
Information and recommendations for paramedics and doctors at the site

- Patients exposed only to ethylene oxide gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with ethylene oxide liquid or solution can secondarily contaminate rescue and medical personnel by direct contact or through off-gassing ethylene oxide.
 - Ethylene oxide can produce CNS depression and immediate eye, skin, and respiratory tract irritation and may lead to seizures, coma, or respiratory paralysis. Signs of pulmonary edema (shortness of breath, cyanosis, expectoration, cough) may evolve 12 hours or more after exposure.
 - There is no antidote to be administered to counteract the effects of ethylene oxide. Treatment consists of supportive measures.
-

1. Substance information

Ethylene oxide ([CH₂]₂O), CAS 75-21-8
Synonyms: dimethylene oxide, epoxyethane, ETO, ethene oxide, oxirane
Ethylene oxide is a colorless gas at room temperature and a colorless liquid below 11°C (51°F, respectively). It is highly reactive and water soluble. Both the gas and liquid are potential fire and explosion hazards. Ethylene oxide has a sweet ether-like odor at air concentrations of 500 ppm and above. However, dangerous exposures may occur at levels too low to smell.
Ethylene oxide is an important industrial solvent, plasticizer, and chemical intermediate. Ethylene oxide is used in the sterilization of hospital supplies, foods, and cosmetics, as a fumigant for spices, tobacco, furs, bedding, etc., and in the manufacture of antifreeze and other chemicals. It reacts with strong acids, alkalis and oxidizers.

2. Routes of exposure

Inhalation

Inhalation is a major route of ethylene oxide exposure. Ethylene oxide's odor is not a reliable indicator of any level of exposure and provides insufficient warning of hazardous exposure. The gas is heavier than air; exposure will be higher in enclosed, poorly ventilated, or low-lying areas.

Skin/eye contact

Ethylene oxide gas or liquids may be absorbed through the skin and eyes; however, direct contact with ethylene oxide gas or concentrated solutions may cause severe chemical burns.

Ingestion

Ingestion of ethylene oxide is unlikely because it is a gas at room temperature.

3. Acute health effects

Respiratory

Initially, ethylene oxide affects the nasopharynx. Concentrations as low as 200 ppm produce rapid onset of nose and throat irritation. Higher concentrations may cause inflammation of the trachea and bronchi, bronchoconstriction, and atelectasis. Acute pulmonary edema may evolve up to 12 hours or more after exposure.

Dermal

Skin contact with ethylene oxide gas or aqueous solutions may cause irritation with redness of the skin, blistering, and crusted ulcerations. Skin reactions may be delayed up to 12 hours or more after exposure. Contact with liquefied ethylene oxide can result in frostbite.

Inhalation and skin exposure may cause allergic and immune-mediated sensitization leading to contact dermatitis, urticaria, and anaphylactic reactions.

B 2

<i>Ocular</i>	Exposure to high levels of ethylene oxide gas or eye splashes of concentrated solutions can cause eye irritation and inflammation, and with more intense exposure, corneal burns.
<i>CNS</i>	Ethylene oxide is a CNS depressant. High-dose exposures can result in diverse neurologic manifestations including seizures and coma. Onset of neurologic signs and symptoms may be delayed up to 12 hours or more after exposure. Respiratory paralysis and delayed peripheral neuropathy have been reported after massive exposure.
<i>Gastrointestinal</i>	Exposure to even low gas concentrations of ethylene oxide can result in nausea and vomiting, often delayed.
<i>Cardiovascular</i>	Dysrhythmias may occur after a severe inhalation exposure.

4. Actions

Rescuer self-protection

If the zone which has to be entered by the rescuer is suspected of containing ethylene oxide, pressure-demand, self-contained breathing apparatus and chemical-protective clothing shall be worn.

Patients exposed only to ethylene oxide gas do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with liquid ethylene oxide (ambient temperature below 11°C) can secondarily contaminate other people by direct contact or through off-gassing ethylene oxide.

Patient recovery

Patients should be removed from the contaminated zone immediately. Patients who are unable to walk may be removed on backboards or stretchers; if these are not available, carefully remove/transport patients with appropriate action to a safe zone, taking into account your self-protection.

Decontamination

Immediate priorities must follow the "A, B, C's" of resuscitation.

Patients exposed only to ethylene oxide gas who have no evidence of skin or eye irritation do not need decontamination. All others require decontamination.

Patients who are able and cooperative may assist with their own decontamination. If the exposure involved liquid ethylene oxide (ambient temperature below 11°C) and if clothing is contaminated, remove and double-bag the clothing.

Assure that skin and hair exposed to liquid containing ethylene oxide have been flushed with plain water for at least 15 minutes. If not, continue flushing during other basic care. Protect eyes during flushing of skin and hair.

Assure that exposed or irritated eyes have been irrigated with plain water or saline for at least 15 minutes. If not, continue eye irrigation during other basic care.

Remove contact lenses if present and easily removable without additional trauma to the eye.

Initial treatment

Therapy will be empiric; there is no antidote to be administered to counteract the effects of ethylene oxide. The following measures are recommended if patients have respiratory complaints and/or evidence of systemic toxic effects after inhalation of ethylene oxide:

- **Administration of oxygen**
- **Administration of 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler.**

Patients with severe clinical respiratory symptoms (e.g. bronchospasms, stridor) should be treated as follows:

a) Nebulization of adrenaline (epinephrine): 2 mg adrenaline (2 ml) with 3 ml NaCl 0.9% and inhale through a nebulizer mask.

b) Administration of a β 2-selective adrenoceptor agonist, e.g., four strokes of terbutaline or salbutamol or fenoterol (one stroke usually

contains 0.25 mg of terbutaline sulfate; or 0.1 mg of salbutamol; or 0.2 mg of fenoterol); this may be repeated once after 10 minutes. Alternatively, 2.5 mg salbutamol and 0.5 mg atrovent may be administered by nebulizer mask. If inhalation is not possible, administration of terbutaline sulfate (0.25 mg to 0.5 mg) subcutaneously or salbutamol (0.2 mg to 0.4 mg over 15 minutes) intravenously.

c) Intravenous administration of 250 mg methylprednisolone (or equivalent steroid dose).

Patients with clinical signs of a toxic lung edema (e.g. foamy sputum, wet crackles) should be treated as follows:

- a) Start CPAP-therapy (Continuous Positive Airway Pressure Ventilation).
- b) Intravenous administration of 1000 mg methylprednisolone (or an equivalent steroid dose) is recommended.

Intubation of the trachea or an alternative airway management should be considered in cases of respiratory compromise. When the patient's condition precludes this, consider cricothyrotomy if equipped and trained to do so.

Note: Efficacy of corticosteroid administration has not yet been proven in controlled clinical studies.

After eye exposure chemical burns may result; treat as thermal burns. Immediately consult an ophthalmologist.

Patients with respiratory complaints and/or evidence of systemic toxic effects should be transported to a hospital/emergency department.

All asymptomatic patients with an exposure history consistent with significant potential for inhalation of ethylene oxide should take 8 puffs of beclomethasone (800 µg beclomethasone dipropionate) from a metered dose inhaler. Thereafter, 4 puffs should be administered every 2 hours for 12 hours. These patients should be observed for at least 12 hours.

*Patient release/
follow-up instructions*

Patients who have a **normal examination and no signs or symptoms of toxicity after an appropriate observation period** may be discharged in the following circumstances:

- a) The evaluating physician is experienced in the evaluation of individuals with ethylene oxide exposure.
- b) Information and recommendations for patients with follow-up instructions are provided verbally and in writing. Patients are advised to seek medical care promptly if symptoms develop or recur.
- c) The physician is comfortable that the patient understands the health effects of ethylene oxide and the provided follow-up instructions.
- d) Site medical is notified, so that the patient may be contacted at regular intervals in the 24-hour period following release.
- e) Heavy physical work should be precluded for up to 24 hours.
- f) Exposure to cigarette smoke should be avoided for 72 hours; the smoke may worsen the condition of the lungs

In this document BASF has made a diligent effort to ensure the accuracy and currency of the information presented but makes no claim that the document comprehensively addresses all possible situations related to this topic. This document is intended as an additional resource for paramedics or doctors in assessing the condition and managing the treatment of patients exposed to ethylene oxide. It is not, however, a substitute for the professional judgement of a paramedic or doctor and must be interpreted in the light of specific information regarding the patient available to such a paramedic or doctor and in conjunction with other sources of authority.

BASF SE
Corporate Health Management
Carl-Bosch-Straße 38
67056 Ludwigshafen
Germany

BASF Corporation
Medical Department
Campus Drive, M/S F 221
Florham Park, NJ 07932
USA