

Common Chemicals



Found at Superfund Sites





EPA Facts About Vinyl Chloride

June 1992

What is vinyl chloride?

Vinyl chloride is a colorless gas with a mild, sweet odor. It is a man-made chemical that does not occur naturally. Most of the vinyl chloride produced in the United States is used to make polyvinyl chloride (PVC). This material is used to manufacture a variety of plastic and vinyl products including pipes, wire and cable coatings, packaging materials, furniture and automobile upholstery, wall coverings, housewares, and automotive parts. Much smaller amounts of vinyl chloride are used as a cooling gas and in the manufacture of other compounds.

Emissions from vinyl chloride and PVC manufacturers are responsible for the majority of vinyl chloride released to the environment.

How might exposure to vinyl chloride occur?

Vinyl chloride has been found in approximately 418 of the 1,300 hazardous waste sites on the *National Priorities List (NPL)*. Vinyl chloride is mainly released into the air and discharged in wastewater from the plastics industry. Most of the vinyl chloride that enters the air gradually breaks down into less harmful substances. Levels of vinyl chloride found in the environment are usually more than a thousand times below levels found in occupational settings. Elevated outdoor levels are usually expressed in terms of parts of vinyl chloride present in a billion parts of air or water (ppb). The term "parts per billion" is a way of expressing the concentration of a contaminant in a liquid or air. One part per billion is equal to one inch in a distance of about sixteen thousand miles (or a penny in ten million dollars), a very small amount. Outdoor levels of vinyl chloride result from the discharge of exhaust gases from factories that manufacture or process vinyl chloride, or evaporation from areas where chemical wastes are stored. The highest outdoor levels have been measured in air near vinyl chloride factories or over chemical waste storage areas.

Vinyl chloride that enters drinking water comes from factories that release vinyl chloride wastes into rivers and lakes, and from *leaching* into groundwater in areas where chemical wastes are stored. Small amounts of vinyl chloride can enter drinking water from contact with polyvinyl chloride pipes. In the past, higher than expected amounts were present in foods packaged in plastic that contained vinyl chloride. Currently, the U.S. Food and Drug Administration (FDA) regulates the amount of vinyl chloride allowed in food packaging in order to limit the intake of vinyl chloride.

How can vinyl chloride affect human health?

Short-term exposures to very high levels of vinyl chloride in air can cause dizziness, lack of muscle coordination, headaches, unconsciousness, or death. Long-term exposure to lower amounts in factories which produce or use vinyl chloride has caused "vinyl chloride disease". This disease is characterized by severe damage to the liver, effects on the lungs, poor circulation in the fingers, changes in the bones of the fingers, thickening of the skin, and changes in the blood. An increased risk of developing cancer of the liver and possibly several other tissues has been linked with breathing air in factories containing vinyl chloride.

Some health effects observed in humans have also been seen in laboratory animals. Effects on the nervous system of animals have occurred following short-term exposure to very high levels of vinyl chloride in air. Animals exposed to high levels for a short period of time, as well as to low levels for a long period, developed liver damage. Kidney effects have also occurred following exposure to high levels. Animals developed cancer in several tissues after eating food or breathing air that contained vinyl chloride.

How can vinyl chloride enter the body?

The most likely way that vinyl chloride can enter the body is by inhalation. This *exposure route* is of concern for persons employed in vinyl chloride manufacturing or processing, for people living in communities where vinyl chloride plants are located, and for individuals living near hazardous waste disposal sites. Vinyl chloride can also enter the body through ingestion. Absorption of vinyl chloride through the skin is not likely to be an important exposure route.

Is there a medical test to identify vinyl chloride exposure?

Vinyl chloride can be measured in urine and body tissues, but these tests cannot be used to determine the level of vinyl chloride exposure. Measuring the amount of the major *breakdown product* of vinyl chloride in the urine may give some indication of recent exposure; however, the quantity of this breakdown product may vary for different people. Neither of these tests is routinely available at a doctor's office. Laboratory tests commonly used by doctors to evaluate liver damage and liver function are usually not helpful in determining whether liver damage has resulted from vinyl chloride exposure.

What levels of exposure have resulted in harmful health effects?

Vinyl chloride is regarded worldwide as a chemical that causes cancer in humans, but exposure levels necessary to cause cancer are not known. The U.S. Environmental Protection Agency (EPA), therefore, uses animal data to estimate risk in humans. According to this data, it is estimated that breathing air containing 1 ppm vinyl chloride for 70 years may place as many as 11,000 persons in a population of 100,000 at risk of developing cancer. Eating food containing 1 ppm vinyl chloride every day for 70 years may place as many as 6,440 persons in a population of 100,000 at risk of developing cancer. Similarly, drinking water containing 1 ppm vinyl chloride every day for 70 years may place as many as 9,570 persons in a population of 100,000 at risk of developing cancer.

What recommendations has the federal government made to protect human health?

EPA requires that community drinking water systems that regularly serve the same 25 persons for at least 8 months of the year must limit vinyl chloride in the drinking water to 2 ppb. Recently, the FDA changed its regulations regarding the vinyl chloride content of various plastics used in food packaging and to carry water used in food processing in order to limit the intake of vinyl chloride in food to levels considered to be safe. Limits range from 5 to 50 ppm depending on the nature of the plastic and its use.

What are the methods of treatment and disposal of vinyl chloride?

The recommended method of disposal of vinyl chloride is incineration, following mixing with another combustible fuel. Complete combustion must be ensured to prevent the formation of phosgene, a poisonous gas. An acid scrubber is also required to remove hydrochloric acid produced during incineration.

EPA has classified vinyl chloride as a "hazardous component of solid waste" in order to control the handling of this chemical. All releases greater than one pound must be reported to the National Response Center.

GLOSSARY

Breakdown Product: Most contaminants are combinations of specific substances. Contaminants are degraded, or separated, into these individual substances through chemical or physical means.

Exposure Route: The way in which people come into contact with a substance. The main routes are ingestion, inhalation, and absorption through the skin.

Leach: The process by which substances are released from the soil by dissolving in fluids, usually rain and surface water, and are carried down through the soil.

National Priorities List (NPL): EPA's list of uncontrolled or abandoned hazardous waste sites identified for possible long-term clean-up under the Superfund Program.

For more information about Vinyl Chloride, please contact EPA at the following address:

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The information contained in this fact sheet was compiled from the Toxicological Profile for Vinyl Chloride, Agency for Toxic Substances and Disease Registry, U.S. Public Health Service, in collaboration with the U.S. Environmental Protection Agency, August, 1989. This fact sheet focuses on the impact of hazardous wastes on human health; however, EPA does evaluate these impacts on the environment, including plants and animals.