# Technical Factsheet on: 1,1-DICHLOROETHYLENE

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: 0.007 mg/L
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HAL(child): 1 day: 2 mg/L; Longer-term: 1 mg/L

**Health Effects Summary**

Acute: EPA has found 1,1-dichloroethylene to potentially cause adverse liver effects due to acute exposures at levels above the MCL.

Drinking water levels which are considered "safe" for short-term exposures: For a 10-kg (22 lb.) child consuming 1 liter of water per day: a one-day exposure of 2 mg/L; upto a 7-year exposure to 1 mg/L.

Chronic: Chronic exposure to 1,1-dichloroethylene at levels above the MCL has the potential to cause liver and kidney damage, as well as toxicity to the developing fetus.

Cancer: There is some evidence that 1,1-dichloroethylene may have the potential to cause cancer at levels above the MCL.

**Usage Patterns**

An estimated 90,700 tons/yr of the monomer were produced in the USA during the early 1980s. Virtually all of the 1,1-dichloroethylene produced is used in the production of copolymers with vinyl chloride or acrylonitrile. A small percentage (4%) of 1,1-dichloroethylene is used as chemical intermediates. These products are then used in adhesives, synthetic fibers, refrigerants, food packaging and coating resins such as the saran types.

**Release Patterns**

1,1-Dichloroethylene may be released into the environment as emissions or in wastewater during its production and use in the manufacture of plastic wrap, adhesives, and synthetic fiber.

1,1-Dichloroethylene is formed by a minor pathway during the anaerobic biodegradation of trichloroethylene and also by the hydrolysis of 1,1,1-trichloroethane. Therefore there is a potential for it to form in groundwater that has been contaminated by chlorinated solvents.

1,1-Dichloroethylene is also produced by the thermal decomposition of 1,1,1-trichloroethane, a reaction that is catalyzed by copper. 1,1,1-Trichloroethane is used as a degreasing agent in welding shops so there is a potential for 1,1-dichloroethylene to be formed in these shops as well as in other industrial environments where 1,1,1-trichloroethane is used near sources of heat.

From 1987 to 1993, according to the Toxics Release Inventory, releases to water totalled over 10,000 lbs. Releases to land totalled about 1,500 lbs. These releases were primarily from facilities classified as producing alkalies/chlorine and plastics materials/resins. The largest releases occurred in Kentucky.

**Environmental Fate**

Releases to water will primarily be lost to the atmosphere through evaporation. The mass transfer coefficient between water and the atmosphere of 1,1-dichloroethylene relative to oxygen has been measured to be 0.62. Using data for the oxygen re-aeration rate of typical bodies of water, one can calculate the half-life for evaporation of 1,1-dichloroethylene to be 5.9, 1.2 and 4.7 days from a pond, river and lake, respectively. In water, the photooxidation of 1,1-dichloroethylene is insignificant. A hydrolysis half-life of 6-9 months has been observed with no significant difference in hydrolysis rate between pH 4.5 and 8.5. This value differs markedly from the estimated hydrolytic half-life of 2 yr at pH 7.

If spilled on land, part of the 1,1-dichloroethylene will evaporate and part will leach into the groundwater where its fate is unknown, but degradation is expected to be slow based upon microcosm studies. No experimental data is available on the adsorption of 1,1-dichloroethylene. A low Koc of 150 are calculated from a regression equation based on its octanol/water partition coefficient (log Kow= 1.48).

Once in the atmosphere it will degrade rapidly by photooxidation with a half-life of 11 hours in relatively clean air or under 2 hours in polluted air.

Few studies on the biodegradation of vinylidene could be found In one study, 45-78% of the chemical was lost in 7 days when incubated with a wastewater inoculum; however, a sizeable fraction of the loss was due to volatilization. 97% of 1,1-dichloroethylene was reported to be removed in a municipal wastewater plant but again the fraction lost by evaporation is unknown.

Under anaerobic conditions in microcosms designed to simulate the anaerobic conditions in groundwater and landfills, 1,1-dichloroethylene undergoes reductive dechlorination to vinyl chloride. In the microcosms designed to simulate a groundwater environment, 50% of the 1,1-dichloroethylene disappeared in 5-6 mo.

Under the simulated landfill conditions, degradation occurred in 1-3 weeks. In another anaerobic biodegradation study that used materials from an aquifer that receive municipal landfill leachate and is known to support methanogenesis, the 1,1-dichloroethylene disappeared in 40 weeks. However, no significant degradation occurred for 16 weeks. 1,1-Dichloroethylene was formed as a degradation product.

No experimental data could be found on the bioconcentration of 1,1-dichloroethylene in fish or aquatic invertebrates. Based on its low octanol/water partition coefficient (log Kow= 1.48) one would not expect any significant bioconcentration.

The general population may be exposed to low levels of 1,1-dichloroethylene in ambient air, indoor air, contaminated drinking water, and food which has come in contact with plastic wrap which contains residual monomer.

**Chemical/Physical Properties**

CAS Number: 75-35-4

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

M.P.: -122.5 C B.P.: 31.7 C

Vapor Pressure: 591 mm Hg at 25 C; highly volatile

Octanol/Water Partition (Kow): Estimated log Kow= 1.32

Density/Spec. Grav.: 1.213 at 20 C

Solubilities: 2.5 g/L of water at 25 C

Soil sorption coefficient: Koc estimated at 150

Odor/Taste Thresholds: N/A

Bioconcentration Factor: N/A; not expected to bioconcentrate in fish.

Henry's Law Coefficient: N/A

Trade Names/Synonyms: 1,1-DCE; 1,1-Dichloroethene; Asym-dichloroethylene; Vinylidene chloride;

**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 |

**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)** | **10,101** | | **1,488** |
| **Top States** | | | |
| KY | 2,880 | 286 | |
| TX | 2,061 | 150 | |
| LA | 2,079 | 3 | |
| **Major Industries** | | | |
| Plastics materials, resins | 3,942 | | 1,299 |
| Alkalies, chlorine | 4,173 | | 154 |

**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