Technical Factsheet on: 1,1,1-TRICHLOROETHANE

List of Contaminants

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:
National Primary Drinking Water Regulations

Drinking Water Standards

MCLG: 0.2 mg/L
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HAL(child): 1 day: 100 mg/L; Longer-term: 40 mg/L

Health Effects Summary

Acute: EPA has found that 1,1,1-trichloroethane has the potential to cause damage to the liver, nervous system and circulatory system from acute exposures above the MCL.

Drinking water levels which are considered "safe" for short-term exposures: For a 10-kg (22 lb.) child consuming 1 liter per day, a one-day exposure of 100 mg/L; upto a 7-year exposure to 40 mg/L.

Chronic: 1,1,1-trichloroethane has the potential to cause liver, nervous system and circulatory system damage from a lifetime exposure at levels above the MCL.

Cancer: There is inadequate evidence to state whether or not 1,1,1-trichloroethane has the potential to cause cancer from exposures in drinking water.

Usage Patterns

Demand for 1,1,1-trichloroethane in 1988 was 700 million lb., increased to 705 million in 1989, and was projected (in 1989) to reach 735 million lb. in 1993.

Solvent uses include vapor degreasing of metal products; for cleaning precision instruments; for textile processing and dyeing; in aerosols, in which it acts both as a vapor pressure depressant and as a solvent and carrier for many of the active ingredients used in aerosols. It is also used as an intermediate in the manufacture of organic chemicals, as a coolant and lubricant in metal cutting oils; as a component of inks and drain cleaners. Agricultural uses have included postharvest fumigation of strawberries; for degreening citrus fruits; as a solvent for various insecticides.

Proportions consumed for various uses in 1989 were: vapor degreasing, 34%; cold cleaning, 12%; aerosols, 10%; adhesives, 8%; intermediate, 7%; coatings, 5%; electronics, 4%; other, 5%; exports, 15%.

Release Patterns

1,1,1-Trichloroethane is likely to enter the environment from air emissions or in wastewater from its production or use in vapor degreasing, metal cleaning, etc. It can also enter the environment in leachates and volatile emissions from landfills.

From 1987 to 1993, according to EPA's Toxic Chemical Release Inventory, releases to water totalled over 222,000 lbs. Releases to land totalled over 812,000 lbs. These releases were primarily from metal fabrication industries. The largest releases occurred in California and Georgia. The largest direct releases to water occurred in Utah and Indiana.

Environmental Fate

1,1,1-Trichloroethane has a high Henry's Law constant (8X10-3 atm-cu m/mole) and will volatilize rapidly from water and soil with diffusion through the liquid phase controlling volatilization from water. Half-life for evaporation from water obtained from laboratory systems range from a fraction of an hour to several hours. Various estimates of volatilization half-lives range from 5.1-10.6 days for ponds, 3-29 hr for rivers, and 3.8-12 days for lakes.

The adsorption of 1,1,1-trichloroethane to soil is proportional to the organic carbon content of the soil. The mineral content of the soil is not a contributing factor. 1,1,1-Trichloroethane is adsorbed strongly to peat moss, less strongly to clay, very slightly to dolomite limestone and not at all to sand. It has a low adsorption to silt loam (Koc = 183). From the fact that it is not retained in the soil during bank infiltration, and that it is frequently found in groundwater in high concentrations, one can safely conclude that it is not adsorbed strongly by soils, especially subsurface soils. Based upon experimental measurement, the mean Koc range of 1,1,1-trichloroethane in a silty clay soil and sandy loam soil is 81-89.

There is no or very slow degradation in soils. No degradation has been observed in subsurface soils in 27 weeks. However in loamy sand, slow degradation has been observed under acclimated conditions. Slow degradation may occur in water under anaerobic or aerated conditions; degradation may take several weeks and acclimation is important. No degradation in river water has been found. 1,1,1-Trichloroethane degraded to vinylidene chloride as a first step in its biotransformation in microcosms containing aquifer water and sediment collected from uncontaminated sites in the Everglades. Considerable degradation occurred within two weeks. Field evidence of biodegradation in aquifers indicates a half-life of 231 days.

1,1,1-Trichloroethane has been shown to undergo biotransformation by a reductive dechlorination to 1,1-dichloroethane and chloroethane under methanogenic conditions. Laboratory reactors have demonstrated that 1,1,1-trichloroethane can be biodegraded under anaerobic simulations; it was suggested that in-situ anaerobic biodegrdation may be a viable alternative for clean-up for various contaminated soil and groundwater sites.

Hydrolysis is not a significant degradation process having a half-life of approximately 6 months. The product of hydrolysis is vinylidene chloride. Direct photolysis is not important in the troposphere, but is in the stratosphere, and leads to the chemical's rapid degradation. Photodegradation is not observed in water.

The BCF in bluegill sunfish in a 28 day test was 8.9. This indicates that 1,1,1-trichloroethane has little tendency to bioconcentrate in fish. Although the amount of experimental data for 1,1,1-trichloroethane is limited, confidence in this result is increased because values of BCFs in related compounds are similar.

Chemical/Physical Properties

CAS Number: 71-55-6

Color/ Form/Odor: Colorless liquid with sweet, chloroform-like odor

M.P.: -30.4 C B.P.: 74.1 C

Vapor Pressure: 127 mm Hg at 25 C

Octanol/Water Partition (Kow): Log Kow = 2.49

Density/Spec. Grav.: 1.34 at 20 C

Solubility: Soluble in water; 4.4 g/L of water at 20 C;

Soil sorption coefficient: Koc is 81in silty clay, 89 in sandy loam.

Odor/Taste Thresholds: N/A

Bioconcentration Factor: Low; 8.9 in fish

Henry's Law Coefficient: 0.008 atm-cu m/mole;

Trade Names/Synonyms: Chloroethene; Methylchloroform; Aerothene TT; Algylen; Alpha-T; Chlorten; Gemalgene; Genklene; Dowclene; Solvent 111; Trichloran; Inhibisol

Other Regulatory Information

Monitoring:

-- For Ground/Surface Water Sources:

Initial Frequency- 4 quarterly samples every 3 years

Repeat Frequency- Annually after 1 year of no detection

-- Triggers - Return to Initial Freq. if detect at > 0.0005 mg/L

Analysis

Reference Source	**Method Numbers**
EPA 600/4-88-039	502.2; 524.2; 551

Treatment - Best Available Technologies: Granular Activated Charcoal and Packed Tower Aeration

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

		Water	**Land**
TOTALS (in pounds)		**222,403**	**812,873**
Top Six States*			
CA	0	109,070	
GA	0	73,258	
AR	0	67,000	
IN	15,000	46,096	
VA	0	51,822	
UT	40,000	0	
Major Industries*			
Gray iron foundries		1,084	76,158
Aircraft		546	73,258
Manufacturing industries		1,018	72,572
Wood furniture		0	53,038
Fabricated structural metal		0	51,425
Plating, polishing		6,152	41,647
Turbines, generators		40,317	966

* State totals only include facilities with releases greater than 10,000 lbs.

For Additional Information

EPA can provide further regulatory or other general information:
EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:
Toxic Substance Control Act Information Line - 202/554-1404
Toxics Release Inventory, National Library of Medicine - 301/496-6531
Agency for Toxic Substances and Disease Registry - 404/639-6000