
ENVIRONMENTAL Fact Sheet



29 Hazen Drive, Concord, New Hampshire 03301 • (603) 271-3503 • www.des.nh.gov

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Chlorofluorocarbons (CFCs): Health Information Summary

Chlorofluorocarbons (CFCs) are a group of colorless, non-combustible liquids, also known as Freons. CFCs have been used as refrigerants, propellants in aerosols, metal degreasers, in fire extinguishers, and as a dry cleaning solvent.

Because CFCs are extremely volatile substances and poorly soluble in water, they are primarily released into the air through evaporation during production and use. CFCs released to surface water will be volatilized within a few days. Because CFCs are not bound strongly to soil, they can easily leach to groundwater. CFCs degrade slowly in groundwater.

Concerns about CFCs have focused on their damage to the ozone layer in the upper atmosphere. Therefore, almost all uses of these chemicals have been phased out. However, because of their former uses in refrigerators, freezers, and air conditioners that tend to last for many years and may still be in use, and the fact that CFCs degrade slowly in ground water, they may still be found as environmental contaminants.

Health Effects

The health effects of three common CFCs were researched: trichlorofluoromethane (CFC-11), dichlorodifluoromethane (CFC-12), and trichlorotrifluoroethane (CFC-113). Health effects of other CFCs will, in general, tend to be similar.

Absorption/Metabolism

CFCs are primarily absorbed by inhalation, and to a lesser extent through ingestion and through the skin. CFCs are preferentially stored in fat tissue. Almost all absorbed CFCs are cleared from the body within 24 hours.

Short-term (acute) Effects

Exposure to pressurized CFCs, such as may occur with a refrigerant leak, can cause frostbite to the skin as well as to the upper airway if inhaled. CFCs exposed to high temperatures can degrade into more acutely toxic gases such as chlorine and phosgene.

Inhalation of CFCs at high concentrations affects the central nervous system (CNS) with symptoms of alcohol-like intoxication, reduced coordination, light-headedness, headaches, tremors, and convulsions. Very high concentrations can cause disturbances in heart rhythm. Intentional sniffing of the vapors has caused some deaths, presumably from disruption of heart rhythm.

In an acute inhalation study, humans were exposed for several hours to increasing concentrations of CFCs. As concentrations of CFCs increased, health impacts also increased.

Long-Term (Chronic) Effects

In occupational studies, workers exposed to CFCs at the occupational standard showed no adverse health effects.

In a study of laboratory animals exposed orally to CFC-11, increased mortality was observed. Guinea pigs exposed to CFC-12 by inhalation had liver effects. Other species of laboratory animals exposed under the same conditions showed no adverse health effects.

Carcinogenic Effects (Ability to Cause Cancer)

Research involving different animal species exposed to CFCs did not show any evidence of carcinogenic (cancer) effects. Although the U. S. Environmental Protection Agency (EPA) has not yet formally evaluated CFCs for their carcinogenic potential, the available studies' results seem to indicate that their potential to cause cancer is low.

Reproductive/Developmental Effects

Laboratory animals exposed to high levels of CFCs have not resulted in any observable adverse health effects.

Health Standards and Criteria

There are EPA Drinking Water Lifetime Health Advisories (LHAs) for CFC-11 and CFC-12. The CFC-11 LHA of 2,000 parts per billion (ppb) is based on increased mortality seen in animals. The CFC-12 LHA of 1,000 ppb is based on a significant reduction in body weight gain observed in rats. The DES Ambient Groundwater Quality Standards (AGQSs) for CFC-11 and CFC-12 are the same as their LHAs. Although there is currently no AGQS for CFC-113, a provisional drinking water guideline of 21,000 ppb has been developed by the State based on occupational inhalation exposure in which no harmful health effects were observed in workers.

The Occupational Safety and Health Administration (OSHA) enforceable standards (permissible exposure limits or PELs) for CFC-11, CFC-12 and CFC-113 in workplace air are set at 1,000 parts per million (ppm), which equals 1,000,000 ppb for each of these CFCs averaged over the work day.

For more information, please contact the DES Environmental Health Program, 29 Hazen Drive, Concord, NH 03302-0095; (603) 271-4608.

Suggested Reading and References

Casarett and Doull's Toxicology: The Basic Science of Poisons, Sixth Edition. Klaassen, C.D., ed. McGraw-Hill Publishing Co. Inc., New York, 2001.

Toxicological information on dichlorodifluoromethane. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last significant revision: August, 1990.

Toxicological information on trichlorofluoromethane. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last significant revision: March, 1988.

Toxicological information on trichlorotrifluoroethane. Integrated Risk Information System (IRIS). U.S. EPA, Office of Health and Environmental Assessment. Last significant revision: April, 1987.

Hazardous Substances Data Bank (HSDB). Toxicology database files for dichlorodifluoromethane, trichlorofluoromethane, and trichlorotrifluoroethane. Available at National Library of Medicine's Toxicology Data Network (TOXNET) at <http://toxnet.nlm.nih.gov>.