Chemical Profiles

Ethylene Oxide

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What are other names or identifying information for ethylene oxide?

CAS Registry No.: 75-21-8
Other Names: EO, ETO, 1,2-Epoxyethane, dimethylene oxide
Main Uses: Used to manufacture other chemicals, to sterilize medical devices, and as a fumigant.
Appearance: Colourless gas.
Odour: Sweet, ether-like

Canadian TDG: UN1040

What is the WHMIS classification?

According to the Commission des normes, de l'équité, de la santé et de la sécurité du travail (CNESST), ethylene oxide can be classified as:

Flammable gases - Category 1

Gases under pressure - Liquified gas

Acute toxicity - inhalation - Category 3

Skin corrosion/irritation - Category 1C

Serious eye damage/eye irritation - Category 1

Germ cell mutagenicity - Category 1B

Carcinogenicity - Category 1B

Reproductive toxicity - Category 1B (Toxic to the reproductive function)

Reproductive toxicity - Category 2 (Toxic to the development)

Specific target organ toxicity - single exposure (respiratory tract irritation) - Category 3 - Respiratory tract irritation

Specific target organ toxicity - repeated exposure - Category 1

The signal word is danger.

The hazard statements are:

- Extremely flammable gas
- Contains gas under pressure; may explode if heated
- Toxic if inhaled
- Causes severe skin burns and eye damage
- May cause genetic defects
- May cause cancer
- May damage fertility or the unborn child
- Suspected of damaging fertility or the unborn child
- May cause respiratory irritation
- Causes damage to organs through prolonged or repeated exposure

Please note that this classification was retrieved from the CNESST site on February 21, 2023 and was established by CNESST personnel to the best of their knowledge based on data obtained from scientific literature, and it incorporates the criteria contained in the Hazardous Products Regulations (SOR/2015-17). It does not replace the supplier's classification, which can be found on its Safety Data Sheet.

What are the most important things to know about ethylene oxide in an emergency?

Emergency Overview: Colourless gas. Sweet odour. DANGEROUSLY REACTIVE. Polymerizes vigorously. EXTREMELY FLAMMABLE GAS. Distant ignition and flashback are possible. COMPRESSED GAS. Contains gas under pressure. May explode if heated. VERY TOXIC. Fatal if inhaled. May cause respiratory irritation. May cause drowsiness and dizziness. CORROSIVE. Causes severe skin burns and eye damage. CANCER HAZARD. May cause cancer. REPRODUCTIVE HAZARD. May damage fertility. MUTAGEN. May cause genetic defects.

What are the potential health effects of ethylene oxide?

Main Routes of Exposure: Inhalation.

- **Inhalation:** VERY TOXIC. Can cause severe irritation of the nose and throat. Can harm the nervous system. Symptoms may include headache, nausea, dizziness, drowsiness and confusion. A severe exposure can cause unconsciousness.
- **Skin Contact:** CORROSIVE. The gas irritates the skin. Direct contact with the liquefied gas can chill or freeze the skin (frostbite). Symptoms of mild frostbite include numbness, prickling and itching.
- **Eye Contact:** CORROSIVE. The gas irritates the eyes. Direct contact with the liquefied gas can freeze the eye. Permanent eye damage or blindness can result.
- **Ingestion:** Not a relevant route of exposure (gas).
- **Effects of Long-Term (Chronic) Exposure:** Can cause dry, red, cracked skin (dermatitis) following skin contact. May harm the nervous system. In severe cases, symptoms may include muscle weakness, loss of feeling or prickly sensation in the hands, feet, arms or legs, clumsiness and paralysis. May cause an allergic skin reaction in some people. May cause asthma or an asthma-like reaction in some people.
- **Carcinogenicity:** CARCINOGEN. May cause cancer. Has been associated with: cancer of the blood or blood system.
    - International Agency for Research on Cancer (IARC): Group 1 - Carcinogenic to humans
    - American Conference for Governmental Industrial Hygienists (ACGIH): A2 - Suspected human carcinogen.
- **Teratogenicity / Embryotoxicity:** May harm the unborn child. Conclusions cannot be drawn from the limited studies available.

- **Reproductive Toxicity:** REPRODUCTIVE HAZARD. May cause reproductive effects in men and women based on animal information. Known to cause: reduced fertility.
- **Mutagenicity:** MUTAGEN. May cause genetic damage. Exposure of the parent may cause effects in children.

What are first aid measures for ethylene oxide?

Inhalation: Take precautions to prevent a fire (e.g. remove sources of ignition). Take precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment). Move the victim to fresh air. Keep at rest in a position comfortable for breathing. If breathing has stopped, trained personnel should begin artificial respiration (AR). If the heart has stopped, trained personnel should start cardiopulmonary resuscitation (CPR) or automated external defibrillation (AED). Avoid mouth-to-mouth contact by using mouth guards or shields. Get medical attention immediately. Treatment is urgently required. Transport to a hospital.

Skin Contact: Flush with gently flowing water. If the clothing is contaminated, immediately remove the clothing and flush the skin with water. Get medical attention.

Eye Contact: Immediately flush the contaminated eye(s) with large amounts of gently flowing water, occasionally lifting the upper and lower eyelids. If irritation or pain persists, see a doctor. Get medical attention immediately.

Ingestion: Not applicable (gas).

First Aid Comments: If exposed or concerned, see a medical professional for advice. All first aid procedures should be periodically reviewed by a medical professional familiar with the chemical and its conditions of use in the workplace.

Note to Physicians: Some jurisdictions specifically regulate an ingredient of this product and require a complete medical surveillance program. Specific information should be sought from the appropriate government agency in your jurisdiction.

What are fire hazards and extinguishing media for ethylene oxide?

Flammable Properties: EXTREMELY FLAMMABLE GAS. Can easily ignite. Can readily form an explosive mixture with air at room temperature. Can be ignited by static discharge.

Suitable Extinguishing Media: Carbon dioxide, dry chemical powder, appropriate foam, water spray or fog. Use flooding quantities of water or other suitable extinguishing agent. Foam manufacturers should be consulted for recommendations regarding types of foams and application rates.

Specific Hazards Arising from the Chemical: Gas or vapour may travel a considerable distance to a source of ignition and flash back to a leak or open container. The heat of a fire may cause spontaneous polymerization or explosive decomposition. Heat from fire can cause a rapid build-up of pressure inside cylinders. Explosive rupture and a sudden release of large amounts of gas may result. The cylinder may rocket. In a fire, the following hazardous materials may be generated: very toxic carbon monoxide, carbon dioxide; flammable hydrogen; toxic, flammable aldehydes.

What are the stability and reactivity hazards of ethylene oxide?

- **Chemical Stability:** Normally stable.
- **Conditions to Avoid:** Open flames, sparks, static discharge, heat and other ignition sources. Contamination.
- **Incompatible Materials:** Highly reactive. Polymerizes violently on contact with: strong bases (e.g., sodium hydroxide), and strong acids (e.g., hydrochloric acid). Reacts explosively with: metals (e.g. aluminum), alcohols (e.g., ethanol).
- **Hazardous Decomposition Products:** None known.
- **Possibility of Hazardous Reactions:** DANGEROUSLY REACTIVE. Polymerizes violently in the presence of increased temperature contaminants. Self-reactive in the presence of heat. May cause an explosion.

What are unintentional release measures for ethylene oxide?

Personal Precautions: Evacuate the area immediately. Isolate the hazard area. Keep out unnecessary and unprotected personnel. Increase ventilation in the area or move the leaking container to a well-ventilated and secure area. Remove or isolate incompatible materials as well as other hazardous materials.

Methods for Containment and Clean-up: Small spills or leaks: stop or reduce leaks if safe to do so. Evacuate the area and let evaporate. Large spills or leaks: knock down gas with fog or fine water spray. Dike and recover contaminated water for appropriate disposal. Contact emergency services and manufacturer or supplier for advice.

Other Information: Contact supplier, or local fire and emergency services for help.

What handling and storage practices should be used when working with ethylene oxide?

Handling: Before handling, it is important that all engineering controls are operating and that protective equipment requirements and personal hygiene measures are being followed. Prevent uncontrolled release of the product. Eliminate heat and ignition sources such as sparks, open flames, hot surfaces and static discharge. Post "No Smoking" signs. Immediately report leaks, spills or failures of the safety equipment (e.g. ventilation system). Do not use at elevated temperatures without a thorough safety assessment. Prevent unintentional contact with incompatible chemicals. Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems. Do not weld, cut or perform hot work on an empty container until all traces of the product have been removed. Use the pressure regulator appropriate for cylinder pressure and contents. Secure the cylinder in an upright position. Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop.

Storage: Store in an area that is: cool, dry, well-ventilated, separate from incompatible materials, out of direct sunlight and away from heat and ignition sources, an approved, fire-resistant area, on the ground floor or preferably, if stored in large volumes, in an isolated, detached building, clear of combustible and flammable materials (e.g., old rags, cardboard). Electrically bond and ground containers. Ground clips must contact bare metal. Regularly inspect for physical changes or signs of crystallization, damage or leaks.

What is the American Conference of Governmental Industrial Hygienists (ACGIH®) recommended exposure limit for ethylene oxide?

ACGIH® TLV® - TWA: 1 ppm. A2 Skin. BEI®

Exposure Guideline Comments: TLV® = Threshold Limit Value. TWA = Time-Weighted Average. A2 = Suspected human carcinogen.Skin = Danger of cutaneous absorption. BEI® = Biological Exposure Index

Adapted from: 2022 TLVs® and BEIs® - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists (ACGIH)

NOTE: In many (but not all) Canadian jurisdictions, the exposure limits are similar to the ACGIH® TLVs®. Since legislation varies by jurisdiction, contact your local jurisdiction for exact details. A list is available in the OSH Answers on Canadian Governmental Occupational Health & Safety Departments.

A list of acts and regulations that cover exposure limits to chemical and biological agents is available on our website. Please note that while you can see the list of legislation for free, you will need a subscription to view the actual documentation.

What are the engineering controls for ethylene oxide?

Engineering Controls: Use stringent control measures such as process enclosure to prevent product release into the workplace. Use non-sparking ventilation systems, approved explosion-proof equipment and intrinsically safe electrical systems in areas where this product is used and stored. Use leak and fire detection equipment and an automatic fire suppression system. Provide eyewash and safety shower if contact or splash hazard exists.

What Personal Protective Equipment (PPE) is needed when working with ethylene oxide?

Eye/Face Protection: Wear chemical safety goggles. A face shield (with safety goggles) may also be necessary.

Skin Protection: Wear chemical protective clothing e.g. gloves, aprons, boots. In some operations: wear a chemical protective, full-body encapsulating suit and self-contained breathing apparatus (SCBA). Suitable materials include: Viton®/Butyl rubber, Kemblok®, Silver Shield® - PE/EVAL/PE, Chemprotex ® 300, ChemMAX® (3, 4 Plus), Frontline® 500, AlphaTec® (4000, EVO, VPS,), Tychem® (5000, 6000 FR, 9000, Responder® CSM, 10000, 10000 FR,) Zytron® 500.

Not recommended: natural rubber, neoprene rubber, nitrile rubber, polyvinylchloride (PVC), Viton®, Saranex®.

Respiratory Protection:

Up to 5 ppm:
(APF = 50) Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against ethylene oxide*; or Any self-contained breathing apparatus with a full facepiece; or Any supplied-air respirator with a full facepiece.

*End of service life indicator (ESLI) required.

APF = Assigned Protection Factor

Recommendations apply only to National Institute for Occupational Safety and Health (NIOSH) approved respirators. Refer to the NIOSH Pocket Guide to Chemical Hazards for more information.

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