

## Ethylene Glycol (C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>) CAS 107-21-1

Synonyms include 1,2-dihydroxyethane, 1,2-ethanediol, 2-hydroxyethanol, ethylene alcohol, glycol, glycol alcohol, monoethylene glycol, and ethylene dihydrate. Ethylene glycol is sold under a variety of brand names as automobile radiator antifreeze. It should not be confused with ethylene glycol ethers, which are a different group of chemicals.

- **Persons exposed to ethylene glycol do not pose a significant risk of secondary contamination to response personnel outside the Hot Zone.**
- **Ethylene glycol is a clear, odorless, slightly viscous liquid. It is combustible and has a low vapor pressure. Odor does not provide any warning of hazardous concentrations.**
- **Ingestion is the most important exposure route. Dermal absorption is negligible and does not contribute significantly to systemic toxicity.**
- **Significant inhalation exposure does not occur at room temperature, but respiratory tract irritation is possible when the liquid is heated, agitated, or sprayed.**

### Description

Ethylene glycol is a clear, odorless, slightly viscous liquid with a sweet taste. It is combustible and has a low vapor pressure. Ethylene glycol is a very useful industrial compound because of its low freezing point and high boiling point. It is widely available as automotive antifreeze; in that application, it is often mixed with a yellow-green fluorescent.

### Routes of Exposure

#### *Inhalation*

Toxic inhalation of ethylene glycol is unlikely at room temperature because of the chemical's low volatility, but can occur when the liquid is heated, agitated, or sprayed. Ethylene glycol is odorless and thus, **odor does not provide any warning of hazardous concentrations**. Ethylene glycol vapor is lighter than air.

Children exposed to the same levels of ethylene glycol as adults may receive larger doses because they have greater lung surface area:body weight ratios and increased minute volumes:weight ratios.

#### *Skin/Eye Contact*

Ethylene glycol is only mildly irritating to mucous membranes or skin and is slowly and poorly absorbed through the skin.

*Ingestion* Ethylene glycol is rapidly absorbed following ingestion, which is the predominant route of exposure. Ingestion of ethylene glycol leads to systemic toxicity beginning with CNS effects, followed by cardiopulmonary effects, and finally renal failure.

**Sources/ Uses** Ethylene glycol is produced commercially in large amounts and widely used as an antifreeze and de-icer. It is also used in chemical synthesis, including synthesis of plastics, films, and solvents. Ethylene glycol can be found in many consumer products, including automotive antifreeze, hydraulic brake fluids, inks used in some stamp pads, ballpoint pens, solvents, paints, plastics, and solar energy systems.

**Standards and Guidelines**

ACGIH ceiling limit = 100 mg/m<sup>3</sup> (39 ppm)

**Physical Properties**

*Description:* odorless, colorless, slightly viscous, sweet-tasting liquid. Many antifreeze products also contain yellow-green fluorescent dyes and a bitter taste to reduce the chances of accidental ingestion.

*Warning properties:* **odor is inadequate to protect against acute inhalation exposure**

*Molecular weight:* 62.07 daltons

*Boiling point:* (760 mm HG): 387 °F (198 °C)

*Freezing point:* 8.6 °F (-13 °C)

*Specific gravity:* 1.11 at 68 °F (20 °C) (water = 1)

*Vapor pressure:* 0.06 mm Hg at 68 °F (20 °C)

*Gas density:* 0.092 (air = 1)

*Water solubility:* miscible with water; can absorb twice its weight of water

*Flammability:* 232 ° F (111 °C)

*Flammable range:* 3.2% to 21.6% (concentration in air)

**Incompatibilities**

Ethylene glycol reacts with strong oxidizers and acids, including chromium trioxide, potassium permanganate, sodium peroxide, potassium dichromate, chlorosulfonic acid, sulfuric acid, perchloric acid, and diphosphorous pentasulfide.

## Health Effects

- Ethylene glycol is only mildly irritating to skin and mucous membranes and is not absorbed well through the skin or by inhalation.
- Ingestion of ethylene glycol produces CNS depression which may be accompanied by nausea, vomiting, and abdominal cramps.
- Metabolites of ethylene glycol produce severe metabolic acidosis and damage to the brain, heart, and kidneys.
- Severe poisoning is potentially fatal if treatment is inadequate or delayed.

### Acute Exposure

Ethylene glycol is a dehydrating agent and is mildly irritating to the skin and mucous membranes after prolonged contact.

Upon ingestion, it is rapidly absorbed (within 1 to 4 hours). Less than 20% is excreted unmetabolized; most is successively metabolized to very toxic compounds. A characteristic progression of toxic effects can be roughly divided into three stages, although overlap is possible:

**Stage 1:** From 30 minutes to 12 hours after exposure, unmetabolized ethylene glycol produces CNS depression, intoxication, and hyperosmolarity similar to that produced by ethanol.

**Stage 2:** From 12 to 48 hours, metabolites produce severe acidosis with compensatory hyperventilation. The acidosis is primarily the result of an increase in glycolic acid, although glyoxylic, oxalic, and lactic acids also contribute in small part. Calcium oxalate crystals are deposited in the brain, lungs, kidneys, and heart.

**Stage 3:** From 24 to 72 hours, the direct toxic effects of ethylene glycol metabolites in the kidneys can cause acute renal failure.

Children do not always respond to chemicals in the same way that adults do. Different protocols for managing their care may be needed.

### CNS

Unmetabolized ethylene glycol can produce an ethanol-like intoxication. Symptoms include dizziness, ataxia, disorientation, irritation, restlessness, nystagmus, headache, slurred speech, and somnolence. Severe poisoning can lead to coma and death.

Cerebral edema and deposits of calcium oxalate crystals in the walls of small blood vessels contribute to the CNS toxicity.

*Renal*

Kidney toxicity is a major consequence of ethylene glycol absorption. Acute cell death (i.e., tubular necrosis) and kidney failure can occur within 24 to 28 hours as a result of the direct cytotoxic action of oxalic, glyoxylic, and glycolic acids or due to precipitation of calcium oxalate crystals in the renal tubules. Focal tubular degeneration, atrophy, and tubular interstitial inflammation have also been observed. Renal damage, if untreated, can lead to acute oliguric renal failure and can necessitate long-term hemodialysis. The resulting hyperkalemia can cause life-threatening cardiac dysrhythmias.

*Metabolic*

An osmolar gap can be present early after ingestion; this represents unmetabolized ethylene glycol. It will resolve as metabolism proceeds. A severe metabolic acidosis with elevated anion gap develops as metabolism to glycolic, glyoxylic, and oxalic acids occurs. Large quantities of sodium bicarbonate can be administered without affecting the acidosis because of the ongoing generation of acid metabolites. However, over zealous alkalinization could cause ionized calcium deficits. Hypocalcemia and tetany can occur as a result of calcium oxalate deposition.

*Respiratory*

Very high levels of inhaled ethylene glycol vapors can irritate the upper respiratory tract. Levels higher than 80 ppm produce intolerable respiratory discomfort and cough. Ethylene glycol's CNS effects can cause respiratory depression, and metabolic acidosis can result in hyperventilation and respiratory alkalosis. Aspiration of ethylene glycol following ingestion can result in pulmonary edema.

Children may be more vulnerable to gas exposure because of relatively increased minute ventilation per kg and failure to evacuate an area promptly when exposed.

*Cardiovascular*

Cardiovascular effects include tachycardia, dysrhythmias, congestive heart failure, hypertension or hypotension, and circulatory collapse. Hyperkalemia resulting from kidney toxicity can cause life-threatening cardiac dysrhythmias.

*Gastrointestinal*

Nausea and vomiting can be present in the initial stage of intoxication.

*Dermal*

Ethylene glycol is a minor skin irritant, although a few cases of allergic contact dermatitis have been reported.

*Ocular* Mild ocular irritation may occur after contact with ethylene glycol.

*Potential Sequelae* Renal failure can occur 24 to 72 hours after an acute ingestion and can necessitate hemodialysis. Some loss of renal function can be permanent. There are infrequent reports of cranial nerve palsies (e.g., facial palsy, hearing loss, visual disturbances) or peripheral neuropathy one or more weeks after an acute poisoning.

**Chronic Exposure** There are only a few reports on the adverse health effects in humans of chronic exposure to ethylene glycol. Irritation of the throat, mild headache, low backache, loss of consciousness, and nystagmus have been reported. These symptoms were resolved when the exposure ceased.

*Carcinogenicity* The U.S. Department of Health and Human Services (DHHS), the International Agency for Research on Cancer (IARC) and EPA have not classified ethylene glycol in terms of its carcinogenic potential. Studies in humans and animals have not yielded any associations between ethylene glycol exposure and the incidence of any cancer.

*Reproductive and Developmental Effects* Ethylene glycol is not included in *Reproductive and Developmental Toxicants*, a 1991 report published by the U.S. General Accounting Office (GAO) that lists 30 chemicals of concern because of widely acknowledged reproductive and developmental consequences. Some experimental animal studies of exposure to glycols have shown teratogenicity, specifically craniofacial and neural tube closure defects and skeletal dysplasia. Human effects are not known or documented.



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## Prehospital Management

- **Persons exposed to ethylene glycol liquid or vapor do not pose significant risks of secondary contamination to rescuers.**
- **Ethylene glycol is a CNS depressant, similar to ethanol. Its metabolites are toxic and cause profound metabolic acidosis, cerebral edema, cardiovascular collapse, acute renal failure, and possibly death.**
- **Timely treatment is effective and consists of supportive care, hemodialysis, and administration of a specific antidote.**

### **Hot Zone**

Rescuers should be trained and appropriately attired before entering the Hot Zone. If the proper equipment is not available, or if the rescuers have not been trained in its use, call for assistance from a local or regional HAZMAT team or other properly equipped response organization.

### *Rescuer Protection*

Ethylene glycol is a mild respiratory tract irritant. It is not well absorbed through the lungs or skin.

*Respiratory protection:* Respirable concentrations of ethylene glycol are significant only when the liquid is heated (e.g., during a fire) or aerosolized. Positive-pressure, self-contained breathing apparatus (SCBA) is recommended under these circumstances.

*Skin protection:* Chemical-protective clothing is generally not required because ethylene glycol (whether vapor or liquid) is only a minor skin irritant and is absorbed poorly and slowly through the skin.

### *ABC Reminders*

Quickly access for a patent airway, ensure adequate respiration and pulse. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible.

### *Victim Removal*

If victims can walk, lead them out of the Hot Zone to the Decontamination Zone. Victims who are unable to walk may be removed on backboards or gurneys. If these are not available, carefully carry or drag victims to safety.

Consider appropriate management of chemically contaminated children, such as measures to reduce separation anxiety if a child is separated from a parent or other adult.

**Decontamination Zone**

Victims exposed only to ethylene glycol vapor who have no skin or eye irritation do not need to undergo decontamination. These individuals may be transferred immediately to the Support Zone. Others can undergo decontamination, but even severely exposed victims need only external decontamination (see *Basic Decontamination* below) because ingestion is the major toxic exposure route.

*Rescuer Protection*

Ethylene glycol acts as a systemic toxicant only when ingested. Rescuers need not take any special precautions.

*ABC Reminders*

Quickly access for a patent airway, ensure adequate respiration and pulse. Stabilize the cervical spine with a collar and a backboard if trauma is suspected. Administer supplemental oxygen as required. Assist ventilation with a bag-valve-mask device if necessary.

*Basic Decontamination*

Victims who are able may assist with their own decontamination. Quickly remove and double-bag contaminated clothing and personal belongings.

Wash exposed skin and hair with mild soap and water (preferably under a shower). Rinse thoroughly with water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Irrigate exposed eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If pain or injury is evident, continue irrigation while transferring the victim to the Support Zone.

In cases of recent ingestion (less than one hour), in an alert, awake patient, emesis may be induced with ipecac. For other patients, perform gastric lavage. **Early treatment is important to reduce absorption of ethylene glycol and subsequent production of highly toxic metabolites.** Activated charcoal absorbs ethylene glycol poorly, but may be of use if there is suspicion of multiple chemical ingestion. Administer activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g).

Consider appropriate management of chemically contaminated children at the exposure site. Also, provide reassurance to the child during decontamination, especially if separation from a parent occurs. If possible, seek assistance from a child separation expert.

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<i>Transfer to Support Zone</i>	As soon as basic decontamination is complete, move the victim to the Support Zone.
<b>Support Zone</b>	Victims pose no serious risk of secondary contamination to rescuers. Therefore, Support Zone personnel require no specialized protective gear.
<i>ABC Reminders</i>	Quickly access for a patent airway. If trauma is suspected, maintain cervical immobilization manually and apply a cervical collar and a backboard when feasible. Ensure adequate respiration and pulse. Administer supplemental oxygen as required and establish intravenous access if necessary. Place on a cardiac monitor.
<i>Additional Decontamination</i>	<p>Continue irrigating exposed skin and eyes, as appropriate.</p> <p>In cases of recent ingestion (less than one hour), in an alert, awake patient, emesis may be induced with ipecac. For other patients, perform gastric lavage (if the patient has not already undergone gastric lavage in the Decontamination Zone). <b>Early treatment is important to reduce absorption of ethylene glycol and subsequent production of highly toxic metabolites.</b> Activated charcoal absorbs ethylene glycol poorly, but may be of use if there is suspicion of multiple chemical ingestion. Administer activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g).</p>
<i>Advanced Treatment</i>	<p>In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, perform cricothyroidotomy if equipped and trained to do so.</p> <p>Patients who are comatose, hypotensive, or are having seizures or cardiac arrhythmias should be treated according to advanced life support (ALS) protocols.</p> <p>A pH of less than 7.0 and a serum bicarbonate of less than 7 mmol/L are common with severe ethylene glycol intoxication. Treatment of this metabolic acidosis may be difficult. Liberal use of sodium bicarbonate solution is appropriate to correct the acidemia.</p>
<i>Transport to Medical Facility</i>	Only decontaminated patients or patients not requiring decontamination should be transported to a medical facility. “Body bags” are not recommended.

Report to the base station and the receiving medical facility the condition of the patient, treatment given, and estimated time of arrival at the medical facility.

Vomit containing ethylene glycol requires no chemical safety precautions since there is little exposure potential or risk of secondary contamination.

### **Multi-Casualty Triage**

Consult with the base station physician or the regional poison control center for advice regarding triage of multiple victims.

Patients with evidence suggesting ingestion of ethylene glycol should be rapidly transported to a medical facility for evaluation. All patients who have ingested more than a taste or sip of ethylene glycol, even if asymptomatic, should be evaluated in a hospital where appropriate laboratory studies can be carried out. Delays in treatment can result in more severe toxicity and potentially irreversible damage to major organ systems.

Patients with a history suggesting insignificant exposure and who have no symptoms of ethylene glycol toxicity may be discharged from the scene after their names, addresses, and telephone numbers have been recorded. Those discharged should be advised to seek medical care promptly if symptoms develop (see *Patient Information Sheet* below).

## Emergency Department Management

- **Patients exposed to ethylene glycol liquid or vapor pose no risk of secondary contamination to hospital personnel.**
- **Ethylene glycol is only mildly irritating to skin and mucous membranes and is not absorbed well through the skin or by inhalation.**
- **Ingestion of ethylene glycol causes CNS depression. If the patient is not treated, ethylene glycol's metabolites can cause acidosis, hyperventilation, and renal failure requiring hemodialysis.**
- **Timely treatment is effective and consists of supportive care, hemodialysis, and administration of a metabolic antidote such as ethanol or 4-methylpyrazole (fomepizole).**

### Decontamination Area

Patients exposed to ethylene glycol do not require extensive decontamination. Remove contaminated clothing and personal belongings.

Be aware that use of protective equipment by the provider may cause fear in children, resulting in decreased compliance with further management efforts.

Emergency room personnel should examine children's mouths because of the frequency of hand-to-mouth activity among children.

### *ABC Reminders*

Evaluate and support airway, breathing, and circulation. In cases of respiratory compromise secure airway and respiration via endotracheal intubation. If not possible, surgically create an airway.

Patients who are comatose, hypotensive, or have seizures or ventricular dysrhythmias should be treated in the conventional manner.

A pH of less than 7.0 and a serum bicarbonate of less than 7 mmol/L are common with severe ethylene glycol intoxication. Treatment of this metabolic acidosis may be difficult. Liberal use of sodium bicarbonate solution is appropriate to correct the acidemia.

*Basic Decontamination*

Patients who are able may assist with their own decontamination. Remove and double-bag contaminated clothing and personal belongings.

Wash exposed skin and hair with mild soap and water (preferably under a shower). Rinse thoroughly with water. Use caution to avoid hypothermia when decontaminating children or the elderly. Use blankets or warmers when appropriate.

Flush exposed or irritated eyes with plain water or saline for at least 15 minutes. Remove contact lenses if easily removable without additional trauma to the eye. If pain or injury is evident, continue irrigation while transferring the victim to the Critical Care Area.

In cases of substantial recent ingestion (less than 1 hour), where the patient is alert and awake, emesis can be induced with ipecac. In unconscious or symptomatic patients, consider gastric lavage if it can be administered within 1 hour of ingestion. Activated charcoal absorbs ethylene glycol poorly, but may be of use if there is suspicion of ingestion of multiple chemicals. Administer activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g). Ethylene glycol is rapidly absorbed and little benefit is expected from these procedures if more than an hour has elapsed. Early antidotal treatment with ethanol or 4-methylpyrazole to prevent formation of toxic metabolites is the most effective intervention. (More information is provided in *Antidotes and Other Treatments* under *Critical Care Area* below)

**Critical Care Area**

*ABC Reminders*

Evaluate and support the airway, breathing, and circulation as in *ABC Reminders* above. Establish intravenous access in seriously ill patients if this has not been done previously. Continuously monitor cardiac rhythm.

Patients who are comatose, hypotensive, or have seizures or cardiac arrhythmias should be treated in the conventional manner.

A pH of less than 7.0 and a serum bicarbonate of less than 7 mL/dL are common with severe ethylene glycol intoxication. Treatment of this metabolic acidosis may be difficult. Liberal use of sodium bicarbonate solution is appropriate to correct the acidemia.

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<i>Inhalation Exposure</i>	Administer supplemental oxygen by mask to patients who have respiratory complaints.
<i>Skin Exposure</i>	In most cases, no further treatment is needed after washing. If irritation or allergic contact dermatitis occurs, treatment with emollient creams, antihistamines, or topical steroids might be indicated.
<i>Eye Exposure</i>	Ensure that adequate eye irrigation has been completed. Test visual acuity. Examine the eyes for conjunctival or corneal damage and treat appropriately. Immediately consult an ophthalmologist for patients with suspected severe corneal injuries.
<i>Ingestion Exposure</i>	In cases of substantial recent ingestion where the patient is alert and awake, emesis can be induced with ipecac. In unconscious or symptomatic patients, consider gastric lavage if it can be administered within 1 hour of ingestion. Activated charcoal absorbs ethylene glycol poorly, but may be of use if there is suspicion of ingestion of multiple chemicals. Administer activated charcoal at 1 gm/kg (usual adult dose 60–90 g, child dose 25–50 g)
<i>Antidotes and Other Treatments</i>	<p>Contact a medical toxicologist or a regional poison control center for assistance in evaluating the anion and osmolar gaps, and to decide whether antidotal therapy, intravenous sodium bicarbonate, or hemodialysis is needed.</p> <p>In severe poisoning by ingestion, prompt administration of ethanol or another blocking agent (e.g., 4-methylpyrazole) prevents further metabolism of ethylene glycol. Rapid treatment with a blocking agent is very important; do not wait for symptoms to appear before treatment. Time elapsed between ingestion and treatment and the dose ingested are major factors of fatality.</p> <p>Administration of thiamine and pyridoxine may aid metabolism of ethylene glycol to nontoxic products, but these compounds are less effective than ethanol or 4-methylpyrazole. Hemodialysis is indicated in cases of severe acidosis and/or renal dysfunction.</p> <p>By competing with ethylene glycol as a substrate for alcohol dehydrogenase, ethanol inhibits the formation of toxic ethylene glycol metabolites. A medical toxicologist or the poison control center should be contacted to determine the proper dosage, which depends on many factors (e.g., age, degree of alcohol use by the victim, and effect on blood sugar). In general, the optimal</p>

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blood ethanol level is 100 to 150 mg/dL; this level should be attained quickly by administering 10% ethanol intravenously over 30 to 60 minutes.

Alternatively, ethanol can be administered orally with a 20% ethanol solution until a blood ethanol level of 100 to 150 mg/dL is reached. **Patients previously treated with ipecac/charcoal cannot tolerate oral loading.** The dosage must be adjusted if the patient is undergoing hemodialysis. Repeatedly monitor blood ethanol and glucose levels, as under dosing and overdosing of ethanol regularly occur; this can lead to hypoglycemia, especially in children.

An alternative to ethanol that also inhibits the action of alcohol dehydrogenase on ethylene glycol has recently become available in the United States. This drug, 4-methylpyrazole, has low toxicity and is easier to administer than ethanol. It is available as fomepizole (Antizol) in packages of 1.5 mL vials (concentration = 1 g/1 mL). Each vial is diluted to 100 mL with sodium chloride. Treatment consists of a 15-mg/kg loading dose followed in 12 hours by 10 mg/kg every 12 hours for four doses, then 15 mg/kg every 12 hours as long as indicated. Although fomepizole has been less widely used than ethanol, its use is rapidly increasing because of advantages over ethanol in terms of its predictable pharmacokinetics, ease of administration and lack of adverse effects.

### *Laboratory Tests*

In all patients with known or suspected ethylene glycol poisoning, blood tests should be performed to measure blood glucose, serum electrolyte, calcium, BUN, creatinine, ethylene glycol, and ethanol levels. ABG levels and osmolarity should also be measured. These tests should be repeated as necessary to closely monitor the progression of toxic effects. Expected values depend on the time elapsed since the ingestion of ethylene glycol, so this must be considered in interpreting laboratory results.

Methanol levels should be measured in patients with elevated anion and osmolar gaps. Other conditions that can elevate anion and osmolar gaps include methanol poisoning and diabetic ketoacidosis.

Traditionally, a serum ethylene glycol level greater than 50 mg/dL has been associated with significant toxicity. Nevertheless, although the toxicokinetics are not well known, if enough time has passed for metabolism to toxic metabolites to

occur, significant poisoning can be present when serum ethylene glycol levels are less than 50 mg/dL.

Chest radiography and pulse oximetry (or ABG measurements) are recommended for patients with respiratory complaints.

A cardiac monitor should be placed to look for QT prolongation, an indication of hypocalcemia.

Calcium oxalate crystals can be seen on microscopic examination of the urine, but their absence does not preclude ethylene glycol poisoning. A Woods (UV) lamp test of the urine detects the fluorescent compound, fluorescein, which is commonly added as a coloring agent to automotive antifreezes. Urine fluorescence cannot be relied upon to diagnose the presence or absence of ethylene glycol ingestion. If present, it supports the diagnosis.

## **Disposition and Follow-up**

All patients with ethylene glycol poisoning should be evaluated and treated without delay. Even patients with no or mild symptoms should undergo appropriate blood and urine tests if they have a history of significant ingestion. Patients requiring ethanol infusions, 4-methylpyrazole, or hemodialysis should be admitted to an intensive care unit.

### *Delayed Effects*

Renal effects typically take 24 to 72 hours to develop. Hemodialysis to treat acute renal failure is essential.

### *Patient Release*

Patients who have no history suggestive of significant exposure and who have no symptoms or laboratory findings of ethylene glycol poisoning may be discharged with instructions to seek medical care promptly if symptoms develop (see the *Ethylene Glycol—Patient Information Sheet* below).

### *Follow-up*

Obtain the name of the patient's primary care physician so that the hospital can send a copy of the ED visit to the patient's doctor.

In cases of severe exposure, follow-up laboratory evaluation of renal function should be arranged and neurologic examination for post-hypoxic or oxalate crystal injury is recommended.

Patients who have corneal lesions should be re-examined within 24 hours.

## **Reporting**

If a work-related incident has occurred, you may be legally required to file a report; contact your state or local health department.

Other persons might still be at risk in the setting where this incident occurred. If the incident occurred in the workplace, discussing it with company personnel might prevent future incidents. If a public health risk exists, notify your state or local health department or other responsible public agency. When appropriate, inform patients that they may request an evaluation of their workplace from OSHA or NIOSH. See Appendices III and IV for a list of agencies that may be of assistance.

## **Ethylene Glycol (C<sub>2</sub>H<sub>6</sub>O<sub>2</sub>) Patient Information Sheet**

This handout provides information and follow-up instructions for persons who have been exposed to ethylene glycol.

### **What is ethylene glycol?**

Ethylene glycol is a colorless, syrupy liquid used in antifreeze solutions and as a solvent in making certain chemicals. When used in antifreeze solutions, it is usually mixed with a fluorescent yellow dye to create a bright yellow color. Ethylene glycol is odorless and can have a sweet taste.

### **What immediate health effects can be caused by exposure to ethylene glycol?**

Drinking even small amounts (from 1 to 3 ounces) of ethylene glycol can result in damage to the kidneys if the poisoning is not treated. Consumption of larger quantities can be fatal. Skin contact with liquid ethylene glycol or breathing low levels of vapors in the air is generally not harmful or causes only minor irritation. Very few individuals develop an allergic rash when the liquid is on their skin.

### **Can ethylene glycol poisoning be treated?**

Persons who have swallowed large amounts of ethylene glycol should be hospitalized. In severe exposures, special antidotes and hemodialysis might be needed. Treatment is generally successful if begun within 3 hours of swallowing, and most people recover completely after treatment.

### **Are any future health effects likely to occur?**

Kidney damage is the most common effect if severe exposure by ingestion is not treated.

### **What tests can be done if a person has been exposed to ethylene glycol?**

Ethylene glycol and its breakdown products can be measured in blood and urine. After significant exposure, diagnostic tests are needed to measure kidney function and the levels of the toxicant in the blood.

### **Where can more information about ethylene glycol be found?**

More information about ethylene glycol can be obtained from your regional poison control center; your state, county, or local health department; the Agency for Toxic Substances and Disease Registry (ATSDR); your doctor; or a clinic in your area that specializes in occupational and environmental health. If the exposure happened at work, you may wish to discuss it with your employer, the Occupational Safety and Health Administration (OSHA), or the National Institute for Occupational Safety and Health (NIOSH). Ask the person who gave you this form for help in locating these telephone numbers.

### Follow-up Instructions

Keep this page and take it with you to your next appointment. Follow *only* the instructions checked below.

Call your doctor or the Emergency Department if you develop any unusual signs or symptoms within the next 24 hours, especially:

- headache, dizziness, or a feeling of intoxication
- nausea, vomiting, or abdominal cramps.

No follow-up appointment is necessary unless you develop any of the symptoms listed above.

Call for an appointment with Dr. \_\_\_\_\_ in the practice of \_\_\_\_\_.  
When you call for your appointment, please say that you were treated in the Emergency Department at \_\_\_\_\_ Hospital by \_\_\_\_\_ and were advised to be seen again in \_\_\_\_\_ days.

Return to the Emergency Department/ \_\_\_\_\_ Clinic on (date) \_\_\_\_\_ at \_\_\_\_\_ AM/PM for a follow-up examination.

Do not perform vigorous physical activities for 1 to 2 days.

You may resume everyday activities including driving and operating machinery.

Do not return to work for \_\_\_\_\_ days.

You may return to work on a limited basis. See instructions below.

Avoid exposure to cigarette smoke for 72 hours; smoke may worsen the condition of your lungs.

Avoid drinking alcoholic beverages for at least 24 hours; alcohol may worsen injury to your stomach or have other effects.

Avoid taking the following medications: \_\_\_\_\_

You may continue taking the following medication(s) that your doctor(s) prescribed for you: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Other instructions: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

• Provide the Emergency Department with the name and the number of your primary care physician so that the ED can send him or her a record of your emergency department visit.

• You or your physician can get more information on the chemical by contacting: \_\_\_\_\_  
\_\_\_\_\_ or \_\_\_\_\_, or by checking out the following Internet Web sites: \_\_\_\_\_; \_\_\_\_\_.

Signature of patient \_\_\_\_\_ Date \_\_\_\_\_

Signature of physician \_\_\_\_\_ Date \_\_\_\_\_