



PUBLIC HEALTH STATEMENT

1,1-DICHLOROETHENE

CAS#: 75-35-4

Division of Toxicology

May 1994

This Public Health Statement is the summary chapter from the Toxicological Profile for 1,1-Dichloroethene. 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 1,1-dichloroethene 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. 1,1-Dichloroethene has been found in at least 492 of the sites on the NPL. However, the number of NPL sites evaluated for 1,1-dichloroethene is not known. As EPA evaluates more sites, the number of sites at which 1,1-dichloroethene is found may increase. This information is important because exposure to 1,1-dichloroethene may cause harmful health effects and because these sites are potential or actual sources of human exposure to 1,1-dichloroethene.

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 may be exposed by breathing,

eating, or drinking substances containing the substance or by skin contact with it.

If you are exposed to a substance such as 1,1-dichloroethene, 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 1,1-DICHLOROETHENE?

1,1-Dichloroethene, also known as vinylidene chloride, is a chemical used to make certain plastics (such as packaging materials, flexible films like SARAN wrap) and flame-retardant coatings for fiber and carpet backing. It is a colorless liquid that evaporates quickly at room temperature. It has a mild sweet smell and burns quickly.

1,1-Dichloroethene is a man-made chemical and is not found naturally in the environment. Although 1,1-dichloroethene is manufactured in large quantities, most of it is used to make other substances or products such as polyvinylidene chloride

1.2 WHAT HAPPENS TO 1,1-DICHLOROETHENE WHEN IT ENTERS THE ENVIRONMENT?

1,1-Dichloroethene can enter the environment when it is released to the air during its production or released to surface water or soil as a result of waste

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disposal. Most 1,1-dichloroethene evaporates quickly and mainly enters the environment through the air, although some enters into rivers or lakes. 1,1-Dichloroethene can enter soil, water, and air in large amounts during an accidental spill. 1,1-Dichloroethene can also enter the environment as a breakdown product of other chemicals in the environment.

1,1-Dichloroethene behaves differently in air, water, and soil. 1,1-Dichloroethene evaporates to the air very quickly from soil and water. In the air, 1,1-dichloroethene is broken down by reactive compounds formed by sunlight. 1,1-Dichloroethene remains in the air for about 4 days.

From water, 1,1-dichloroethene evaporates into the air; it breaks down very slowly in water. We do not know exactly how long 1,1-dichloroethene stays in water. It is not readily transferred to fish or birds, and only very small amounts enter the food chain.

In soil, 1,1-dichloroethene either evaporates to the air or percolates down through soil with rainwater and enters underground water. Small living organisms in soil and groundwater may transform it into other less harmful substances, although this happens slowly.

1.3 HOW MIGHT I BE EXPOSED TO 1,1-DICHLOROETHENE?

You may be exposed to 1,1-dichloroethene by breathing it when it is in the air or eating food or water that contains it. You may also be exposed to 1,1-dichloroethene if it touches your skin. 1,1-Dichloroethene is found at very low levels in indoor and outdoor air (estimated as less than 1 part per trillion parts of air [ppt]). Therefore, the potential

for exposure in the environment is extremely low. The amounts are somewhat higher near some factories that make or use 1,1-dichloroethene (those that make food-packaging films, adhesives, flame-retardant coatings for fiber and carpet backing, piping, and coating for steel pipes), hazardous waste sites, and areas near accidental spills. The exact amount of 1,1-dichloroethene in the air near these factories is not known. In air around waste sites where it has been identified, the amount of 1,1-dichloroethene ranges from 0.39 to 97 parts 1,1-dichloroethene per billion parts of air (ppb, 1 ppb is 1,000 times more than 1 ppt). The levels of 1,1-dichloroethene in air around waste sites are usually much lower than those that have caused health effects in animals. We estimate that 1,1-dichloroethene contaminates the air around 97 chemical factories in the United States. Factories that make 1,1-dichloroethene are mainly located in Texas and Louisiana. Measured air levels inside manufacturing plants range from less than 5 to 1,900 parts 1,1-dichloroethene per million parts of air (ppm, 1 ppm is 1,000 times more than 1 ppb).

A small percentage (3%) of the drinking water sources in the United States contain low amounts of 1,1-dichloroethene (0.2-0.5 ppb with an estimated average of 0.3 ppb). The amounts are very low compared with levels that are expected to affect human health. The concentration of 1,1-dichloroethene in groundwater samples from hazardous waste sites ranged from 0.001 to 0.09 ppm.

Since 1,1-dichloroethene is used to make some consumer products, exposure might occur while these products are made or used. For example, the estimated average amount of 1,1-dichloroethene in plastic food-packaging films ranged from <0.02 to

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1.26 ppm. The measured average amount in food wrapped in these films was less than 0.01 ppm. Not every tested food sample contained 1,1-dichloroethene, so these numbers only reflect the levels found in food samples tested that did contain 1,1-dichloroethene. The Food and Drug Administration (FDA) regulates the use of plastic packaging films. The FDA has determined that the films can contain no more than 10 ppm 1,1-dichloroethene and that the low levels of 1,1-dichloroethene found in food wrapped in these films present no health risk to the consumer. Besides environmental exposures, occupational exposure can occur for workers who are involved in the manufacture and use of 1,1-dichloroethene. These workers include primarily carpenters, warehouse workers, and machine operators.

1.4 HOW CAN 1,1-DICHLOROETHENE ENTER AND LEAVE MY BODY?

1,1-Dichloroethene can easily enter the body through the lungs as an air pollutant or through the stomach and intestines if you eat or drink contaminated food or water. Based on the physical and chemical properties of 1,1-dichloroethene, we think that 1,1-dichloroethene can also enter the body through the human skin. Harmful effects have occurred in animals after 1,1-dichloroethene was applied to their skin.

Animal studies indicate that following exposure, 1,1-dichloroethene partly leaves the body through the lungs. The remaining 1,1-dichloroethene breaks down into other substances that leave the body in the urine within 1-2 days. Some of the breakdown products of 1,1-dichloroethene such as dithioglycolic acid, are more harmful than 1,1-dichloroethene. The way 1,1-dichloroethene and its

breakdown products leave the body depends on the amount of 1,1-dichloroethene that enters the body. Low or moderate levels breathed in (25-200 ppm) or taken by mouth (up to 50 milligrams per kilogram of body weight) leave the body mainly as breakdown products in the urine. As the amount of 1,1-dichloroethene that enters the body increases, more and more 1,1-dichloroethene leaves the body in the exhaled breath. Whether 1,1-dichloroethene is inhaled or taken by mouth it leaves the body in about the same way. 1,1-Dichloroethene is not stored very much in the body when low-to-moderate amounts enter the body.

1.5 HOW CAN 1,1-DICHLOROETHENE AFFECT MY HEALTH?

How a chemical affects your health depends on how much you are exposed to and for how long. As the level and length of your exposure increase, the effects are likely to become more severe. Information on the health effects in humans after breathing 1,1-dichloroethene is insufficient. People who breathed high amounts of 1,1-dichloroethene in a closed space lost their breath and fainted. Some people who breathed 1,1-dichloroethene at work for several years had abnormal liver function. However, exposure to other chemicals may have also contributed to this effect. Available information indicates that prolonged inhalation of 1,1-dichloroethene can induce adverse neurological effects and is possibly associated with liver and kidney damage in humans. Studies in animals indicate that 1,1-dichloroethene can affect the normal functions of the liver, kidneys, and lungs. However, the amount of 1,1-dichloroethene in the air to which the animals were exposed was much higher than the amounts in the air that the general public usually breathes. Some animals that breathed

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large amounts of 1,1-dichloroethene died within a few days. The liver and kidneys of animals were affected after breathing air that contained 1,1-dichloroethene for days, months, or years. After pregnant rats breathed 1,1-dichloroethene in air, some of the newborn rats had birth defects.

We have no information on health effects in humans who ate food or drank water that contained 1,1-dichloroethene. Animals fed food that contained 1,1-dichloroethene or that had 1,1-dichloroethene placed experimentally in their stomachs developed liver and kidney disease, and some even died. These amounts, however, were very much higher than those which occur in drinking water supplies. Birth defects did not occur in the newborn of female rats that drank 1,1-dichloroethene.

Spilling 1,1-dichloroethene on your skin or in your eyes can cause irritation. We do not know what other health effects might occur if 1,1-dichloroethene comes into contact with your skin for long periods. However, no serious effects or deaths occurred in mice after small amounts of 1,1-dichloroethene were put on their skin over a period of months. We do not know whether spilling 1,1-dichloroethene on your skin can cause birth defects or affect fertility.

We do not know whether coming into contact with 1,1-dichloroethene increases the risk of cancer in humans. Evidence from epidemiology studies of workers exposed to 1,1-dichloroethene is inconclusive. Several studies examined the possibility that 1,1-dichloroethene may increase the risk of cancer in animals. Only one of these studies indicated that mice breathing 1,1-dichloroethene for 1 year developed kidney cancer, but the particular

type of mouse used may be especially sensitive to 1,1-dichloroethene.

The U.S. Department of Health and Human Services has not classified 1,1-dichloroethene with respect to carcinogenicity. The International Agency for Research on Cancer (IARC) has determined that 1,1-dichloroethene is not classifiable as to its carcinogenicity in humans. The EPA has determined that 1,1-dichloroethene is a possible human carcinogen. NTP does not include it in its list of substances expected to be human carcinogens.

1.6 IS THERE A MEDICAL TEST TO DETERMINE WHETHER I HAVE BEEN EXPOSED TO 1,1-DICHLOROETHENE?

1,1-Dichloroethene can be measured in the breath, blood, urine, and body tissues of individuals who come in contact with the chemical. However, only relatively high levels of 1,1-dichloroethene in body tissues and fluids can be measured. Because breath samples are easily collected, tests of exhaled air are now the most common way to tell whether a person has been exposed to high levels of 1,1-dichloroethene. One of the breakdown products of 1,1-dichloroethene, dithioglycolic acid, can also be measured in urine. None of these tests are regularly available at a doctor's office because they require special equipment, but your doctor can tell you where you can get the tests done. Although these tests can prove that a person has been exposed to 1,1-dichloroethene, they cannot tell if any health effects will occur. Since most of the 1,1-dichloroethene leaves the body within a few days, these methods are best for determining whether exposures have occurred within the last several days. Detection of 1,1-dichloroethene or its

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breakdown products in the body may not necessarily mean that exposure to 1,1-dichloroethene alone has occurred. People exposed to 1,1-dichloroethene at hazardous waste sites were probably also exposed to other organic compounds, that produce breakdown products similar to those of 1,1-dichloroethene. Other methods for measuring the effects associated with exposure to 1,1-dichloroethene (such as reduced enzyme levels) are not specific enough to detect effects caused by exposure to 1,1-dichloroethene alone.

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

The federal government has developed regulatory guidelines and standards to protect people from the possible health effects of 1,1-dichloroethene. The Occupational Safety and Health Administration (OSHA) requires workplace exposure limits of 1 ppm or less for an 8-hour workday to protect workers from noncancer harmful health effects. To guarantee the maximum protection for human health from the possible cancer effects of drinking water or eating seafood (fish or shellfish) that contain 1,1-dichloroethene over a lifetime, the EPA recommends that the level of 1,1-dichloroethene in lakes and streams should not exceed 0.003 ppm. EPA has determined that drinking water containing 3.5 ppm of 1,1-dichloroethene for adults and 1 ppm for children is not expected to cause noncancerous harmful health effects. The National Institute for Occupational Safety and Health (NIOSH) has recommended that 1,1-dichloroethene is a potential occupational cancer causing chemical.

The EPA limits the amount of 1,1-dichloroethene permitted in publicly owned waste water treatment

plants. To minimize human exposure to 1,1-dichloroethene, EPA requires that industry tell the National Response Center when 100 pounds or more of 1,1-dichloroethene have been released in the environment.

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

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1994. Toxicological profile for 1,1-dichloroethene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

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