Sources of Exposure

General Populations

- The primary source of ethylene glycol in the environment is from disposal of used antifreeze and use of de-icing solutions at airports.
- Intentional or accidental ingestion of antifreeze.
- Ethylene glycol is not expected to be found in the environment away from areas where it is released; therefore inhalation of ambient air, ingestion of drinking water, or dermal contact with water or soil are not expected to be important routes of exposure for the general population.
- Individuals who live near hazardous waste sites, industrial facilities where ethylene glycol is produced or used, or areas where airport de-icing formulations are used may be exposed to ethylene glycol.

Occupational Populations

- Occupational exposures are expected for workers involved in airplane de-icing.
- Occupational exposure may also occur in individuals involved in the production of antifreeze and de-icing products.

Toxicokinetics and Normal Human Levels

Toxicokinetics

- Ethylene glycol is quickly and extensively absorbed through the gastrointestinal tract. It is slowly absorbed through the skin. Limited information suggests that it is absorbed across the respiratory tract.
- Absorbed ethylene glycol is widely distributed throughout the body.
- It is metabolized in a series of steps that ultimately yield formate, glycine, malate, carbon dioxide and oxalic acid.
- Elimination of ethylene glycol occurs via exhaled carbon dioxide and urinary excretion of ethylene glycol, glycolic acid, and oxalic acid. The half-life for elimination is 2.5–8.4 hours.
- Ethylene glycol metabolism is saturated at higher oral doses leading to a shift in excretory pattern with a greater urinary excretion and decreased elimination via expired air.

Normal Human Levels

- No data available.

Biomarkers/Environmental Levels

Biomarkers

- Ethylene glycol can be detected in blood and urine within several hours of exposure.
- The presence of calcium oxalate monohydrate crystals in the urine is a possible indicator of exposure to large doses of ethylene glycol; however, this is not specific to ethylene glycol.

Environmental Levels

Air

- Background levels of ethylene glycol in air are not available.

Sediment and Soil

- Background levels of ethylene glycol in sediment or soil are not available.

Water

- Background levels of ethylene glycol in surface water, groundwater, or drinking water are not available.

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. Toxicological Profile for Ethylene Glycol. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

ToxGuide™ for Ethylene Glycol

$C_2H_6O_2$

CAS# 107-21-1

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

Contact Information:
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1-800-432-4636
http://www.atsdr.cdc.gov/toxprofiles/index.asp

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Ethylene Glycol is a Liquid

- Ethylene glycol is a colorless liquid.
- Ethylene glycol is odorless, but has a sweet taste.
- Ethylene glycol is used to manufacture antifreeze and de-icing solutions for cars, airplanes, and boats.
- Ethylene glycol is also used in hydraulic brake fluids and inks used in stamp pads, ballpoint pens, and print shops.

Routes of Exposure

- Inhalation – Important route of exposure for workers applying ethylene glycol products.
- Oral – Intentional or accidental ingestion of antifreeze has resulted in thousands of poisonings each year.
- Dermal –Predominant route of exposure for the general population. Skin and eye contact may occur during the use of ethylene glycol-based antifreeze.

Ethylene Glycol in the Environment

- When released to the environment, ethylene glycol is expected to partition to surface water and groundwater.
- Ethylene glycol has high mobility in soil and the potential to leach to ground water.
- Ethylene glycol is not likely to volatilization from moist soil or water surfaces.
- Ethylene glycol is biodegraded in soil and water under both aerobic and anaerobic conditions within a day to a few weeks.
- Aerosols or vapors released to the atmosphere readily undergo photochemical oxidation with an estimated half-life of 1.4 days.
- Ethylene glycol rapidly degrades in all environmental media and it does not bioaccumulate.

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 MRL of 2 mg/m^3 has been derived for acute-duration inhalation exposure (≤14 days).
- No intermediate- or chronic-duration inhalation MRLs were derived for ethylene glycol.

Oral

- An MRL of 0.8 mg/kg/day has been derived for acute-duration oral exposure (≤14 days).
- The acute oral MRL of 0.8 mg/kg/day was adopted for use as an intermediate-duration oral MRL (15-364 days).
- No chronic-duration oral MRL was derived for ethylene glycol.

Health Effects

- Effects associated with human ingestion of high doses of ethylene glycol include central nervous system depression, metabolic acidosis, and nephrotoxicity.
- Studies in animals have identified the developing fetus as the most sensitive target of toxicity for acute-duration oral exposure to ethylene glycol. Observed effects include decreased body weight and increased skeletal malformations.
- Animal studies have identified the kidney as the most sensitive target organ for intermediate- or chronic-duration oral exposure.
- Mild upper respiratory tract irritation has been reported in subjects who inhaled low levels of ethylene glycol for acute or intermediate durations.
- There is no indication that ethylene glycol is carcinogenic based on oral exposure studies in animals.

Children's Health

- Ingestion of antifreeze is a potential route of exposure for children because they are attracted to the bright colors of antifreeze and sweet taste of ethylene glycol.
- Health effects observed in children accidentally exposed to ethylene glycol are consistent with effects observed in adults.