

## Sources of Exposure

## Toxicokinetics and Normal Human Levels

## Biomarkers/Environmental Levels

# 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](http://www.atsdr.cdc.gov)

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### 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

- 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

- 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.

## Chemical and Physical Information

## Routes of Exposure

## Relevance to Public Health (Health Effects)

### 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.

### 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.

- 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.

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<sup>3</sup> 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.