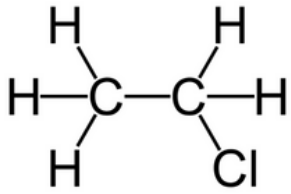
CHLOROETHANE - TOXGUIDE™

CHEMICAL AND PHYSICAL INFORMATION



Chloroethane (CASRN 75-00-3; also known as ethyl chloride) is a volatile, low molecular weight halogenated colorless gas. It can be a liquid when stored in pressurized containers. Chloroethane is characterized as having a sharp pungent smell.

In the past, the single largest use of chloroethane was in the production of tetraethyl lead for use in gasoline. However, government-mandated reduction in the amount of lead additives used in gasoline in the United States and a shift to the use of unleaded gasoline caused a drastic reduction in the amount of chloroethane required to produce tetraethyl lead. Chloroethane is currently used in the production of ethyl cellulose, in the manufacture of dyes, pharmaceuticals, chemicals, and formed plastics, and as a solvent. Chloroethane is a local refrigerant spray anesthetic used by physicians and is also available over the counter to alleviate pain associated with insect bites and stings and sports injuries.

ENVIRONMENTAL FATE AND DETECTED LEVELS

Air: The mean concentration of chloroethane measured in 65 ambient air samples across the United States in 2022 was 0.048 ppbv.

Chloroethane may be released to the air through process and fugitive emissions related to its production and use as a chemical intermediate; evaporative losses from wastewater streams, landfills, solvents, refrigerants, and anesthetics; and emissions from combustion of plastics, refuse, and biomass.

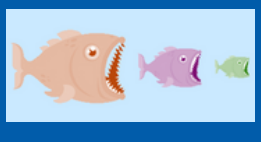
Once in the atmosphere, it will break down by reactions with photochemically generated hydroxyl radicals. The half-life for this reaction has been estimated to be 40 days.

Water: Analysis of surface water samples collected from 1981 to 2023 revealed that chloroethane was detected in 19,166 of 144,292 samples (0.13% of samples). Of those 19,166 samples, only 1,060 had values >10 µg/L, with a median value of 2.5 µg/L.

Chloroethane released into water is expected to volatilize rapidly. Any remaining compound may undergo biodegradation under both aerobic and anaerobic conditions and may also be broken down by hydrolysis.

Sediment and Soil: No recent monitoring data were located regarding levels of chloroethane in sediment or soil.

Chloroethane released into soil is expected to volatilize rapidly but it may leach into groundwater since it is expected to possess high mobility in soil. It may undergo biodegradation under both aerobic and anaerobic conditions and may also be broken down by hydrolysis.



Bioconcentration: Chloroethane is not expected to bioaccumulate in aquatic organisms.

CHLOROETHANE

GENERAL POPULATION EXPOSURE

General population exposure to chloroethane is expected to be low.

Likely routes of potential exposure: Inhalation and Dermal

- The primary source of exposure to the general population is through inhalation of ambient air. Due to its volatility, vapor intrusion may contribute to indoor air levels of chloroethane.
- Inhalation and dermal exposure may occur during household water use (e.g., showering, bathing, washing of dishes or clothes) if the water contains chloroethane.
- Dermal exposure can occur from the direct use of chloroethane as a topical anesthetic.

Possible routes of potential exposure: Oral

- Oral exposure may occur via ingestion of contaminated drinking water.

POPULATIONS WITH POTENTIALLY HIGH EXPOSURE

Emissions data suggest that workers in the following industries may be exposed to chloroethane: chemical manufacturing, cement manufacturing, pulp and paper, oil and gas production, petroleum refining, waste disposal, agriculture, and electric services. Since chloroethane is used in cleaning solvents and degreasers, plumbers, pipe fitters, and automotive mechanics can be exposed. Medical personnel who use chloroethane to anesthetize the skin have a higher potential for exposure than the general population. These workers may be exposed via:

- Inhalation of contaminated workplace air
- Dermal contact with chloroethane vapor or pressurized liquid
- Dermal contact with products containing the compound

Compared to the general population, the following groups may also have higher exposure to chloroethane:

- People who intentionally misuse chloroethane by inhaling its vapor for narcotic effects

BIOMARKERS

Chloroethane can be detected in the blood and can therefore be used as a biomarker of exposure. Because a portion of the chloroethane inhaled is exhaled, measurement of chloroethane in breath may serve as a useful biomarker of exposure. These biomarkers only reflect recent exposures.

BIOMONITORING LEVELS

The 2013 NHANES study reported that <0.1% of blood samples were above the limit of detection (i.e., 0.045 µg/L). The highest detected blood concentration was 0.617 µg/L.

TOXICOKINETICS

Absorption: Chloroethane is readily absorbed following inhalation exposure in humans, rats, and mice and oral exposure in rats. The dermal absorption potential is low, as indicated by the estimated dermal flux rate of 0.99 mg/cm^2 hour.

Distribution: Rat partition coefficients indicate that chloroethane, once absorbed, would have a greater affinity for fat than for muscle or the liver. Distribution was widespread in rats following inhalation and oral exposure, with the highest concentrations found in ovaries, adrenal glands, fat, and skin.

Metabolism: In rats and mice, the two major pathways of chloroethane metabolism are the production of acetaldehyde by cytochrome P450 and conjugation of chloroethane with glutathione to form S-ethyl-glutathione.

Excretion: Following a 30-second inhalation exposure in humans, 30% of the retained dose was excreted in expired air in the first hour. The rate of urinary excretion in the first hour was described as slow (i.e., <0.01% per minute).

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HEALTH EFFECTS

Based on systematic review, neurological effects are a presumed health effect in humans following inhalation exposure.

- Neurological effects reported in humans after inhalation of chloroethane include dizziness, feeling of intoxication, increased reaction time, slurred speech, sleep and movement disorders, visual hallucinations, tremors, altered reflexes, and unconsciousness.
- Animal inhalation studies have shown hyperactivity in mice and dogs, slight lethargy in rats, and unsteadiness, dizziness, and sluggish behavior in guinea pigs after exposure.

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

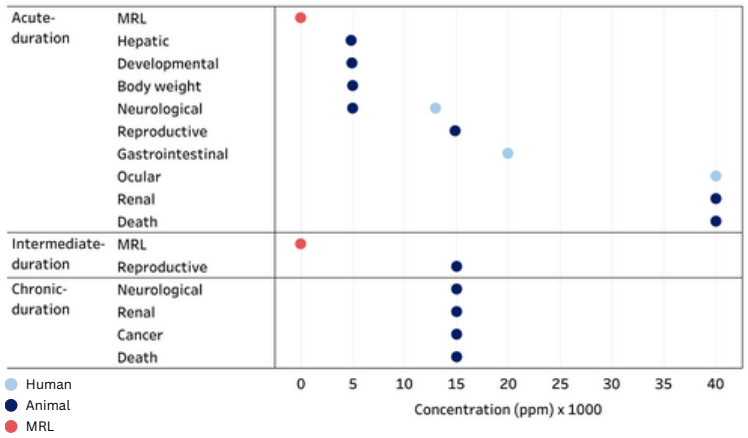
Based on systematic review, the data are inadequate to conclude whether reproductive and developmental effects are health effects in humans following inhalation exposure.

- Effects on the reproductive system, such as decreased uterine weight and increased estrous cycle length in mice and decreased uterine motility and muscle tone in dogs, were observed following inhalation exposure.
- Increased incidence of delayed fetal foramina closure of the skull bones (developmental delay of ossification of small centers of unossified bone of the skull) was seen in mouse pups exposed in utero on gestation days 6–15.

Additional effects noted in exposed humans

- Acute inhalation has resulted in abdominal cramps, nausea, vomiting, and eye irritation.
- Frostbite can occur if it is applied to the skin for too long.

Effects of Inhalation Exposure to Chloroethane



Sensitive Effects of Oral Exposure to Chloroethane

None identified (extremely limited data available)

MINIMAL RISK LEVELS (MRLs)

Acute: ≤14 days; Intermediate: 15–364 days; Chronic: ≥365 days

Inhalation:

- **Acute:** An acute-duration inhalation MRL of 13 ppm was derived based on developmental effects in mice.
- **Intermediate:** An intermediate-duration inhalation MRL of 13 ppm was derived based on reproductive effects in mice.
- **Chronic:** A chronic-duration inhalation MRL was not derived.

Oral: No oral MRLs were derived for any duration.

CANCER

Animal studies reported carcinogenicity, but consistent target organs were not identified across sexes or species. Tumors observed included uterine tumors and hepatocellular carcinomas/adenomas in female mice, alveolar and bronchiolar adenomas/carcinomas in male mice, skin tumors in male rats, and brain astrocytomas in female rats.

The carcinogenicity of chloroethane has not been evaluated by the Department of Health and Human Services. A provisional carcinogenicity assessment by the U.S. Environmental Protection Agency (EPA) determined that chloroethane is likely to be carcinogenic to humans. The International Agency for Research on Cancer (IARC) considers chloroethane to be in Group 3, not classifiable as to its carcinogenicity to humans.

REFERENCE

Agency for Toxic Substances and Disease Registry (ATSDR). 2024. Toxicological profile for chloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services. https://wwwn.cdc.gov/TSP/ToxProfiles/ToxProfiles.aspx?id=827&tid=161.