Sources of Exposure

General Populations

- There are low levels of chloromethane in ambient air from biomass combustion, and a large amount is produced naturally from rotting wood and by plankton in the ocean.
- Chloromethane may enter the public water supply during chlorinated disinfection processes. Monitoring in the United States has shown that detectable levels of chloromethane are present in <1% of samples from public water systems.
- In past decades, people were exposed to chloromethane when their refrigerators leaked chloromethane refrigerant. However, in the past 50 years chloromethane has mostly been replaced by other refrigerant chemicals, decreasing general population exposure to chloromethane.
- Exposure of the general population to chloromethane may occur through contaminated air, water, or soil near manufacturing facilities where chloromethane is used.
- Chloromethane may also be a byproduct of burning plastic, cigarettes, or biomass.

Occupational Populations

- Workers may be exposed in industries where chloromethane is used, such as production of adhesives, sealants, silicones, and PVC or use as a cleaner or pest control fumigant.
- Due to chloromethane's state as a gas at room temperature, occupational exposure is most likely to occur through inhalation.

Toxicokinetics and Biomonitoring

Toxicokinetics

- Chloromethane is well absorbed through the lungs and may also be absorbed through the skin.
- Animal studies found that chloromethane absorbed from the lungs is distributed throughout the body and that distribution did not depend on the dose. Its half-life in blood is 60–90 minutes.
- Chloromethane metabolism is not fully understood. Humans are likely to be in one of two categories of chloromethane metabolism: slow metabolizers and fast metabolizers. Chloromethane is conjugated, dehalogenated, or oxidated during the metabolism process, which can lead to the formation of formaldehyde and other metabolites.
- Urine and expired breath are the main routes of excretion for chloromethane and its metabolites in both humans and animals.

NHANES Biomonitoring

- No information on background levels of chloromethane in the general U.S. population was identified.

Biomarkers/Environmental Levels

Biomarkers

- No reliable biomarkers of chloromethane exposure or effect have been identified.
- Chloromethane exposure is often identified through evaluation of symptoms, occupational risk, and a sweet or acetone odor of the breath.

Environmental Levels

- Air:
  - The average ambient air concentration across 34 U.S. locations in 2022 was 0.5712 ppbv.
- Water:
  - Groundwater levels from 5,527 U.S. samples (2019–2022): not detected–360 µg/L
  - Surface water levels from 78 U.S. samples (2019–2022): not detected–0.6 µg/L
  - Drinking water levels from 26 U.S. samples (2016): <0.1–0.269 µg/L
- Soil:
  - Information on chloromethane levels in soil is limited to data from 11 National Priorities List (NPL) sites with a mean level of 58,300 ppt.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2023. Toxicological Profile for Chloromethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Chloromethane

CH_3Cl

CAS# 74-87-3

September 2023

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

Chloromethane is a Colorless Liquid or Gas

- Chloromethane, often times also referred to as methyl chloride, exists as a gas at room temperature.
- It is highly soluble in water and highly mobile in soil. It is unlikely to bioaccumulate.
- Chloromethane has a high vapor pressure, which makes it able to volatilize from soil and water and contributes to its flammability.
- Chloromethane was formerly used as a refrigerant, but now is used in the manufacturing of adhesives, sealants, and silicones. It is also an impurity in vinyl chloride, such that it may be present in polyvinylchloride (PVC) products.

Routes of Exposure

- Inhalation – Inhalation exposure from chloromethane released into the atmosphere or volatilized from water may occur near industries where chloromethane is released. Inhalation is a primary route of exposure for the general population and workers as it comes from natural sources.
- Oral – Exposure may occur through ingestion of water that has low levels of chloromethane, possibly due to the water chlorination process.
- Dermal – Dermal contact is a potential route of exposure for workers, but is less likely since chloromethane is volatile.

Chloromethane in the Environment

- Chloromethane is naturally produced during biomass combustion, meaning that it is present at low levels in ambient air.
- Chloromethane exists in the atmosphere as a gas. The half-life of chloromethane in air has been estimated as ranging from 0.6 to 3 years.
- It easily volatilizes from surface water, but the half-life of chloromethane in groundwater is estimated to be about 4 years.
- Chloromethane will volatize from the surface of soil but it's very high soil mobility also allows it to migrate through lower levels of soil and into groundwater.

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

- An acute-duration (≤14 days) inhalation MRL of 0.5 ppm was derived for chloromethane.
- An intermediate-duration (15–364 days) MRL of 0.3 ppm was derived for chloromethane.
- A chronic-duration (≥365 days) inhalation MRL of 0.03 ppm was derived for chloromethane.

Oral

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

Health Effects

- Based on human and animal studies, neurological endpoints are the most sensitive to chloromethane exposure.
- Human case studies have reported neurological effects ranging from headache and fatigue to slurred speech and coma at high levels (>200 ppm). Death or persistent neurological effects occurred at very high concentrations.
- Both human case studies and animal studies reported hepatic effects following inhalation exposure to chloromethane, including cirrhosis, liver degeneration, and changes in liver enzyme levels.

Health Effects (*cont'd*)

- Animal studies on inhalation exposure to chloromethane also found some evidence of cardiovascular, male reproductive, developmental, and renal effects. Cardiovascular effects included decreased heart rate and blood pressure. Renal effects ranged from enzyme changes to kidney failure. Reproductive effects included decreased fertility, sperm effects, and testicular lesions in rodents. Developmental effects included reduced fetal body weight and incomplete or malformed skeletal development in fetuses.
- The National Toxicology Program (NTP) has not classified the carcinogenic potential of chloromethane to humans. Both the U.S. Environmental Protection Agency (EPA) and the International Agency for Research on Cancer (IARC) have determined that chloromethane is not classifiable as it relates to human carcinogenicity.

Children's Health

- Children exposed to chloromethane are expected to experience effects similar to those expected in adults. However, given that children inhale more air per unit of body weight, they may be exposed to higher levels of chloromethane. Children may also be exposed through contaminated water.