Sources of Exposure

General Populations

- The general population may be exposed to 1,2-dichloroethene in urban air and drinking water, with higher potential for exposure in community systems relying on groundwater supplies.
- Contaminated tap water can cause exposure via ingestion, inhalation, and dermal contact during showering and bathing.
- The general population may also be exposed through cooking and laundering with contaminated water.
- At sites with contaminated shallow groundwater, 1,2-dichloroethene can vaporize and move into the air of nearby homes.

Occupational Populations

- Occupational exposure to 1,2-dichloroethene may occur through inhalation or dermal contact in facilities that produce or use this chemical.
- Volatile organic compounds, such as 1,2-dichloroethene, may be emitted from additive manufacturing and from 3D printing machines; therefore, workers in these emerging technologies could be exposed to 1,2-dichloroethene.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Information on the toxicokinetics of cis- and trans-1,2-dichloroethene mainly comes from inhalation studies conducted in rats.
- Inhaled 1,2-dichloroethene is rapidly absorbed with air:blood equilibrium occurring within 1–2 hours of constant exposure.
- The blood:air partition coefficient for cis-1,2-dichloroethene is higher than that of trans-1,2-dichloroethene.
- No studies were located regarding absorption for cis-or trans-1,2-dichloroethene following oral or dermal exposure.
- Metabolism is the primary mechanism of elimination of 1,2-dichloroethene. 1,2-Dichloroethene is metabolized by the microsomal cytochrome P450 (CYP) monooxygenase enzyme system in the liver.
- trans-1,2-Dichloroethene is a more potent inhibitor of CYP than cis-1,2-dichloroethene, and is more slowly metabolized than cis-1,2-dichloroethene.
- No studies were located regarding the distribution or excretion of 1,2-dichloroethene in humans or animals following exposure by any route.

Normal Human Levels

- NHANES 2011–2012 reported that 1,2-dichloroethene (both cis- and trans-isomers) blood levels were below the detection limit of 0.010 ng/mL for all age and demographic groups studied.

Biomarkers/Environmental Levels

Biomarkers

- 1,2-Dichloroethene can be measured in blood and expired air.

Environmental Levels

Air

- In 2021, the arithmetic mean concentration of cis-1,2-dichloroethene measured in air samples from the national Air Quality System database (from 6,152 sites across the United States) ranged from not detectable to 0.073 ppbv, with a maximum concentration of 1.29 ppbv. No information was available on levels of trans-1,2-dichloroethene in air.

Water

- In a survey of 3,498 aquifer samples from around the United States; trans-1,2-dichloroethene was detected in 0.74% of samples, with levels as low as 0.2 ppb and levels as high as 100 ppb (µg/L). Numerous sites in the United Stated have detected cis-1,2-dichloroethene, with concentrations ranging from 0.013 to 20,000 ppb.

Sediment and Soil

- There are no monitoring data for levels of cis- or trans-1,2-dichloroethene in the sediment or soil in the United States.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2023. Toxicological Profile for 1,2-Dichloroethene (Draft for Public Comment). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for 1,2-Dichloro-ethene

CAS # 540-59-0; 156-59-2; 156-60-5

August 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

1,2-Dichloroethene

- 1,2-Dichloroethene is a volatile, low molecular weight, halogenated compound that is in liquid form at room temperature. It is highly flammable and colorless with a sweet smell.
- Although 1,2-dichloroethene is often referred to as a single chemical, it exists as two geometric isomers, cis- and trans- forms, that have distinct properties.
- 1,2-Dichloroethene is used primarily as a chemical intermediate in the synthesis of chlorinated solvents and compounds or as an industrial solvent.
- Other possible uses include refrigerant, pharmaceutical manufacture, artificial pearl manufacture, and extraction of fats from fish and meat.

Routes of Exposure

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

1,2-Dichloroethene in the Environment

- 1,2-Dichloroethene may be released into the environment during its production, use in industry, or degradation products of other chemicals, including vinyl chloride, trichloroethene, and tetrachloroethene.
- 1,2-Dichloroethene has been shown to volatilize from environmental media.
- It is removed from the atmosphere via reactions with photochemically generated oxygenated species (hydroxyl radicals) or by precipitation.
- The estimated atmospheric lifetimes for cis- and trans-1,2-dichloroethene due to this removal process are 12 and 5 days, respectively.
- In surface water and soil, 1,2-dichloroethene most likely will volatilize into the air.
- The chemical is not significantly bound to soils or sediments and possesses high mobility in soil; therefore, it may leach into groundwater.
- 1,2-Dichloroethene is unlikely to bioconcentrate in fish and other 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 3 ppm was derived for trans-1,2-dichloroethene.
- No intermediate- or chronic-duration inhalation MRLs were derived for trans-1,2-dichloroethene.
- No acute-, intermediate-, or chronic-duration inhalation MRLs were derived for cis-1,2-dichloroethene.

Oral

- No acute- or chronic-duration oral MRLs were derived for trans-1,2-dichloroethene.
- A provisional intermediate-duration (15–364 days) oral MRL of 0.2 mg/kg/day was derived for trans-1,2-dichloroethene.
- No acute-, intermediate-, or chronic-duration oral MRLs were derived for cis-1,2-dichloroethene.

Health Effects

- trans-1,2-Dichloroethene resulted in ocular irritation in rats after whole-body inhalation (lacrimation) and in rabbits after instillation (corneal opacity, moderate iritis, and conjunctivitis).
- Humoral immunity was decreased in mice after oral exposure to trans-1,2-dichloroethene for 90 days. No changes in cellular immunity were observed.
- Dermal exposure to trans-1,2-dichloroethene led to irritation, erythema, edema, necrosis, fissuring and/or scaling in rabbits.
- No association between maternal exposure to trans-1,2-dichloroethene during pregnancy and birth defects was seen in humans. In pregnant rats, exposure via inhalation resulted in increased resorptions and decreased fetal weights.
- 1,2-Dichloroethene is not listed by the Department of Health and Human Services (HHS) National Toxicology Program (NTP) in the 15th Report on Carcinogens. The U.S. Environmental Protection Agency (EPA) has not classified the carcinogenicity of 1,2-dichloroethene due to inadequate information. The International Agency for Research on Cancer (IARC) has not evaluated the carcinogenicity of 1,2-dichloroethene.

Children's Health

- It is not known if children are more sensitive to 1,2-dichloroethene exposure than adults.