ToxGuide™ for 1,2-Dichloro-ethane

$C_2H_4Cl_2$

CAS# 107-06-2

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Sources of Exposure

General Populations

- Exposure of the general population to 1,2-dichloroethane occurs primarily through inhalation of contaminated air.

- 1,2-Dichloroethane can be ingested or absorbed through skin from contaminated water.

- The general population can also be exposed via skin contact to soils contaminated with 1,2-dichloroethane.

- Previously, household cleaning products (textile and carpet cleaners) and soil fumigants contained 1,2-dichloroethane, although risk of dermal exposure for the general population is very low as most of these products were discontinued.

- Exposure to 1,2-dichloroethane may occur from ingestion of contaminated food, although not very likely.

- It is possible that infants may be exposed through ingestion of breast milk if their mother was exposed through contaminated air, water, or food. However, recent data reporting levels in breast milk are not available; current levels in breast milk may be lower than in the past because of decreased use of 1,2-dichloroethane.

- Fetuses may be exposed through placental transfer if the mother was exposed, although research is limited.

Occupational Populations

- Workers in industries where 1,2-dichloroethane is manufactured or used in production are at highest risk of exposure.

Toxicokinetics and Biomonitoring Levels

Toxicokinetics

- 1,2-Dichloroethane is well absorbed through the respiratory tract, gastrointestinal tract, and skin.

- Absorbed 1,2-dichloroethane is distributed widely within the body, including to the blood stream, liver, and kidneys. High levels are found in fat.

- 1,2-Dichloroethane undergoes metabolism through oxidation reactions and glutathione conjugation.

- Urine and expired breath are the main routes of excretion for 1,2-dichloro-ethane and its metabolites. Excretion of 1,2-dichloroethane is rapid, and was completed within 48 hours in animals.

NHANES Levels

- The geometric mean concentration of 1,2-dichloroethane in blood was 7.2 pg/mL in NHANES 2015–2016.

Biomarkers/Environmental Levels

Biomarkers

1,2-Dichloroethane and its metabolites can be measured in breath, blood, and urine; however, measurements must be taken immediately after exposure due to rapid elimination of 1,2-dichloroethane from the body.

Environmental Levels

Ambient air

- 2018 concentrations in the United States range from 0 to 234.8 $\mu g/m^3$.

Water

- The geometric mean level at hazardous waste sites was 46 $\mu g/L$ (232 National Priorities List [NPL] sites).

Soil

- The geometric mean level at hazardous waste sites was 1,990 $\mu g/kg$ (49 NPL sites).

Food

- Concentrations range from 0 to 180 ng/g.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2024. Toxicological Profile for 1,2-Dichloroethane. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

Chemical and Physical Information

1,2-Dichloroethane is a clear colorless, oily liquid

- 1,2-Dichloroethane is also known as ethylene dichloride, or 1,2-DCE.

- 1,2-Dichloroethane is a volatile liquid that is slightly soluble in water and very soluble in several organic solvents. It has a relatively low vapor pressure.

- The chemical has a sweet, chloroform-like smell.

- It is expected to be very mobile in the environment.

- The chemical is manufactured only, and does not occur naturally in the environment.

Routes of Exposure

- Inhalation – Inhalation exposure from 1,2-dichloroethane released into the atmosphere or volatilized from water or soils may occur near hazardous waste sites or near industries where 1,2-dichloroethane is released. Inhalation is a primary route of exposure for the general population and workers.

- Oral – A minor route of exposure may occur through ingestion of contaminated drinking water or, and to a lesser extent, contaminated foods.

- Dermal – Dermal contact is a potential route of exposure for the general population near hazardous waste sites and workers.

1,2-Dichloroethane in the Environment

- 1,2-Dichloroethane is a contaminant released into the atmosphere as a vapor. It undergoes photochemical degradation, with an estimated half-life of 73 days in air.

- It volatilizes from water, with an estimated volatilization half-life of 28–29 minutes.

- In soil, 1,2-dichloroethane volatizes into the air or leaches into groundwater.

- Biodegradation is the primary degradation process for 1,2-dichloroethane in water and soils.

- 1,2-Dichloroethane is not likely to bioconcentrate in fish or other aquatic organisms, nor is it expected to bioaccumulate in the food chain.

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 0.1 ppm was derived for 1,2-dichloroethane.

- An intermediate-duration (15–364 days) inhalation MRL of 0.1 ppm was derived for 1,2-dichloroethane.

- No chronic-duration inhalation MRLs were derived for 1,2-dichloroethane.

Oral

- No acute- or chronic-duration oral MRLs were derived for 1,2-dichloroethane.

- An intermediate-duration (15–364 days) oral MRL of 0.7 mg/kg/day was derived for 1,2-dichloroethane.

Health Effects

- Case reports of humans acutely exposed to high doses by ingestion or inhalation reported central nervous depression, nausea, vomiting, blurred vision, bronchitis, respiratory distress, lung congestion, myocardial lesions, hemorrhagic gastritis and colitis, increased blood clotting time, hepatocellular damage, renal necrosis, and histopathological changes in brain tissue. Death was primarily attributed to cardiac arrhythmia. Similar effects have been reported in animal studies.

Health Effects

- One worker exposed to 1,2-dichloroethane via inhalation for 11 months sustained lethal lung damage leading to respiratory failure and death.

- Main targets of mammalian toxicity to 1,2-dichloroethane include the liver, kidneys, gastrointestinal tract and neurological, respiratory, reproductive, and immune systems.

- In animals, increased susceptibility to microbial pathogens and reduced bactericidal activity in the lungs were seen.

- In rats, implantation loss, decreased fertility, and embryo lethality occurred when exposed prior to mating and during gestation. Male mice had pathological changes in the testes and sperm abnormalities following inhalation.

- The Department of Health and Human Services (HHS) classified 1,2-dichloroethane as "may reasonably be anticipated to be a human carcinogen." The International Agency for Research on Cancer (IARC) placed 1,2-dichloethane in Group 2B (possibly carcinogenic to humans). The U.S. Environmental Protection Agency (EPA) classified the chemical as a Group B2 carcinogen (probable human carcinogen).

Children's Health

- Children exposed to 1,2-dichloroethane would be expected to experience effects similar to those expected in adults.

- It is unclear if developmental effects would occur in humans.