

ETHYLENE OXIDE AWARENESS TRAINING

Substance: Ethylene Oxide

CAS Registry Number: 75-21-8

Synonyms: Dihydrooxirene, Dimethylene oxide, EO, ETO, 1,2-Epoxyethane, Epoxyethane, Ethene oxide, Oxacyclopropane, Oxane, Oxidoethane , Oxirane

Ethylene oxide (EtO) is a flammable, colorless gas at temperatures above 51.3° F (10.7° C), which smells like ether at toxic levels. Ethylene oxide can decompose explosively and the liquid can accumulate static charge by splashing or agitation. The gas is slightly heavier than air and may spread long distances, closer to the bench top or floor. Distant ignition and flashback are possible. EtO is found in the production of solvents, antifreeze, textiles, detergents, adhesives, polyurethane foam, and pharmaceuticals. Smaller amounts are present in fumigants, sterilants for spices and cosmetics, as well as during hospital sterilization of surgical equipment. EtO is also used in medical research as a sterilant for equipment and animal cages. Ethylene oxide (EtO) is produced in large volumes and is primarily used as an intermediate in the production of several industrial chemicals, the most notable of which is ethylene glycol. It is also used as a fumigant in certain agricultural products and as a sterilant for medical equipment and supplies. Unfortunately, EtO possesses several physical and health hazards that merit special attention.

Health Effects: EtO is both flammable and highly reactive. Acute exposures to EtO gas may result in respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis. Chronic exposure has been associated with the occurrence of cancer, reproductive effects, mutagenic changes, neurotoxicity, and sensitization.

In addition to eye pain and sore throat, exposure to EtO can cause difficulty breathing and blurred vision. Exposure can also cause dizziness, nausea, headache, convulsions, and blisters and can result in vomiting and coughing. Both human and animal studies show that EtO is a carcinogen that may cause leukemia and other cancers. EtO is also linked to spontaneous abortion, genetic damage, nerve damage, peripheral paralysis, muscle weakness, as well as impaired thinking and memory. In liquid form, EtO can cause severe skin irritation upon prolonged or confined contact.

Employee exposure is limited to one part EtO per million parts of air (1 ppm) measured as an 8-hour time-weighted average (TWA). Employee exposure may not exceed the short-term excursion limit of 5 ppm EtO averaged over any 15-minute sampling period. These limits are called permissible exposure limits (PELs). Most occupational exposures to EtO are covered by OSHA's specific standard for EtO.

The standard does not apply, however, when employers can demonstrate that the processing, use, or handling of products containing EtO will not release airborne concentrations of EtO at or above the standard's action level of 0.5 ppm. The action level is calculated as an 8-hour TWA and is the threshold for increased compliance

activities (e.g., air monitoring, medical examinations, labeling, employee information, and training). However, awareness training is required for any use of EtO. For details of the requirements in OSHA's EtO standard for occupational exposures, see Title 29 of the Code of Federal Regulations (CFR) Part 1910.1047 or contact Environmental Health and Safety at X4150.

Note: Workplaces are exempt from this standard when objective data shows that the processing, use, or handling of products containing EtO cannot release airborne concentrations of EtO at or above the action level or in excess of the excursion limit during normal conditions. Awareness training is required for any use of EtO.

The key provisions of the EtO standard include:

- A limit on workplace exposure of one part EtO per million parts air (1 ppm) averaged over an eight-hour day
- An excursion limit, of five parts EtO per million parts of air (5 ppm) averaged over a sampling period of 15 minutes. Employee rotation is prohibited as a means of compliance with the excursion limit.

Where the exposure limits are exceeded, employers must:

- ❖ Use engineering controls, such as a fume hood, and work practices, such as a closed filtered system, to reduce exposure. These controls and practices may be supplemented by the use of respirators where necessary.
- ❖ Establish and implement a written compliance program (SOP) to achieve the limits.
- ❖ Establish exposure monitoring and training programs for employees subjected to EtO exposure above the limits.
- ❖ Identify, as a regulated area, any location where airborne concentrations of EtO are expected to exceed the limits.
- ❖ Place warning labels on containers capable of releasing EtO to the extent that an employee's exposure would foreseeably exceed the action level or excursion limit.
- ❖ Dispose of EtO waste as hazardous waste.
- ❖ Do not have open flames or hot plates in the area where EtO is used.

Respiratory protection: Respirators shall be used to control exposure only in the following circumstances:

- ❖ While feasible engineering and work practice controls are being installed
- ❖ During maintenance, repair and other operations for which engineering controls are not feasible
- ❖ In work situations where feasible engineering and work practice controls do not reduce exposures below the permissible exposure limit (PEL)
- ❖ In emergencies.

Action level (0.5 ppm): If the eight-hour time-weighted airborne concentration of EtO is at or exceeds the action level, employers must begin periodic exposure monitoring and medical surveillance.

Employers who demonstrate that worker exposures are below the action level need not comply with most provisions of the standard.

Exposure monitoring: If an employer has not monitored worker exposures within the past year, he or she must do so for each job classification in a work area during each shift; representative sampling is permitted under certain circumstances. The frequency of subsequent monitoring depends on the results of the initial sampling. Affected employees or their designated representatives must be provided an opportunity to observe the exposure monitoring.

Medical surveillance: The standard requires a comprehensive medical surveillance program to be conducted by or under the supervision of a licensed physician. Workers must be granted a medical examination:

- ❖ Before assignment to an area and annually where exposure is at or above the action level.
- ❖ At or above action level for 30 days or more during the year.
- ❖ Upon request if a worker has developed symptoms suggesting overexposure or wants medical advice concerning the effects of EtO exposure on his or her ability to produce a healthy child.
- ❖ At the time a worker ends employment in an area of exposure.

Regulated areas: Employers must identify areas where occupational exposure exceeds the PEL or excursion limit. These areas must be clearly marked and only authorized persons allowed to enter.

Communication of EtO hazards to employees: Establish regulated areas where occupational exposure to EtO exceeds the 8-hr TWA or excursion limit, and clearly mark them to limit number of workers in the regulated area and to allow only authorized persons to enter. Provide the signs and labels specified by the standard clearly indicating EtO's carcinogenic and reproductive hazards in regulated areas. Train workers upon initial assignment and then annually if they are at risk of exposure at or above the action level or above the excursion limit. Maintain a material safety data sheet for EtO that conforms to the provisions of OSHA's hazard communication standard, 29 CFR 1910.1200(g).

Record keeping: Exposure records must be retained for 30 years, medical records must be kept for the worker's duration of employment plus 30 years. Workers, former employees, and their designated representatives may have access to records, upon request.

Applicability: The standard generally applies to all occupational exposures to EtO. However, workplaces in which the processing, use or handling of products containing EtO cannot result in airborne concentration at or above the action level are excluded. An employer who claims exemption from the standard must keep records that document this determination.

To protect against EtO exposure, follow these safety precautions:

- ❖ Wear goggles and skin protection at all times in areas where there is a risk of splashes from liquid EtO.

- ❖ Wear proper protective clothing and other approved personal protective equipment when working with EtO.
- ❖ Discard clothing that has been degraded by EtO.
- ❖ See a doctor if you are exposed to EtO.
- ❖ Do not eat, drink, or smoke while working with EtO.

Emergency Procedures: In a medical emergency, call 911, then 4111.

Inhalation: Take proper precautions to ensure your own safety before attempting rescue (e.g. wear appropriate protective equipment, use the buddy system). Remove source of contamination or move victim to fresh air. Obtain medical attention immediately.

Skin contact: For ethylene oxide in GAS form: If irritation occurs, flush with lukewarm, gently flowing water for 15 minutes or until the chemical is removed. If irritation persists, obtain medical attention.

For ethylene oxide SOLUTIONS: Avoid direct contact. Wear chemical protective clothing, if necessary. As quickly as possible, flush with lukewarm, gently flowing water for at least 15 minutes or until the chemical is removed.

Under running water remove contaminated clothing, shoes and leather goods (e.g. watchbands, belts). Obtain medical attention immediately. Completely decontaminate clothing, shoes and leather goods before re-use or discard.

Contact with eyes: Avoid direct contact. Wear chemical protective gloves, if necessary. Immediately flush the contaminated eye(s) with lukewarm, gently flowing water for 15 minutes or until the chemical is removed, while holding eyelid(s) open. Take care not to rinse contaminated water into the unaffected eye or onto the face. Obtain attention immediately.

Ingestion: NEVER give anything by mouth if victim is rapidly losing consciousness, is unconscious or is convulsing. DO NOT INDUCE VOMITING. Have victim drink a cup of water to dilute material in the stomach. Obtain medical attention immediately.

Before working with any chemical, review the Material Safety Data Sheet.