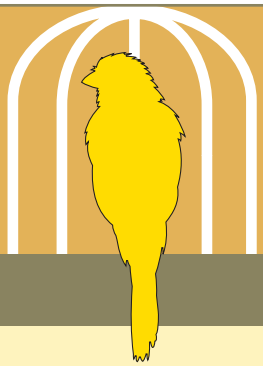
Ethylene Oxide

HEALTH AND SAFETY FACT SHEET

CUPE Canadian Union of Public Employees



Ethylene oxide (EtO) is a flammable, colourless gas or liquid that has a sweet odour. The odour threshold is very high – if it can be smelled, it is already well beyond toxic levels. EtO can sometimes be confused with ether, a common and far less dangerous solvent. At room temperature, EtO is usually a gas. Under 10 degrees Celsius, it can exist as a liquid. In high concentrations, EtO can be very explosive.

EtO is found in the production of solvents, antifreeze, textiles, detergents, adhesives, polyurethane foam, and pharmaceuticals. Smaller amounts are present in fumigants, sterilant for spices and cosmetics, as well as during hospital sterilization of surgical equipment.

How is ethylene oxide used?

EtO is commonly used in the health care industry for sterilization purposes. It is used as a chemical sterilant for items that can't be effectively or safely sterilized by heat or steam, including rubber goods, oxygen tents, catheters and telescopic instruments. The contaminated goods are exposed to ethylene oxide gas in closed chambers, then packaged for reuse in the facility. The gas is supplied in two ways: either in ampoules (small cartridges) for one-time use in sterilizing trays; or as an EtO/inert gas mixture in tanks which are connected to the sterilizing chamber.

There are many possible sources of worker exposure to EtO throughout the sterilizing process. These include:

- Leaks from the gas delivery system (e.g. hoses or piping, tanks)
- Faulty ventilation
- Poor aeration of items
- Faulty evacuation of ethylene oxide
- Leaking door gaskets, and
- Unvented chambers

Exposure risks

At room temperature, EtO is extremely flammable and a human carcinogen (Type 1 as defined by the International Agency for Research on Cancer), mutagen, anaesthetic and irritant.

Workers exposed to ethylene oxide can experience the following immediate side effects:

- Irritation of eyes, skin, nose, airways and lungs
- Sensitization of skin (an allergic reaction)
- Upset stomach, vomiting and diarrhea
- Loss of feeling in the arms, hands and legs, as well as other effects on the central nervous system

In addition, exposure to EtO can cause a sore throat, difficulty breathing and blurred vision. Exposure can also cause dizziness, nausea, headaches, convulsions, blisters and coughing. Studies have shown that EtO is a carcinogen that may cause leukemia and other cancers. EtO is also linked to higher rates of miscarriages.

Reducing the risk

While the only safe exposure is zero, and exposure limits vary by jurisdiction, the

American Conference of Governmental Industrial Hygienists has set a threshold limit value of one-part EtO per million parts of air (1 ppm), measured as an 8-hour time-weighted average.

Some of the most effective control methods include redesigning equipment and work areas, and improving ventilation and maintenance. Some examples are:

- Ventilation on the sterilizer and aeration cabinet that exhausts directly to the outside
- Increase in aerator capacity so that all materials from the sterilizer can be handled in one load, and
- Development of a planned maintenance program which includes testing of the tanks, piping and sterilizer for leaks

Safe work practices

To reduce the exposure risks and implement safe work practices, employers must provide and ensure that employees wear personal protective clothing or equipment. Workers should always wear goggles and skin protection in areas where there is a risk of splashes from liquid EtO. Workers should discard clothing that has been degraded by EtO.

The requirements of a respirator program for EtO-exposed workers go beyond general respirator programs. If workers must wear respirators in case of emergencies such as leaks and spills, they must be declared medically able to wear a respirator and be fitted quantitatively (that is, actual exposure is measured while they are wearing a respirator). They must also be trained in the uses and limitations of respirators and be retrained on an annual basis.

Employers must also provide information and training in all workplaces where there is potential exposure to airborne EtO. This includes developing and implementing a written plan for emergency situations and proper warning labels.

It is the employer's responsibility to put a monitoring program in place. This program should be developed in consultation with the health and safety committee and include the following:

- Monitoring for leak detection when equipment is first installed and then on a regular basis during operation
- Continuous monitoring that provides a visible readout (e.g. on a meter) and with monitor attached to an audible alarm
- Periodic monitoring of personal breathing zones with pumps and charcoal tubes to assess individual worker exposures, to ensure continuous monitoring is accurate or in the absence of continuous monitoring
- Wearing of dosimeters (or monitor) to assess personal exposures, and
- Keeping accurate records (which include exposure levels, locations, time, etc.), and sharing these with the health and safety committee

Finally, it is crucial that all workers potentially exposed to EtO are made aware of the hazards and necessary controls.

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