Sources of Exposure

General Populations

- The primary sources of exposure to the general population are through ambient air and possible consumption of contaminated drinking groundwater.
- Exposure can also occur from the direct use of chloroethane as a topical anesthetic.
- People who intentionally misuse chloroethane by inhaling its vapor for narcotic effects are exposing themselves to high levels.

Occupational Populations

- Occupational exposure, inhalation or dermal, can occur at facilities where chloroethane is manufactured and used (e.g., printing and publishing, painting companies, and electric services).
- 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 anaesthetize the skin have a higher potential for exposure than the general population.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- 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.
- 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, adrenals, fat, and skin.
- 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.
- 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).

Normal Human Levels

- The 2013 NHANES study reported that <0.1% of blood samples were above the limit of detection (i.e., 0.045 µg/L), with blood concentrations reported up to 0.617 µg/L.

Biomarkers/Environmental Levels

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.

Environmental Levels

Air

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

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.

Sediment and Soil

- No recent monitoring data were located regarding levels of chloroethane in sediment and soil.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2024. Toxicological Profile for Chloroethane (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Chloroethane

CAS # 75-00-3

January 2024

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Chloroethane

- Chloroethane is a volatile, low molecular weight halogenated colorless gas.
- It 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.
- 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 and in the manufacture of dyes, pharmaceuticals, chemicals, 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.

Routes of Exposure

- Inhalation – Likely route of exposure for the general public and occupational populations.
- Oral – Possible route of exposure for the general population through ingestion of contaminated water.
- Dermal – Likely route of exposure for the general public and occupational populations.

Chloroethane in the Environment

- Chloroethane may be released to the environment 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.
- If released to soil or water, chloroethane 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.
- Chloroethane is not expected to bioaccumulate in aquatic organisms.

Relevance to Public Health (Health Effects)

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

Minimal Risk Levels (MRLs)

Inhalation

- A provisional acute-duration (≤14 days) inhalation MRL of 13 ppm was derived.
- A provisional intermediate-duration (15–364 days) inhalation MRL of 13 ppm was derived.
- A provisional chronic-duration (≥365 days) inhalation MRL was not derived.

Oral

- No provisional acute-, intermediate-, or chronic-duration oral MRLs were derived for chloroethane.

Health Effects

- Neurological effects reported in humans after inhalation of chloroethane include dizziness, feeling of intoxication, increased reaction time, slurred speech, sleep disturbances, rapid eye movement, visual hallucinations, tremors, altered reflexes, and unconsciousness.
- Acute inhalation has resulted in abdominal cramps, nausea, vomiting, and eye irritation in people.
- Frostbite can occur if it is applied to the skin for too long.
- 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.
- 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. 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.
- Animal cancer studies have observed specific carcinogenic outcomes but have not consistently identified a target organ across sexes or species. Female mice developed uterine tumors; male rats developed skin tumors; and female rats had increased brain astrocytomas.
- The carcinogenicity of chloroethane has not been classified by the Department of Human Health Services (HHS). 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.

Children's Health

- It is not known if children are more sensitive to chloroethane than adults.