
Information and recommendations for paramedics and doctors at the site

- Patients exposed only to ethylenimine vapor do not pose a significant risk of secondary contamination. Patients whose clothing or skin is contaminated with ethylenimine liquid can secondarily contaminate rescue and medical personnel by direct contact or through evaporation of ethylenimine.
 - Ethylenimine can produce immediate eye, skin, and respiratory tract irritation and may cause nausea and vomiting. These symptoms as well as signs of pulmonary edema (shortness of breath, cyanosis, expectoration, cough) may be delayed for more than 3 hours after exposure.
 - Immediate decontamination by flushing of exposed skin and eyes with copious amounts of water is required in order to avoid irreversible damage.
 - There is no antidote to be administered to counteract the effects of ethylenimine. Treatment consists of supportive measures.
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1. Substance information

Ethylenimine (C₂H₅N), CAS 151-56-4

Synonyms: azacyclopropane, aziridine, dimethylenimine

Ethylenimine is a colorless liquid at room temperature with a boiling point of 56°C (133°F, respectively). Both the vapor and liquid are potential fire and explosion hazards. Ethylenimine has an ammonia-like odor at air concentrations of 1.5 ppm and above. However, dangerous exposures may occur at levels too low to smell.

Ethylenimine is a highly reactive chemical, used as an intermediate and monomer for oil additive compounds, ion exchange resins, coating resins, pharmaceuticals, adhesives, polymer stabilizers, and surfactants. Polymerization products of ethylenimine are used in the manufacture of paper.

2. Routes of exposure

Inhalation

Inhalation of vapor is a relevant route of ethylenimine exposure.

Eye and nose irritation have been reported to occur at concentrations of 100 ppm and above. **Ethylenimine's odor is not a reliable indicator of exposure and provides insufficient warning of hazardous exposure.**

Skin/eye contact

Liquid ethylenimine is absorbed readily through the skin and eyes. It is a potent irritant and vesicant. Fatal ethylenimine intoxication caused mainly by skin absorption has been observed. Percutaneous absorption of vapor probably does not occur, but ethylenimine vapors severely irritate the eyes and may irritate moist skin.

Ingestion

Involuntary ingestion of ethylenimine is unlikely.

3. Acute health effects

Respiratory

Exposure to ethylenimine vapors may produce immediate, severe, local irritation of the nose, throat, and lungs, and moist skin; clinical effects usually occur between 30 and 120 minutes after inhalation exposure. Higher concentrations may cause inflammation of the trachea and bronchi, bronchoconstriction, and laryngeal edema. Acute pulmonary edema may evolve up to 3 hours or more after exposure. Cough may be delayed in onset.

Dermal

After a very brief period of contact, liquid ethylenimine results in skin irritation. Depending on the concentration and length of exposure, the skin irritation may be evident within 5 minutes or not noticed until after

several days. Skin contact with ethylenimine may cause inflammation and redness of the skin, blistering, and slowly healing necrotic burns. Dermal sensitization leading to contact dermatitis, urticaria, and anaphylactic reactions may occur.

Ocular

Exposure to both ethylenimine liquid and vapor can cause tearing and redness of the eye, and with more intense exposure, severe corneal injury.

Other

Neurologic signs and symptoms of excitation may occur as well as damage to the liver and the kidneys. Exposure to even low vapor concentrations of ethylenimine can result in nausea and vomiting, often delayed.

4. Actions

Rescuer self-protection

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

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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 ethylenimine vapor 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 ethylenimine and if clothing is contaminated, remove and double-bag the clothing.

Assure that skin and hair exposed to liquid containing ethylenimine 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 eyes exposed to liquid containing ethylenimine 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 ethylenimine.

The following measures are recommended if patients have respiratory complaints and/or evidence of systemic toxic effects after inhalation of ethylenimine:

- **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.

If ethylenimine was in contact with the skin, severe chemical burns may result; treat as thermal burns: adequate fluid resuscitation and administration of analgesics, maintenance of the body temperature, covering of the burn with a sterile pad or clean sheet. If relevant dermal absorption with the risk of systemic toxic effects cannot be excluded, transport to hospital/emergency department.

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

All asymptomatic patients with an exposure history consistent with significant potential for inhalation of ethylenimine should take 8 puffs of beclomethasone 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 ethylenimine 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 ethylenimine 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.

Patients who have skin or eye exposure should be reexamined in 24 hours.

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 ethylenimine. 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.

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