



CAMEO Chemicals



Chemical Datasheet

ETHYLENE OXIDE



Chemical Identifiers

CAS Number	UN/NA Number	DOT Hazard Label	USCG CHRIS Code
75-21-8	1040	Poison Gas Flammable Gas	EOX

NFPA 704

Diamond	Hazard	Value	Description
4 3 3	Health	3	Can cause serious or permanent injury.
	Flammability	4	Burns readily. Rapidly or completely vaporizes at atmospheric pressure and normal ambient temperature.
	Instability	3	Capable of detonation or explosive decomposition or explosive reaction but requires a strong initiating source or must be heated under confinement before initiation.
	Special		

(NFPA, 2010)

NIOSH Pocket Guide

Ethylene oxide

International Chem Safety Card

ETHYLENE OXIDE

General Description

A clear colorless gas with an ethereal odor with a flash point below 0°F. Liquid less dense than water. Vapors heavier than air.




May polymerize exothermically if heated or contaminated. If the polymerization takes place inside a container, the container may rupture violently.

Vapors very toxic. Vapors irritate the eyes, skin, and respiratory system. Prolonged skin contact may result in delayed burns.

Used to make other chemicals, as a fumigant and industrial sterilant.

Hazards

Reactivity Alerts

-  Highly Flammable
-  Explosive
-  Polymerizable

Air & Water Reactions

Highly flammable. Flammable over a wide vapor-air concentration range. Must be diluted on the order of 24 to 1 with water to lose flammability. Soluble in water.

Fire Hazard

Severe explosion hazard when exposed to heat or flame. Irritating vapors are generated when heated. Vapor is heavier than air and may travel considerable distance to a source of ignition and flash back. Vapor forms explosive mixtures with air over a wide range. Liquid is not detonable but the vapor may be readily initiated into explosive decomposition. Avoid metal fittings containing copper, silver, mercury or magnesium; ammonia, oxidizing agents; acids, organic bases; amines; certain salts; alcohols; mercaptans, ferric chloride; magnesium perchlorate; m-nitroaniline; trimethylamine, potassium, tin chlorides; alkanethiols; bromoethane; aluminum chloride; aluminum oxide; iron chlorides; and iron oxides. Avoid air, heat, acids and bases, metal or metal chloride catalysts. Hazardous polymerization may occur. Avoid acids; covalent halides such as chlorides of aluminum, iron (III), tin (IV); basic materials like alkali hydrides, ammonia, amines, and potassium; catalytically active solids such as aluminum or iron oxides or rust, chlorides of boron, aluminum, tin, and iron; some carbonates; and metals such as copper and copper alloys (EPA, 1998)

Health Hazard

It can cause death. Lowest inhalation concentration causing toxic effects is 12500 ppm/10 seconds. It is a strong skin irritant. Neurological disorders and even death have been reported. (EPA, 1998)

Reactivity Profile

Colorless gas at room temperature (b.p. 11° C), confirmed carcinogen. Highly flammable, severe explosion hazard when exposed to flame. The autoignition temperature may be as low as 140° C in presence of rust. Rapid compression of the vapor with air causes explosion. Ethylene oxide vapor may be initiated into explosive decomposition in absence of air [Hess, L. G., et al., Ind. Eng. Chem., 1950, 42, p. 1251]. Metal fittings containing magnesium, copper or silver should be avoided, since traces of acetylene in ethylene oxide may produce metal acetylides capable of detonating the vapor [MCA SD-38, 1971]. Violent polymerization occurs on contact with strong bases (alkali hydroxides, ammonia) or acids, amines, metallic potassium, oxides (aluminum oxide, iron oxide, rust), covalent halides (aluminum chloride, ferric chloride, tin(IV) chloride) [Gupta, A. K., J. Soc. Chem. Ind., 1949, 68, p. 179]. Violent reaction with m-nitroaniline, magnesium perchlorate, mercaptans, thiols, triethylamine [Bretherick, 5th ed., 1995, p. 316]. Ethylene oxide and SO₂ can react violently in pyridine solution with pressurization if ethylene oxide is in excess (Nolan, 1983, Case History 51).

Belongs to the Following Reactive Group(s)

- Epoxides
- Polymerizable Compounds

Potentially Incompatible Absorbents

Use caution: Liquids with this reactive group classification have been known to react with the absorbents listed below.

- Mineral-Based & Clay-Based Absorbents
- Dirt/Earth

Response Recommendations

Isolation and Evacuation

Excerpt from ERG Guide 119P [Gases - Toxic - Flammable]:

As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions.

SPILL: See ERG Tables 1 and 3 - Initial Isolation and Protective Action Distances on the UN/NA 1040 datasheet.

FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 1600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. (ERG, 2016)

Firefighting

Move container from fire area if you can do so without risk. Stay away from ends of tanks. Fight fire from maximum distance. For massive fire in cargo area, use unmanned hose holder or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tank due to fire. Isolate for 1 mile in all directions if tank car or truck is involved in fire. Keep unnecessary people away; isolate hazard area and deny entry. Stay upwind; keep out of low areas. Wear positive pressure breathing apparatus and full protective clothing. Evacuate area endangered by gas.

Extinguish with alcohol foam, carbon dioxide, dry chemical or water spray, fog, or foam. Let burn unless leak can be stopped immediately. (EPA, 1998)

Non-Fire Response

Excerpt from ERG Guide 119P [Gases - Toxic - Flammable]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Fully encapsulating, vapor-protective clothing should be worn for spills and leaks with no fire. Do not touch or walk through spilled material. Stop leak if you can do it without risk. Do not direct water at spill or source of leak. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. FOR CHLOROSILANES, use AFFF alcohol-resistant medium-expansion foam to reduce vapors. If possible, turn leaking containers so that gas escapes rather than liquid. Prevent entry into waterways, sewers, basements or confined areas. Isolate area until gas has dispersed. (ERG, 2016)

Protective Clothing

Skin: If chemical is in liquid form, wear appropriate personal protective clothing to prevent skin contact.

Eyes: If chemical is in liquid form, wear appropriate eye protection to prevent eye contact.

Wash skin: If the chemical is in liquid form, the worker should immediately wash the skin when it becomes

contaminated.

Remove: Work clothing that becomes wet should be immediately removed due to its flammability hazard(i.e. for liquids with flash point < 100°F)

Change: No recommendation is made specifying the need for the worker to change clothing after the work shift.

Provide: Facilities for quickly drenching the body should be provided (when chemical is in liquid form) within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2016)

DuPont Tychem® Suit Fabrics

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QC	SL	TF	TP	C3	BR	RC	TK	RF
Dimethylene oxide (gas)	75-21-8	Vapor	imm.	imm.	126	126	>480	>480	>480	>480	>480
Dimethylene oxide (liquid, -70° C)	75-21-8	Liquid								>180	
Dimethylene oxide (liquid, 0° C)	75-21-8	Liquid						>480	>480	>480	>480
Dimethylene oxide (liquid, 11° C)	75-21-8	Liquid					18				
Epoxyethane (gas)	75-21-8	Vapor	imm.	imm.	126	126	>480	>480	>480	>480	>480
Epoxyethane (liquid, -70° C)	75-21-8	Liquid								>180	
Epoxyethane (liquid, 0° C)	75-21-8	Liquid						>480	>480	>480	>480
Epoxyethane (liquid, 11° C)	75-21-8	Liquid					18				
Ethylene oxide (gas)	75-21-8	Vapor	imm.	imm.	126	126	>480	>480	>480	>480	>480
Ethylene oxide (liquid, -70° C)	75-21-8	Liquid								>180	
Ethylene oxide (liquid, 0° C)	75-21-8	Liquid						>480	>480	>480	>480
Ethylene oxide (liquid, 11° C)	75-21-8	Liquid					18				

> indicates greater than.

"imm." indicates immediate; having a normalized breakthrough time of 10 minutes or less.

A blank cell indicates the fabric has not been tested. The fabric may or may not offer barrier.

Special Warnings from DuPont

1. Serged and bound seams are degraded by some hazardous liquid chemicals, such as strong acids, and should not be worn when these chemicals are present.

2. CAUTION: This information is based upon technical data that DuPont believes to be reliable. It is subject to revision as additional knowledge and experience are gained. DuPont makes no guarantee of results and assumes no obligation or liability...

(DuPont, 2016)

First Aid

Warning: Ethylene oxide is corrosive to moist tissues. Caution is advised.

Signs and Symptoms of Acute Ethylene Oxide Exposure: Signs and symptoms of acute exposure to ethylene oxide may be severe, and include dyspnea (shortness of breath), cough, pulmonary edema, pneumonia, and respiratory failure. Lethargy, headache, dizziness, twitching, convulsions, paralysis, and coma may be observed. Cardiac arrhythmias and cardiovascular collapse may also occur. Gastrointestinal effects of acute exposure may include nausea, vomiting, and abdominal pain. Ethylene oxide may severely irritate or burn mucous membranes and moist skin. Eye contact may result in conjunctivitis (red, inflamed eyes) and erosion of the cornea.

Emergency Life-Support Procedures: Acute exposure to ethylene oxide may require decontamination and life support for the victims. Emergency personnel should wear protective clothing appropriate to the type and degree of contamination. Air-purifying or supplied-air respiratory equipment should also be worn, as necessary. Rescue vehicles should carry supplies such as plastic sheeting and disposable plastic bags to assist in preventing spread of contamination.

Inhalation Exposure:

1. Move victims to fresh air. Emergency personnel should avoid self-exposure to ethylene oxide.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
4. Transport to a health care facility.

Dermal/Eye Exposure:

1. Remove victims from exposure. Emergency personnel should avoid self-exposure to ethylene oxide.
2. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
3. Remove contaminated clothing as soon as possible.
4. If eye exposure has occurred, eyes must be IMMEDIATELY flushed with lukewarm water for AT LEAST 15 minutes.
5. If liquid is spilled on the skin, allow ethylene oxide to vaporize before washing THOROUGHLY with soap and water.
6. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
7. Transport to a health care facility.

Ingestion Exposure:

1. Evaluate vital signs including pulse and respiratory rate, and note any trauma. If no pulse is detected, provide CPR. If not breathing, provide artificial respiration. If breathing is labored, administer oxygen or other respiratory support.
2. Obtain authorization and/or further instructions from the local hospital for administration of an antidote or performance of other invasive procedures.
3. Give the victims water or milk: children up 1 year old, 125 mL (4 oz or 1/2 cup); children 1 to 12 years old

200 mL (6 oz or 3/4 cup); adults, 250 mL (8 oz or 1 cup). Water or milk should be given only if victims are conscious and alert.

4. Activated charcoal may be administered if victims are conscious and alert. Use 15 to 30 g (1/2 to 1 oz) for children, 50 to 100 g (1-3/4 to 3-1/2 oz) for adults, with 125 to 250 mL (1/2 to 1 cup) of water.

5. Ethylene oxide generally acts as its own cathartic; however, if deemed necessary, excretion may be promoted by administering a saline cathartic or sorbitol to conscious and alert victims. Children require 15 to 30 g (1/2 to 1 oz) of cathartic; 50 to 100 g (1-3/4 to 3-1/2 oz) is recommended for adults.

6. Transport to a health care facility. (EPA, 1998)

Physical Properties

Chemical Formula: C₂H₄O

Flash Point: -0.4 to 0 ° F (EPA, 1998)

Lower Explosive Limit (LEL): 3 % (EPA, 1998)

Upper Explosive Limit (UEL): 100 % (EPA, 1998)

Autoignition Temperature: 804 ° F (USCG, 1999)

Melting Point: -170.5 ° F (EPA, 1998)

Vapor Pressure: 1095 mm Hg at 68 ° F (EPA, 1998)

Vapor Density (Relative to Air): 1.49 (EPA, 1998)

Specific Gravity: 0.8222 at 50 ° F (EPA, 1998)

Boiling Point: 51.3 ° F at 760 mm Hg (EPA, 1998)

Molecular Weight: 44.06 (EPA, 1998)

Water Solubility: Miscible (NTP, 1992)

Ionization Potential: 10.56 eV (NIOSH, 2016)

IDLH: 800 ppm ; A potential occupational carcinogen. (NIOSH, 2016)

AEGLs (Acute Exposure Guideline Levels)

Final AEGLs for Ethylene oxide (75-21-8)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	NR	80 ppm	360 ppm
30 minutes	NR	80 ppm	360 ppm
60 minutes	NR	45 ppm	200 ppm
4 hours	NR	14 ppm	63 ppm
8 hours	NR	7.9 ppm	35 ppm

NR = Not recommended due to insufficient data
(NAC/NRC, 2016)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Ethylene Oxide (75-21-8)	NA	50 ppm	500 ppm

NA = not appropriate.

(AIHA, 2016)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Ethylene oxide; (Oxirane) (75-21-8)	5 ppm	45 ppm	200 ppm	LEL = 30000 ppm

(DOE, 2016)

Regulatory Information

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112 (r) RMP TQ
Ethylene oxide	75-21-8	1000 pounds	10 pounds	10 pounds	313	U115	10000 pounds
Oxirane	75-21-8	1000 pounds	10 pounds	10 pounds	X	U115	10000 pounds

"X" indicates that this is a second name for an EPCRA section 313 chemical already included on this consolidated list. May also indicate that the same chemical with the same CAS number appears on another list with a different chemical name.

(EPA List of Lists, 2015)

DHS Chemical Facility Anti-Terrorism Standards (CFATS)

Chemical of Interest	CAS Number	RELEASE			THEFT			SABOTAGE		
		Min Conc	STQ	Security Issue	Min Conc	STQ	Security Issue	Min Conc	STQ	Security Issue
Ethylene oxide; [Oxirane]	75-21-8	1.00 %	10000 pounds	flammable						

(DHS, 2007)

Alternate Chemical Names

- 12/88
- ALPHA, BETA-OXIDOETHANE
- AMPROLENE
- ANPROLENE
- ANPROLINE
- CIBA-GEIGY 9138
- DIHYDROOXIRENE
- DIMETHYLENE OXIDE
- E O
- E.O.
- ENT-26263

- 1,2-EPOXY ETHANE
- EPOXYETHANE
- 1,2-EPOXYETHANE
- ETHENE OXIDE
- ETHOX
- ETHYLENE OXIDE
- ETHYLENEOXY
- ETO
- FEMA NO. 2433
- MERPOL
- NCI-C50088
- OXACYCLOPROPANE
- OXANE
- OXIDOETHANE
- OXIRAN
- OXIRANE
- OXIRENE, DIHYDRO-
- OXYFUME
- OXYFUME 12
- STERILIZING GAS ETHYLENE OXIDE 100%
- T-GAS