Glossary of Volatile Organic Compounds

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Ethylbenzene

Ethylbenzene is a colorless, flammable liquid found in natural products such as coal tar and petroleum. It is also found in manufactured products such as inks, insecticides, and paints. Ethylbenzene is a minor component of JP-8 fuel.

Route of exposure

Ethylbenzene is most commonly found as a vapor in the air. In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water. In soil, most ethylbenzene is broken down by soil bacteria.

Ethylbenzene is released into the environment from burning oil, gas, and coal, and from discharges of ethylbenzene from factories. Ethylbenzene gets into the soil by spills of gasoline or other fuels and poor disposal of industrial and household wastes. People are exposed to ethylbenzene from gasoline, use of ethylbenzene as a solvent in pesticides, carpet glues, varnishes and paints, and use of tobacco. Some people are exposed to ethylbenzene at work. Gas and oil workers can be exposed to ethylbenzene through skin contact or by breathing ethylbenzene vapors. Varnish workers, spray painters, and people involved in gluing operations also can be exposed to high levels of ethylbenzene.

Health effects

Exposure to high levels of ethylbenzene in air can cause dizziness, throat and eye irritation, tightening of the chest, and burning feeling in the eyes. At high concentrations, ethylbenzene will depress the central nervous system in humans and in animals. A high concentration exposure to ethylbenzene in humans can cause liver problems.

Studies in laboratory animals showed problems with the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

No studies in people have shown that ethylbenzene exposure can cause cancer.

Measuring exposure

In a large U.S. study, 95% of the participants in the study had an ethylbenzene concentration up to 0.25 parts per billion in their blood.

The effect of ethylbenzene exposure on the general population at current levels of exposure is not known. The health effects of ethylbenzene at the levels found among the Churchill County study population are not known.

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Benzene

Benzene is a colorless liquid formed from both human-made activities and natural processes. Benzene is widely used in the United States and ranks in the top 20 chemicals used. Two natural sources of benzene are volcanoes and forest fires. Benzene is a natural part of crude oil, gasoline, and cigarette smoke. Benzene is one of the major components of JP-8 fuel.

Industry is the main source of benzene in the environment. Emissions from burning coal and oil, benzene waste and storage operations, motor vehicle exhaust, and evaporation from gasoline service stations can cause benzene levels in the air to increase.

In the air, benzene reacts with other chemicals and breaks down within a few days. Benzene in water and soil breaks down more slowly. Benzene in the environment does not build up in plants or animals.

Route of exposure

People are exposed to benzene mainly through breathing air that contains it, for example while showering or bathing. The level of exposure to benzene through food (for example, cooking with contaminated water), beverages, or drinking water is not as high as through air.

Health effects

Exposure to low levels of benzene can cause eye and skin irritation, drowsiness, dizziness, rapid heartbeat, headaches, nausea, tremors, confusion, and unconsciousness. Exposure to high levels of benzene can cause those symptoms plus vomiting, seizures, irregular heartbeats, coma, and death.

People who breathe benzene for long periods can have health problems in the tissues that form blood cells, especially the bone marrow. Problems with the bone marrow may include anemia, a low white blood cell count, and a low platelet count. Chronic (long-term) exposure to benzene can harm the immune system, increasing the chance for infection and perhaps lowering the body's defense against cancer. Long-term exposure to high levels of benzene in the air can cause a particular type of leukemia called acute myelocytic leukemia.

Measuring exposure

In a large U.S. study, 95% of the participants had a benzene concentration up to 0.48 parts per billion in their blood (0.15 ppb for nonsmokers and 0.66 ppb for smokers).

The effect of benzene exposure on the general population at current levels of exposure is not known. The health effects of benzene at the levels found among the Churchill County study population are not known.

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Xylenes

The term “total xylenes” refers to all three types of xylene (*meta*-, *ortho*-, and *para*-xylene). Xylene is mostly a human-made chemical. Chemical industries produce xylene from petroleum. Xylene also occurs naturally in petroleum and coal tar and is formed during forest fires. Xylene is used as a solvent and in the printing, rubber, and leather industries. It is used as a cleaning agent and a thinner for paint and varnishes. Xylene is a major component of JP-8 fuel.

Route of exposure

Xylene is primarily released from industrial sources, in automobile exhaust, and during its use as a solvent. It quickly evaporates into the air from surface soil and water. People are usually exposed to xylene by breathing it in contaminated air.

Health effects

Xylene affects the brain. High levels from exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in balance. Acute exposures also irritate the skin, eyes, nose, and throat, and cause difficulty breathing, problems with the lungs, slow reaction time, memory difficulties, stomach discomfort, and changes in the liver and kidneys.

Studies of humans and animals have shown that xylene causes cancer, but these studies did not provide enough information to conclude that xylene does not cause cancer.

Measuring exposure

In a large U.S. study, 95% of the participants had a *meta-, para*-xylene concentration up to 0.78 parts per billion and an *ortho*-xylene concentration up to 0.30 parts per billion in their blood.

The effect of xylene exposure on the general population at current levels of exposure is not known. The health effects of xylenes at the levels found among the Churchill County study population are not known.

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Toluene

Toluene is clear, colorless liquid that 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. Toluene is also used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber, and in some printing and leather tanning processes. Toluene is a major component of JP-8 fuel.

Toluene enters the air through automobile exhaust. It can enter surface water and groundwater from spills of solvents and petroleum products, and from leaking underground storage tanks at gasoline stations and other facilities. Toluene does not concentrate or build up to high levels in animals or humans.

Route of exposure

People can be exposed to toluene from many sources, including drinking water, food, air, and consumer products. Workers can be exposed to toluene by breathing the chemical. People who deliberately sniff glue or abuse solvents also are exposed. Smokers are exposed to small amounts of toluene from cigarette smoke.

Health effects

Breathing high levels of toluene in a short time can cause light-headiness, dizziness, sleepiness, unconsciousness, and death. High levels can affect the kidneys. Animals exposed to moderate or high levels can have liver, kidney, and lung problems.

Health problems from chronic (long-term) exposure include harmful effects on the central nervous system in exposed workers. These workers may develop depression, difficulty concentrating, muscle weakness, memory loss, and personality changes. Chronic abuse of toluene can cause problems with the central nervous system.

Studies in workers and in animals exposed to toluene show that toluene does not cause cancer.

Measuring exposure

In a large U.S. study, 95% of participants had a toluene concentration up to 1.5 parts per billion in their blood (1.0 ppb for nonsmokers and 1.9 ppb for smokers).

The effect of toluene exposure on the general population at current levels of exposure is not known. The health effects of toluene at the levels found among the Churchill County study population are not known.

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Styrene

Styrene is mainly a human-made chemical used mostly to make rubber and plastics. Low levels of styrene occur naturally in a variety of foods such as fruits, vegetables, nuts, beverages, and meats. Styrene is also present in combustion products, such as cigarette smoke and automobile exhaust.

Route of exposure

Styrene can be found in air, soil, and water after release from the manufacture, use, and disposal of styrene-based products. It evaporates from shallow soils and surface water. Styrene that remains in soil or water can be broken down by bacteria. Styrene is not usually found in drinking water. Styrene can be a natural part of some foods or can be transferred to food from polystyrene packaging material.

People are exposed to styrene by breathing contaminated air or eating or drinking contaminated food or water. Styrene can also pass through the skin into the body.

Health effects

Acute exposure to styrene can cause nausea; dizziness; headache; irritation of the eyes, nose, and throat. Chronic (long-term) exposure can harm the nervous system of people exposed at work. These workers can have depression, concentration problems, muscle weakness, personality changes, and anxiety.

In laboratory animals, long-term exposure to high levels of styrene damaged the liver, but this problem has not been seen in people. Short-term exposure to very high levels caused reproductive and developmental problems in laboratory animals.

Some workers who made styrene rubber and polystyrene developed cases of leukemia and lymphoma. However, these workers also could have been exposed to benzene and other chemicals.

Styrene may possibly cause cancer in humans.

Measuring exposure

In a large U.S. study, 95% of the participants had a styrene concentration up to 0.18 parts per billion in their blood.

The effect of styrene exposure on the general population at current levels of exposure is not known. The health effects of styrene at the levels found among the Churchill County study population are not known.

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Carbon tetrachloride

Carbon tetrachloride is a manufactured compound that does not occur naturally. It has been produced in large quantities to make refrigeration fluid and propellants for aerosol cans. However, the production of carbon tetrachloride is being phased out.

In the past, carbon tetrachloride was widely used as a cleaning fluid, in industry and dry cleaning businesses, and in the household. Carbon tetrachloride also was used in fire extinguishers and as a fumigant to kill insects in grain. These uses were stopped in the mid-1960s.

Route of exposure

Levels of carbon tetrachloride are found in air, water, and soil because of past and present releases. Most carbon tetrachloride that escapes to the environment is found as a gas in the atmosphere. It is not expected to build up in fish. We do not know if it builds up in plants.

People are exposed to carbon tetrachloride mainly from breathing air, drinking water, or coming in contact with contaminated soil. This mostly occurs around hazardous waste sites or in the workplace. Carbon tetrachloride accumulates in body fat and can enter the kidney, liver, brain, and skeletal muscle.

Health effects

High exposure to carbon tetrachloride can cause liver, heart, kidney, and central nervous system damage. The liver and kidneys are especially sensitive to carbon tetrachloride.

Acute exposure can cause people to feel intoxicated (drunk) and have headaches, dizziness, sleepiness, and nausea and vomiting. These effects may disappear if exposure is stopped, but in severe cases, coma and even death can occur.

In laboratory animals, carbon tetrachloride given by mouth can cause more liver tumors. We do not know if breathing carbon tetrachloride causes cancer in animals. We also do not know if breathing, or eating or drinking it will cause cancer in people, but carbon tetrachloride possibly causes cancer in humans.

Measuring exposure

In a large U.S. study, over 90% of the participants did not have a detectable carbon tetrachloride concentration in their blood.

The effect of carbon tetrachloride exposure on the general population at current levels of exposure is not known. The health effects of carbon tetrachloride at the levels found among the Churchill County study population are not known.

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1,1,1-Trichloroethane

1,1,1-Trichloroethane does not occur naturally in the environment. It is used in commercial products, mostly to dissolve other chemicals. Beginning in 1996, 1,1,1-trichloroethane was no longer made in the United States because of its effects on the ozone layer.

Because of its tendency to evaporate easily, the vapor form is usually found in the environment. 1,1,1-Trichloroethane also can be found in soil and water, particularly at hazardous waste sites. It will not build up in plants or animals.

Route of exposure

People are exposed to 1,1,1-trichloroethane usually by breathing contaminated air or by drinking contaminated water and eating contaminated food.

Health effects

People who breathe air containing high levels of 1,1,1-trichloroethane for a short time can become dizzy or light-headed, and lose their balance. Breathing it at much higher levels can cause unconsciousness, low blood pressure, and loss of heartbeat.

In some animals, exposure to high levels damages the breathing passages, affects the nervous system, and causes mild harm to the liver.

No studies have been done in people to tell whether harmful health effects occur from eating food or drinking water contaminated with 1,1,1-trichloroethane.

No information is available to show that 1,1,1-trichloroethane causes cancer.

Measuring exposure

In a large U.S. study, 95% of the participants had a concentration of 1,1,1-trichloroethane up to 0.80 parts per billion in their blood.

The effect of 1,1,1-trichloroethane exposures on the general population at current levels of exposure is not known. The health effects of 1,1,1-trichloroethane at the levels found among the Churchill County study population are not known.

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Tetrachloroethylene

Tetrachloroethylene, also known as perchloroethylene, is a human-made chemical that is widely used for dry cleaning of fabrics and for metal-degreasing operations. It is also used as a starting material (building block) for making other chemicals and is used in some consumer products such as water repellents, silicone lubricants, fabric finishers, spot removers, adhesives, and wood cleaners.

Tetrachloroethylene can stay in the air for a long time before breaking down into other chemicals or coming back to the soil and water in rain. Much of the tetrachloroethylene that gets into water and soil will evaporate. However, because tetrachloroethylene can travel easily through soils, it can get into underground drinking water supplies.

Route of exposure

People usually are exposed to tetrachloroethylene by breathing contaminated air, but they also can be exposed by drinking contaminated water and eating contaminated food.

Health effects

High concentrations of tetrachloroethylene can cause dizziness, headache, sleepiness, confusion, nausea, difficulty in speaking and walking, unconsciousness, liver and kidney damage, and even death.

Chronic (long-term) exposure to tetrachloroethylene can cause skin irritation and nervous system problems, such as memory loss and concentration problems.

Even though tetrachloroethylene has caused liver tumors in laboratory mice and kidney tumors in male rats, it has not been shown linked to cancer in humans.

Measuring exposure

In a large U.S. study, 95% of the participants had a concentration of tetrachloroethylene up to 0.62 parts per billion in their blood.

The effect of tetrachloroethylene exposure on the general population at current levels of exposure is not known. The health effects of tetrachloroethylene at the levels found among the Churchill County study population are not known.

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Trichloroethylene

Trichloroethylene is a colorless liquid that does not occur naturally. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical.

Trichloroethylene is mainly used as a solvent to remove grease from metal parts and is found in some household products, including typewriter correction fluid, paint removers, adhesives, and spot removers.

It is found in some foods; however, the trichloroethylene found in foods is believed to come from contamination of water used in food processing or from food processing equipment cleaned with trichloroethylene.

Route of exposure

People are exposed to trichloroethylene by breathing air or drinking water containing it, or by getting it on their skin.

Health effects

People who are exposed to large amounts of trichloroethylene can become dizzy, sleepy, and even unconscious. Other effects reported at high levels include liver and kidney damage and changes in heartbeat.

Animals that were exposed to moderate levels of trichloroethylene can get enlarged livers, and high levels of exposure can cause liver and kidney damage.

Studies of people exposed over long periods to high levels of trichloroethylene in drinking water found more heart defects and cancer such as leukemia. However, these results are inconclusive because other chemicals were involved and could have contributed to these problems.

Some studies with mice and rats suggest that high levels of trichloroethylene may cause liver or lung cancer.

Measuring exposure

Almost all of the Churchill County blood samples tested for trichloroethylene fell below the level of detection (0.01 ppb).

The effect of trichloroethylene exposure on the general population at current levels of exposure is not known. The health effects of trichloroethylene at the levels found among the Churchill County study population are not known.

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1,4-Dichlorobenzene

1,4-dichlorobenzene is a chemical used to control moths, molds, and mildew and to deodorize restrooms and waste containers. It does not occur naturally but is produced by chemical companies to make products for home use and other chemicals such as resins.

Most of the 1,4-dichlorobenzene enters the environment as a result of its use in moth-repellant products and in toilet-deodorizer blocks. Because it changes from a solid to a gas easily, almost all 1,4-dichlorobenzene produced is released into the air. If it is released to groundwater, it can be transported to surface water. Plants and fish seem to absorb 1,4-dichlorobenzene.

Tobacco smoke also contains 1,4-dichlorobenzene.

Route of exposure

People are exposed to 1,4-dichlorobenzene mainly by breathing vapors from 1,4-dichlorobenzene products used in the home. 1,4-Dichlorobenzene can also get into the body from drinking water that contains it or from eating certain foods, such as meat, chicken, eggs, or fish, that contain it.

Health effects

There is no evidence that moderate use of common household products that contain 1,4-dichlorobenzene harms human health. However, very high use of 1,4-dichlorobenzene products in the home can result in dizziness, headaches, and liver problems.

Even though there is no evidence that 1,4-dichlorobenzene causes cancer in humans, laboratory animals given very high levels in water developed liver and kidney tumors.

Measuring exposure

In a large U.S. study, 95% of the participants had a concentration of 1,4-dichlorobenzene up to 9.2 parts per billion in their blood.

The effect of 1,4-dichlorobenzene exposures on the general population at current levels of exposure is not known. The health effects of 1,4-dichlorobenzene at the levels found among the Churchill County study population are not known.

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