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**
- 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**
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 volatilize 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/m³ 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.