene enters the body tissues quickly after it is breathed in or taken in by mouth. Because styrene is not usually found in drinking water, the most common way it will enter your body is if you breathe air containing it. Ingestion of styrene contaminated foods is another way styrene can enter the body. Once styrene is in the body, it changes quickly to other chemical forms and leaves the body through the urine and exhaled air within a few days to a few weeks. Chapter 2 has more information on how styrene enters and leaves the body.

### 1.4 HOW CAN STYRENE AFFECT MY HEALTH?

Illness or injury has been reported in people, especially workers, who breathe large amounts of styrene for short periods of time. The most common health problems involve the nervous system. These health effects include depression, concentration problems, muscle weakness, tiredness, and nausea. People exposed to styrene may also have irritation of the eyes, nose, and throat. There have been no reports of death as a result of styrene exposure.

## 1. PUBLIC HEALTH STATEMENT

Recovery from the ill effects of short-term exposure is rapid after styrene exposure ends. The health effects for people exposed to styrene for longer periods of time are not known except for limited information on the harmful effects on the nervous system in occupationally-exposed workers.

Some studies of female workers exposed to elevated air concentrations of styrene have suggested that styrene may cause lower birth weights and produce an increased risk of spontaneous abortions. However, these studies are not completely reliable because the studies often involved exposure to chemicals other than styrene.

Styrene vapor affects the lungs of animals that breathe it. Animal studies have shown that inhalation of styrene can result in changes in the lining of the nose that can last up to 12 weeks after exposure ceases. Longterm animal exposure to high levels of styrene results in damage to the liver but this effect has not been seen in people.

There is little or no information regarding adverse effects in humans following oral or dermal exposure to styrene. However, animal studies indicate that ingestion of styrene can produce effects on the liver, kidney, blood, immune system and nervous system. Dermal exposure has resulted in irritation to the skin and eyes of rabbits. The International Agency for Research on Cancer has determined that styrene is possibly carcinogenic to humans.

Further information on the health effects of styrene in humans and animals can be found in Chapter 2.

### **1.5 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO STYRENE?**

Styrene and its breakdown products can be found in your blood, urine, and body tissues for a short time following exposure to moderate-to-high levels. Because urine samples are easily obtained, urine is often analyzed for the common breakdown products to determine whether a person has been exposed to styrene. However,, the breakdown products can also be found in the urine of persons who have been exposed to chemicals other than styrene. The tests for styrene and its breakdown products in urine require specific methods and equipment and are not usually available at a doctor's office. Because styrene is cleared quickly from the body, the above methods are useful only for detecting exposures that have occurred within 1 day. Testing within 1 day after moderate-to-high exposures allows us to estimate the actual exposure level. Testing urine for styrene and its breakdown products usually does not help predict how severe the resulting health effects may be, Information about tests for detecting styrene in the body is given in Chapters 2 and 6.

## 1. PUBLIC HEALTH STATEMENT

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

The Environmental Protection Agency (EPA) has determined that 0.1 ppm is the maximum amount of styrene that may be present in drinking water. This level is believed to be low enough to protect an adult from the noncancer effects of styrene, even if exposure occurs for a lifetime. The EPA is currently reviewing the cancer studies on styrene to decide if this chemical is likely to cause cancer in humans.

The Occupational Safety and Health Administration (OSHA) has set a time weighted average (TWA) of 50 ppm styrene as a permissible exposure limit (PEL) and a short-term exposure limit (STEL) of 100 ppm styrene to protect workers during an 8-hour shift over a 40-hour workweek.

More information on governmental regulations for styrene can be found in Chapter 7.

**1.7 WHERE CAN I GET MORE INFORMATION?**

If you have any more questions or concerns not covered here, please contact your state health or environmental department or:

Agency for Toxic Substances and Disease Registry  
Division of Toxicology  
1600 Clifton Road, E-29  
Atlanta, Georgia 30333

This agency can also provide you with information on the location of the nearest occupational and environmental health clinic. Such clinics specialize in recognizing, evaluating, and treating illnesses that result from exposure to hazardous substances.