

ETHYLENE OXIDE GUIDANCE DOCUMENT

1. OVERVIEW

Synonyms: Dimethylene oxide; 1,2-Epoxyethane; Oxirane; EtO

CAS NUMBER: 75-21-8

2. SCOPE

Ethylene Oxide is a colorless gas with a characteristic ether-like odor that is used in various processes to produce textiles, detergents, solvents, cosmetics, and pharmaceuticals. Ethylene Oxide possesses several physical and health hazards that merit special attention. The primary usage in Georgia Tech research is for sterilization purposes.

3. ENVIRONMENTAL HEALTH AND SAFETY REQUIREMENTS

- 3.1. EH&S requirements are based on hazard assessment of the procedure requiring the usage of Ethylene Oxide.
- 3.2. Notify [EHS](#) of Ethylene Oxide use; Hazard assessment will need to be conducted.
 - 3.2.1. Personal protective equipment for working with Ethylene Oxide includes appropriate lab attire, safety glasses, nitrile gloves and lab coat.
 - 3.2.2. Areas with ethylene oxide sterilizers are required to be equipped with monitors set to alarm at 0.5 ppm.
 - 3.2.3. The best protection against inhalation of Ethylene Oxide is making sure that all personnel using Ethylene Oxide follow a Standard Operating Procedure (SOP) which has been proven to keep worker exposures below the action level of 0.5 PPM.
 - 3.2.4. SOP should be constructed based on EHS hazard assessment.
 - 3.2.5. Signage must be posted in areas where ETO sterilizer is housed or used

4. ACCEPTABLE METHODS OF MONITORING ETHYLENE OXIDE USE

- 4.1. Area monitoring for Ethylene Oxide is possible by direct reading devices. Many such devices are available and can be set to alarm if levels exceed a pre-set level. Portable gas detectors are marked by flexibility and quality. A variety of single or multi-gas detectors are offered in compact, lightweight designs— from simple alarm-only units to advanced, fully configurable and serviceable instruments.



5. SIGNAGE

- 5.1. EHS RECOMMENDS THAT THE EHS ETHYLENE OXIDE SIGN BE POSTED ON, NEAR, OR AROUND THE ETO STERILIZER. SIGN CAN BE FOUND [HERE](#).

CAUTION!
Ethylene Oxide Sterilizer

Please refer to Safety Data Sheet for hazard information
If you have any questions, the following person(s) are familiar and knowledgeable:

Name	Number
1.	
2.	
3.	

Also, you can call EHS 404-385-4635 or email lab-chemicals@ehs.gatech.edu

6. EMERGENCY PROCEDURES

- 6.1. IF ONE OR MORE OF THESE APPLIES, CALL THE GEORGIA TECH POLICE DEPARTMENT AT **404-894-2500 IMMEDIATELY!**

- 6.2. In the event of the gas detector alarming, exit the building immediately, pulling the fire alarm on your way out. Be sure to stay in the area to inform emergency responders of the nature of the emergency.
- 6.3. In the event of an inhalation exposure to Ethylene Oxide, move victim outdoor to fresh air. Exposure victims should rest in half upright position and seek medical attention.
- 6.4. In the event of a skin exposure to concentrated vapor or aqueous solutions
 - 6.4.1. Remove contaminated clothes.
 - 6.4.2. Use the eyewash, sink, or emergency shower for 15 minutes
- 6.5. In the event of a skin exposure to liquefied ethylene oxide
 - 6.5.1. Rinse for 15 minutes with plenty of water
 - 6.5.2. Do NOT remove clothes.
- 6.6. ***Skin reactions may be delayed 5 hours or more after exposure.

7. PHYSICAL HAZARDS

- 7.1. Ethylene Oxide has a sweet odor with an odor threshold of 200 ppm (perception) but is not distinguishable until 500-700 ppm. Ethylene Oxide (EtO) is an extremely flammable and reactive material which is a gas at room temperature. It has a flash point of -0.4°F and an extremely large flammable range of 3 to 100%.
- 7.2. It is very water soluble and solutions containing as little as 4% in water are flammable. In closed systems, such as sewers, dilutions of 1:100 are required to produce a mixture that will not support combustion. Violent self-polymerization of the material can occur with exposure to heat, acids, or bases. It is very water soluble and solutions containing as little as 4% in water are flammable. In closed systems, such as sewers, dilutions of 1:100 are required to produce a mixture that will not support combustion. Violent self-polymerization of the material can occur with exposure to heat, acids, or bases.
- 7.3. It also reacts violently with exposure to copper, copper alloys, and rust. Liquids can accumulate a static charge by splashing or agitation. The gas can be ignited by a static charge. The gas is heavier than air and can travel long distances to a source of ignition and flash back to a leaking or open container. The heat of a fire may cause spontaneous polymerization, causing containers to rupture violently.
- 7.4. Ethylene Oxide can also ignite and decompose explosively at pressures less than one atmosphere. Once the decomposition reaction has been initiated, it can be propagated from the ignition source through the gas phase as a flame and, under certain conditions, may be explosive. This reaction can occur in the absence of air or oxygen.

8. WARNING PROPERTIES AND EXPOSURE LIMITS

8.1. DEFINITIONS

- 8.1.1. Permissible Exposure Limit (PEL) - This is the level that a worker can be exposed for up to eight hours a day, forty hours per week, for a working lifetime without adverse health effects.
- 8.1.2. Threshold Limit Value (TLV) - level to which it is believed a worker can be exposed day after day for a working lifetime without adverse effects.

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8.1.3. Excursion Limit (EL) - the maximum exposure that an individual may have to a chemical over a short period (30 minutes).

8.1.4. Action Level (AL) - Indicates the level of a harmful or toxic substance/activity which requires medical surveillance, increased industrial hygiene monitoring, or biological monitoring.

8.1.5. Immediately Dangerous to Life and Health Level (IDLH) - This is the level to which a worker can be exposed for up to 30 minutes while escaping from a hazardous atmosphere without serious permanent injury.

Exposure Limit	Limit Value
OSHA PEL	1ppm- Time Weighted Average
OSHA EL	5 ppm- Excursion Limit
OSHA AL	0.5 ppm- Action Level
American Conference of Governmental Industrial Hygienists (ACGIH) TLV	1ppm- Time Weighted Average
National Institutes of Occupational Safety and Health (NIOSH) Immediately Dangerous to Life and Health Level (IDLH)	800 ppm

9. HEALTH EFFECTS/SIGNS AND SYMPTOMS OF EXPOSURE

9.1. Acute exposures to Ethylene Oxide gas may result in respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis.

Eyes	irritation including corneal injury
Skin	Effects go from irritation to blistering with the possibility of frostbite from exposure to the rapidly evaporating liquid.
Inhalation	Central Nervous System (CNS) effects have been reported: headache, nausea and coma. Lung damage/pulmonary edema

9.2. Chronic exposure has been associated with the occurrence of cancer, reproductive effects, mutagenic changes, neurotoxicity, and sensitization.

Eyes	Cataracts have been reported in people working at the 1 ppm (TLV) level with no protection.
Skin	Contact dermatitis has been reported. Sensitization (may be species related)
Inhalation	Chronic exposures to several hundred ppm in humans have resulted in CNS effects: ataxia (muscle incoordination) and slurred speech.

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Reproductive	Increased frequency of spontaneous abortions has been reported in women who worked in hospitals or dental clinics around Ethylene Oxide sterilizers. Damage to the testes and ovaries have been reported from animal studies. May be species related and not directly applicable to human exposures.
Carcinogenicity	International Agency for Research on Cancer: classified as carcinogenic to humans (Group 1), based to a great degree, on studies done on hospital workers who have very few other chemical exposures. ACGIH: classified a possible human carcinogen (A2). LD50 = Lethal Dose, 50%, or the dose that killed 50% of the test animals, usually within 1-2 hours LC50 = Lethal Concentration, 50%, or the concentration of airborne contaminant that killed 50% of the test animals, within a specified time.