SAFETY DATA SHEETS

This SDS packet was issued with item:

078432830

The safety data sheets (SDS) in this packet apply to the individual products listed below. Please refer to invoice for specific item number(s).

078432848 078880705

Material Safety Data Sheets—Ethylene Oxide

Section 1
Chemical Product & Company Identification

Product: EOGAS

Manufactured by:

Andersen Sterilizers, Inc.
Health Science Park
3154 Caroline Drive
Haw River, NC 27258 USA

Information Telephone Number: (336) 376-8622

Emergency Telephone Number
(24 HRS, 7 DAYS PER WEEK)
CHEM-TEL (800)-255-3924

Section 2
Composition/ Information on Ingredients

Chemical Name:	Ethylene Oxide
Weight By %:	84 to 97%
Chemical Family:	Epoxide
Formula:	$(CH_2)_2O$
Molecular Weight:	44.06 gms/mole
CAS Number:	75-21-8
CAS Name:	Oxirane
Synonyms:	EO, EtO, Dihydroxirene; 1-2 Epoxyethane, Dimethylene Oxide, Oxane, Oxirane, Alkene Oxide, Alpha/ Beta-Oxidoethane, Oxacyclopropane.
Product Uses:	Chemical intermediate for production of antifreeze, polyester resins, non-ionic surfactants and specialty solvents; sterilizing agent f or controlling microorganisms in health care applications; fumigant for controlling insect infestation in whole and ground spices and cosmetics.

Section 3
Hazard Identification

EMERGENCY OVERVIEW

Colorless liquid or heavier-than-air gas with a sweet, ether-like odor. Extremely flammable liquefied gas which burns in the absence of oxygen and can explode when exposed to elevated temperatures. Toxic when inhaled. Causes severe skin and eye irritation or burns and respiratory tract irritation; effects may be delayed. Harmful if swallowed or absorbed through the skin. Contact with liquid may cause frostbite.

Statement of Hazards:
DANGER!
Extremely flammable liquid and gas under pressure. May form explosive mixtures with air. Highly reactive. May be harmful if inhaled and may cause delayed lung injury, respiratory system and nervous system damage. Inhalation may cause dizziness or drowsiness. Liquid contact may cause frostbite. May cause allergic skin reaction. Harmful if swallowed. May cause adverse blood effects, liver and kidney damage based on animal data. Cancer and reproductive hazard.

HAZARD RATINGS: (0 = minimum; 4 = maximum)

HMIS RATING: Health = 3
Flammability = 4
Reactivity = 3
Personal Protection Code = x
(Consult your supervisor or standard operating procedures for special handling directions.)

NFPA RATING: Health = 3
Flammability = 4
Reactivity = 3

Exposure Limits:

	TWA (8 hr)	STEL (15-min)
OSHA	1 ppm	5 ppm
ACGIH	1 ppm	n/a

PRIMARY ROUTES OF EXPOSURE: Inhalation; eye contact, skin contact/absorption

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Effects include skin, eye and respiratory tract irritation or burns. Central nervous system effects initially cause headache, dizziness and nausea and in extreme cases, unconsciousness and death. Peripheral nerve damage may result in muscular weakness, giddiness, irrational behavior and loss of sensation in the extremities. Dulling of the sense of smell may occur.

ACUTE HEALTH EFFECTS:

INHALATION: Inhaling concentrated vapor may cause serious health effects. Inhalation may progressively cause mucous membrane and respiratory irritation, headache, vomiting, cyanosis, drowsiness, weakness, incoordination, CNS depression, lachrymation, nasal discharge and salivation, gasping, and labored breathing. Delayed effects may include nausea, diarrhea, edema of the lungs, paralysis and convulsions. NOTE: Ethylene Oxide has a high odor threshold (>250 ppm) and the sense of smell does not provide adequate protection against its toxic effects.

EYE CONTACT: Liquid Ethylene Oxide is severely irritating and corrosive to the eyes and contact can

cause swelling of the conjunctiva and irreversible corneal injury. Contact with liquid Ethylene Oxide can cause frostbite. Vapors may cause eye irritation, tearing, redness and swelling of the conjunctiva.

SKIN CONTACT: Prolonged contact with liquid Ethylene Oxide can cause a local erythema, edema, and formation of blisters. Response is more severe on damp skin. There may be a latency period of several hours prior to the onset of symptoms. Ethylene Oxide may be absorbed by the skin, and sustained contact may produce adverse effects such as headache, dizziness, nausea, and vomiting. Ethylene Oxide is a skin sensitizer and some individuals may suffer an allergic skin reaction. Skin contact may also cause allergic contact dermatitis in some exposed individuals. Liquid Ethylene Oxide evaporates rapidly and may chill the skin causing frostbite.

INGESTION: This relatively unlikely route of exposure is expected to cause severe irritation and burns of the mouth and throat, abdominal pain, nausea, vomiting, collapse and coma. Aspiration may occur during swallowing or vomiting, resulting in lung damage.

CHRONIC HEALTH EFFECTS:

SKIN CONTACT: Long term effects are unknown but are expected to be similar to acute effects of skin exposure.

EYE CONTACT: Some cases of cataract formation have been reported.

INHALATION: Respiratory irritation which can result in permanent, lung injury, chromosomal aberrations and peripheral neurotoxic effects with a numbing of the sense of smell. Cognitive and CNS impairment may result from long term exposures.

INGESTION: May cause anemia, gastrointestinal irritation, effects on liver, kidneys, and adrenal glands.

CARCINOGENICITY:
OSHA classifies Ethylene Oxide as a cancer/ reproductive hazard and considers that, at excessive levels, Ethylene Oxide may present reproductive, mutagenic, genotoxic, neurologic and skin sensitization hazards.
ACGIH classifies Ethylene Oxide as "A2"- suspected human carcinogen.
NTP classifies Ethylene Oxide as a known human carcinogen.
IARC classifies Ethylene Oxide in Group 1 (carcinogenic to humans).
NIOSH classifies Ethylene Oxide as a potential human carcinogen.

Section 4
First Aid Measures

EYE CONTACT: Immediately flush eyes, including the entire surface of the eyes and under the eyelids, gently but thoroughly with plenty of running water for at least 15 minutes. Obtain medical attention immediately. ***NOTE: Never wear contact lenses when working with Ethylene Oxide.***

SKIN CONTACT: Immediately flush skin thoroughly with water for at least 15 minutes while removing contaminated clothing and shoes. Obtain medical attention immediately. Wash clothing before reuse and discard contaminated leather articles such as shoes and belts.

INHALATION: Remove exposed person to fresh air. If breathing has stopped, give artificial respiration, then have qualified personnel administer oxygen, if needed. Get immediate medical attention.

INGESTION: If patient is conscious give plenty of water (minimum of two glasses) but ***DO NOT INDUCE VOMITING***. This material is corrosive. Keep head lower than hips to avoid aspiration, should vomiting occur. Get medical attention immediately.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:
Preexisting skin, eye and respiratory disorders; lung, blood, nervous system and peripheral nerve disorders.

NOTE TO PHYSICIANS: Respiratory symptoms include nausea, vomiting and irritation of the nose and throat. Pulmonary edema may occur. Respiratory effects may be delayed. Consider oxygen administration. If a chemical burn is present decontaminate skin and treat as any thermal burn. No specific antidote is known, however consider gastric lavage and administration of a charcoal slurry.

Section 5
Fire Fighting Measures

FLASH POINT (TEST METHOD):
Tag Closed Cup: -4F (-20C)

FLAMMABLE LIMITS IN AIR (% BY VOLUME):
Upper flammable limit: 100%
Lower flammable limit: 3.0% (30,000 ppm)

NEFA HAZARD RATING:
Health: 3 Flammability: 4 Reactivity: 3

AUTOIGNITION TEMPERATURE:
804 F (429C); burns in the absence of air

EXTINGUISHING MEDIA: Carbon dioxide, dry chemi-

cal or water spray for small fires. Water spray, polymer or alcohol resistant foams for large fires. Dilution of liquid Ethylene Oxide with 23 volumes of water should render it non-flammable. Dilution with 100 parts water to one part of Ethylene Oxide vapor may be required to control build up of flammable vapors in closed systems. Water spray can be used to reduce intensity of flames to cool fire-exposed containers and to dilute spills to render non-flammable.

HAZARDOUS DECOMPOSITION PRODUCTS:
Carbon monoxide and carbon dioxide.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Ethylene Oxide is dangerously explosive under fire condition; it is flammable over an extremely large range of concentrations in air and bums in the absence of oxygen. Liquid Ethylene Oxide is lighter than water (floats) and vapors are heavier than air and may travel along ground long distances to sources of ignition and then flash back. Containers should not be subject to temperatures hotter than 127F (52 C). Vapors are extremely flammable and are readily ignited by static charge, sparks and flames at concentrations above 3%.

Section 6
Accidental Release Measures

PRECAUTIONS: Treat any Ethylene Oxide leak as an emergency. Evacuate all personnel from the area. If an EOGas cartridge is inadvertently dropped and activated before it is sealed inside of the sterilization liner bag, it must be sealed in a liner bag immediately (within 30 seconds) or the room must be evacuated for a minimum of 12 hours. If an EOGas cartridge is inadvertently dropped and activated, it may be placed in an empty liner bag and the bag closed by any secure method. This must be completed within 30 seconds. At that point the bag should be placed in the machine and a cycle should be started. Run a full 16 hour cycle before removing the used EOGas cartridge from the liner bag.

Section 7
Handling and Storage

HANDLING AND STORAGE PRECAUTIONS: Have established handling and emergency response procedures in place prior to use. Make sure that the sterilizer is properly grounded. Protect containers from physical damage and regularly inspect them for cracks or leaks.

ENGINEERING CONTROLS: Ethylene Oxide, a major fire hazard, can burn in the absence of oxygen. All electrical devices used in areas processing or handling Ethylene Oxide must be engineered and designed to meet applicable local electrical/fire codes. Safeguards can include designing electrical devices as explosion proof and/or intrinsically safe.

ATTENTION: Ethylene Oxide vapors are colorless and odorless above OSHA'S permissible exposure level. An air monitoring system and/or AirScan badges are recommended to determine airborne exposure levels.

STORAGE SEGREGATION: Store Ethylene Oxide in a cool, dry, well-ventilated area away from incompatible chemicals and sources of ignition. Store EOGas refill kits upright; do not drop and move in a carefully supervised manner. ***DO NOT STORE IN DIRECT SUNLIGHT.***

SHIPPING AND STORAGE CONTAINERS:
(See 49 CFR 173.4)
All EOGas refill kits containing Ethylene Oxide are packaged and shipped in accordance with the small quantities exemption under 49 CFR 173.4(c) and DOT approval CA 9803005 issued April 9, 1998.

Section 8
Exposure Controls/Personal Protection

EXPOSURE LIMITS:

OSHA ACTION LEVEL (8 HR. TWA)	0.5 ppm
OSHA PEL (8 HR TWA)	1 ppm
OSHA 15 MINUTE EXCURSION LIMIT	5 ppm; 9 mg/m3
ACGIHTLV/TWA	1 ppm; 1.8 mg/m3
IDLH:	800 ppm

EYE PROTECTION: ***NEVER WEAR CONTACT LENSES*** when working with Ethylene Oxide.

VENTILATION: Install and operate general and local exhaust ventilation systems powerful enough to maintain airborne levels of Ethylene Oxide below the OSHA PEL in the worker's breathing area. AAMI / ANSI ST41 Good Hospital Practice: Ethylene Oxide Sterilization and Sterility Assurance Guidelines, Section 3.4 recommends a minimum of 10 room makeup air changes per hour. Emission controls must be in compliance with Federal State and local regulations.

OTHER PROTECTION: Sterilizer must be electrically grounded/bonded. Practice good personal hygiene; always wash thoroughly after using this material. Do not eat, drink, or smoke in the work area.

Section 9
Stability and Reactivity

Boiling Point:	50.9°F (10.5°C)
Freezing Point	-169° F (-111.7°C)
Specific Gravity:	0.871 at 20°C
Vapor Pressure:	1094 mm Hg @ 20°C

Vapor Density (Air =1)	1.5
Solubility in Water:	100%
Molecular Weight:	44.06 gm/mole
Percent Volatile by Volume	100%
Evaporation rate (Butyl Acetate = 1)	Not applicable
pH:	7, neutral (100 grams/ liter in water)
Appearance and Odor:	Colorless liquid or gas with sweet ether -like odor.
Odor threshold:	261 ppm (detectable); 600-700 ppm recognizable).
Log Octanol/Water Partition Coefficient (log Kow):	-0.3

Section 10
Stability and Reactivity

STABILITY: Material is stable for extended periods in closed airtight, pressurized containers at room temperature, under normal storage and handling conditions. Vapors may explode when exposed to common ignition sources.

CONDITIONS TO AVOID: Storage at warm temperatures or any exposure of storage or shipping containers to hot temperatures. Prevent exposure to all sources of ignition such as heat, flame, lighted tobacco products, or electrical or mechanical sparks.

HAZARDOUS DECOMPOSITION PRODUCTS: Ethylene Oxide undergoes thermal decomposition to form carbon dioxide and carbon monoxide gases.

Section 11
Toxicological Information

TOXICOLOGICAL- ACUTE INHALATION:
LC_{50} (1 hr. exposure)

5748 ppm (male rat)
4439 ppm (female rat)
5029 ppm (rat – combined sexes)

Various mammalian species exposed to lethal concentrations of Ethylene Oxide had symptoms of mucous membrane irritation, central nervous system depression, lacrimation, nasal discharge, salivation, nausea, vomiting, diarrhea, respiratory irritation, incoordination, and convulsions.

TOXICOLOGICAL-CHRONIC INHALATION: Symptoms of chronic exposure are similar to those observed in acute studies, including lung, kidney and liver damage and testicular tubule degeneration in some species. Studies demonstrated neuromuscular effects as the most sensitive indicator of Ethylene Oxide over exposure.

TOXICOLOGICAL-ACUTE DERMAL:
No dermal LD_{50} information is available on this product. It is expected to be corrosive to rabbit skin.

TOXICOLOGICAL – CHRONIC DERMAL: No chronic dermal toxicity data are available on this product.

TOXICOLOGICAL- EYE: No eye irritation animal data are available on this product; however, it is expected to be extremely irritating to rabbit eyes.

TOXICOLOGICAL-ACUTE INGESTION:
The acute oral LD_{50} for this product is 72 mg/kg, rat.

TOXICOLOGICAL-CHRONIC INGESTION: The effects of chronic ingestion of this product are unknown.

CARCINOGENICITY: A recent assessment of available epidemiology studies related to Ethylene Oxide concluded that the evidence indicates that Ethylene Oxide does not cause heart disease, an excess of cancers overall, or brain, stomach or pancreatic cancers which were seen in some animal and isolated human studies. The findings with respect to leukemia and non-Hodgkins lymphoma are less definitive. While the majority of the evidence does not indicate that Ethylene Oxide causes these cancers, there are some suggestive trends. Longer follow-up of Ethylene Oxide workers is needed to better clarify these relationships. Two inhalation studies with rats demonstrated carcinogenic responses consisting of increased incidences of mononuclear cell leukemia, peritoneal mesotheliomas , and primary brain tumors. In 2-year inhalation studies with mice there was evidence of carcinogenic activity as indicated by dose-related incidences of benign or malignant neoplasms of the uterus, mammary gland, and hematopoietic system (lymphoma).

MUTAGENICITY: While Ethylene Oxide has demonstrated, in epidemiological studies with exposed workers, an increased incidence of chromosomal aberrations and sister chromatid exchanges, the relevance of such effects to human health hazard evaluation is currently uncertain. In rodent studies, dose related exposure to Ethylene Oxide induces increases in numbers of adducts in DNA and hemoglobin. Laboratory studies with mice have shown that acute exposure to Ethylene Oxide at 300 ppm and above caused testicular injury as evidenced by concentration-related increased embryonic deaths following mating of exposed males to non-exposed females (Dominant-Lethal Test).

NEUROTOXICITY: Effects are similar to those of acute (short term) exposure, namely headaches, nausea, diarrhea, lethargy, and irrational behavior. Muscle weakness, loss of sensation in the extremities and a reduction in the sense of smell and/or taste may also

result. Studies on workers Indicate that CNS and cognitive impairment may result from chronic exposures to Ethylene Oxide.

REPRODUCTIVE EFFECTS: Some limited epidemiological data suggests that women exposed to Ethylene Oxide have a greater incidence of miscarriages. A one-generation reproduction study in rats showed decreased number of pups at 100 ppm, but not at 33 ppm. In a two -generation reproduction study involving exposure of rats to Ethylene Oxide vapor for 5 hrs/day, 5 days/week, there was parental toxicity at 33 ppm and 100 ppm. The no-observable effect concentration for adult toxicity, offspring effect and reproductive effect was 10 ppm.

TERATOLOGY: Inhalation development toxicity studies with rats exposed to Ethylene Oxide vapor at concentrations of 50 ppm, 125 ppm and 225 ppm showed that maternal toxicity occurred at 125 and 225 ppm. Fetotoxicity, evidenced by reduced fetal body weight, occurred at all concentrations. At 225 ppm and to a lesser extent at 125 ppm an increased incidence of skeletal variants was found. There was no evidence of embryotoxicity or malformations.

TARGET ORGANS: Overexposure to this product may affect the skin, eyes, respiratory system, liver, kidneys, brain, blood, reproductive system, and central nervous system.

Section 12
Ecological Information

ECOTOXICOLOGICAL DATA: Ethylene Oxide hydrolyzes to ethylene glycol. Biodegradation of Ethylene Oxide occurs at a moderate rate after acclimation (3-5% degradation after 5 days; 52% after 20 days). Biodegradation is expected in a wastewater treatment plant. Ethylene Oxide has an estimated half-life in the atmosphere of 211 days. A high adsorptivity in soil is expected.

Section 13
Disposal Consideration

WASTE MANAGEMENT/DISPOSAL: Dispose ***used*** EOGas cartridges, sterilization liner bags, indicators and accessories as you would ordinary trash.

However, unused EOGas cartridges containing Ethylene Oxide are a RCRA hazardous waste with waste code U115 (Commercial chemical product - listed for toxicity and ignitability). Unused EOGas cartridges containing Ethylene Oxide may be incinerated in an approved hazardous waste incinerator or can be biologically treated in an approved facility. Unused EOGas cartridges containing Ethylene Oxide are banned from land disposal.

Dispose of waste materials in accordance with all applicable Federal, State, and local laws and regulations.

Section 14
Transport Information

TRANSPORTATION DATA:

DOT Proper shipping Name:	Ethylene Oxide
DOT Class or Division:	2.3 (Poison Gas)
Identification Number	UN 1040
Packing Group:	n/a
DOT Label:	"This package conforms to 49 CFR 173.4 for domestic highway or rail transport only."
DOT Packaging	See section 7, "Handling and storage"
DOT Approval:	CA-9803005

Section 15
Regulatory Information

U.S. REGULATIONS:

TSCA status: Listed
CERCLA Section 103 (40 CFR 302.4): Listed
10 lb. Reportable Quantity
SARA Section 304 (40 CFR 356.40): Listed
1 lb Reportable Quantity
SARA Section 311/312 (40 CFR 370.21) Hazard categories met:
Acute, Chronic, Fire, Reactive, Sudden Release
SARA Section 313 (40 CFR 372.65); Listed
OSHA (29 CFR 1910. 1200): Meets criteria as a hazardous material
OSHA (29 CFR 1910. 1047): Ethylene Oxide Standard
EPA list of Hazardous Air Contaminants: Listed
EPA Organic Hazardous Air Pollutant (HAP) list: Listed
EPA list of Pesticide Chemicals (40 CFR 180.151): Listed
EPA NESHAPS (40 CFR 63.360)
VOC Rule: 100% VOC

STATE RIGHT-TO-KNOW REGULATIONS:

California Proposition 65: Listed; cancer hazard; reproductive hazard
California Director's List: Listed
Florida Hazardous Substance List: Listed
Massachusetts Extraordinarily Hazardous Substance List: Listed
Minnesota Hazardous Substance List: Listed
New Jersey Hazardous Substance List: Listed on 0882 (Special Hazardous Substance: Environmental Hazardous Substance)
Pennsylvania Right-to-know List: Listed

Section 16
Other Information

GLOSSARY OF TERMS AND ABBREVIATIONS:

ACGIH - American Conference of Governmental Industrial Hygienists
CERCLA - Comprehensive Environmental Response, Compensation and Liability Act.
CAS - Chemical Abstract Service
CFR - Code of Federal Regulations
CNS - Central Nervous System
DOT - U.S. Department of Transportation
EPA - U. S. Environmental Protection Agency
HMIS - Hazardous Materials information Sheet
IARC - International Agency for Research on Cancer
IDL - ingredient Disclosure List
IDLH - Immediately dangerous to life and health
HAP - Hazardous Air Pollutant
LC_{50} - Median lethal dose that kills 50% of an exposed population by the inhalation route
LD_{50} - Median lethal dose that kills 50% of an exposed population by the oral (or dermal) route
NESHAPS - National Emission Standards for Hazardous Air Pollutants
NFPA - National Fire Protection Association
NIOSH - National Institute of Occupational Safety and Health
NTP - National Toxicology Program
OSHA - Occupational Safety and Health Administration
p/p - parts per part
PEL - Permissible exposure Limit
PVC - Polyvinyl chloride
ppm - Parts per million
p.s.i.g - Pounds per square inch (gauge pressure)
RCRA - Resource, Conservation and Recovery Act
SARA - Superfund Amendment and Reauthorization Act of 1990
STEL- Short-term exposure Limit
TDG -Transportation of Dangerous Goods
TLV - Threshold Limit Value
TSCA - Toxic Substance Control Act
TWA - Time Weighted Average
VOC - Volatile organic compound
WHMIS -Workplace Hazardous Material Information System

MSDS Revision Date: 01/01/10

Section 17
Disclaimer

It is imperative that the user/reader be familiar with and adhere to OSHA regulations which are specific to Ethylene Oxide (29CFR1910.1047) as well as any other applicable Federal, State, or local government regulations. Regulations listed in Section 14 of this document may not be all inclusive and are subject to change. The data in this MSDS is furnished gratuitously independent of any sale of the product only for your investigation and independent verification. While the information is believed to be correct, Andersen makes no representation as to the accuracy of the information contained herein. Andersen shall in no event be responsible for any damages of whatsoever nature directly or indirectly resulting from publication or use of, or negligence upon data contained herein. No Warranty (either expressed or implied) of merchantability or of fitness for any purpose with respect to the product or to the data herein is made hereunder.

Ethylene oxide

Safety Data Sheet P-4798

according to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

Date of issue: 01/01/1982 Revision date: 07/09/2015 Supersedes: 05/01/2015

SECTION: 1. Product and company identification

1.1. Product identifier

Name : Ethylene oxide

CAS No : 75-21-8

Other means of identification : Dihydrooxirine, dimethylene oxide, ethene oxide, epoxyethane, oxane, oxacyclopropane, oxidoethane, oxiran, oxirane, 1,2 epoxyethane

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113 - USA
T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week
— Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887
(collect calls accepted, Contract 17729)

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Flam. Gas 1	H220
Liquefied gas	H280
Acute Tox. 3 (Inhalation:gas)	H331
Skin Irrit. 2	H315
Eye Irrit. 2A	H319
Skin Sens. 1B	H317
Muta. 1B	H340
Carc. 1A	H350
Repr. 1A	H360
STOT SE 3	H335
STOT RE 1	H372

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :

GHS02 GHS04 GHS06 GHS07 GHS08

Signal word (GHS-US) : DANGER

Hazard statements (GHS-US) : H220 - EXTREMELY FLAMMABLE GAS
H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED
H315+H320 - CAUSES SKIN AND EYE IRRITATION
H317 - MAY CAUSE AN ALLERGIC SKIN REACTION
H331 - TOXIC IF INHALED
H335 - MAY CAUSE RESPIRATORY IRRITATION
H340 - MAY CAUSE GENETIC DEFECTS
H350 - MAY CAUSE CANCER
H360 - MAY DAMAGE FERTILITY OR THE UNBORN CHILD

H372 - CAUSES DAMAGE TO ORGANS (NERVOUS SYSTEM, KIDNEYS) THROUGH PROLONGED OR REPEATED EXPOSURE
CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR
CGA-HG11 - SYMPTOMS MAY BE DELAYED

Precautionary statements (GHS-US) : P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P210 - Keep away from Heat/Open flames/Sparks/Hot surfaces. - No smoking
P260 - Do not breathe gas
P262 - Do not get in eyes, on skin, or on clothing.
P271+P403 - Use and store only outdoors or in a well-ventilated place.
P280+P284 - Wear protective gloves, protective clothing, eye protection, respiratory protection, and/or face protection.
P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
P381 - Eliminate all ignition sources if safe to do so
P405 - Store locked up
P501 - Dispose of contents/container in accordance with container supplier/owner instructions.
CGA-PG05 - Use a back flow preventive device in the piping.
CGA-PG20+CGA-PG10 - Use only with equipment of compatible materials of construction and rated for cylinder pressure.
CGA-PG12 - Do not open valve until connected to equipment prepared for use.
CGA-PG06 - Close valve after each use and when empty.
CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F).

2.3. Other hazards

Other hazards not contributing to the classification : Asphyxiant in high concentrations.

2.4. Unknown acute toxicity (GHS-US)

No data available

SECTION 3: Composition/information on ingredients

3.1. Substance

Name	Product identifier	%
Ethylene oxide (Main constituent)	(CAS No) 75-21-8	100

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : **IMPORTANT** In all cases of exposure, get or summon medical treatment immediately. Take the victim to a doctor or medical facility at once.

First-aid measures after inhalation : Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

First-aid measures after skin contact : In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash with plenty of soap and water.

The liquid may cause frostbite. For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). Water temperature should be tolerable to normal skin. Maintain skin warming for at least 15 minutes or until normal coloring and sensation have returned to the affected area. In case of massive exposure, remove clothing while showering with warm water. Seek medical evaluation and treatment as soon as possible.

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First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

First-aid measures after ingestion : Not expected to be a primary route of exposure. . Give water to drink if victim completely conscious/alert. Do not induce vomiting. Call a physician. Never give anything by mouth to an unconscious person.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

No additional information available

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Carbon dioxide, Dry chemical, Water spray or fog.

5.2. Special hazards arising from the substance or mixture

Fire hazard : EXTREMELY FLAMMABLE GAS.

Explosion hazard : EXTREMELY FLAMMABLE GAS. Forms explosive mixtures with air and oxidizing agents.

Reactivity : Exothermic polymerization is possible (see incompaitible materials).

5.3. Advice for firefighters

Firefighting instructions : **DANGER! Cancer and reproductive hazard.**

DANGER! Toxic, flammable liquefied gas

FORMS EXPLOSIVE MIXTURES WITH AIR

Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.

Other information : Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : **DANGER! Cancer and reproductive hazard.** . **DANGER! Toxic, flammable liquefied gas** . FORMS EXPLOSIVE MIXTURES WITH AIR. If involved in a fire, this product may emit irritating and potentially toxic fumes. Fumes and vapors may spread from leak. Vapors are heavier than air and may collect in low spots. Evacuate personnel to a safe area. Appropriate self-contained breathing apparatus may be required. Approach suspected leak area with caution. Remove all sources of ignition. if safe to do so. Reverse flow into cylinder may cause rupture. Reduce gas with fog or fine water spray. Stop flow of product if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable gas may spread from leak. Before entering the area, especially a confined area, check the atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release. Reduce vapor with fog or fine water spray. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Prevent product contamination

Water or organic contamination may cause a violent reaction.

Do not breathe gas/vapor. Avoid all contact with skin, eyes, or clothing. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment.

Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Because of the potential for violent decomposition, containers of ethylene oxide must be properly blanketed with an inert gas and given extraordinary protection against fire exposure.

Store only where temperature will not exceed 125°F (52°C). Post “No Smoking or Open Flames” signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g., NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16.

All equipment in storage areas must be explosion-proof. Electric installation in storage areas must meet the requirements of National Electric Code (NEC) Article 500. This material is a static accumulator. To avoid ignition of vapors by static discharge, all metal parts and equipment must be grounded. Follow NFPA 77, Recommended Practice on Static Electricity (www.nfpa.org), and API Recommended Practice 2003, Protection Against Ignitions Arising Out of Static, Lightning, and Stray Currents.

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls	:	Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): **Inadequate - Use only in a closed system.** Use explosion proof equipment and lighting.
Hand protection	:	Butyl rubber (IIR) /.
Eye protection	:	Select eye protection in accordance with OSHA 29 CFR 1910.133. Safety glasses with face shield. Contact lenses should not be worn.
Skin and body protection	:	Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138. Rubber shoes and apron where risk of liquid spill exists. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. .
Respiratory protection	:	When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).
Thermal hazard protection	:	Wear cold insulating gloves when transfilling or breaking transfer connections.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state	:	Gas
Color	:	Colorless
Odor	:	ether-like
Odor threshold	:	420 - 490 ppm
pH	:	Not applicable.
Relative evaporation rate (butyl acetate=1)	:	No data available
Relative evaporation rate (ether=1)	:	Not applicable.
Melting point	:	No data available
Freezing point	:	No data available
Boiling point	:	10.5 °C (51.26 °F)
Flash point	:	-20 °C (-67 °F)
Critical temperature	:	195.8 °C
Auto-ignition temperature	:	429 °C (804 °F)
Decomposition temperature	:	No data available
Flammability (solid, gas)	:	3 - 100 vol %
Vapor pressure	:	1.5 bar (22 psia) (at 20°C (68°F))
Relative vapor density at 20 °C	:	No data available
Relative density	:	0.87 (Water = 1) (at 4°C (39.2°F))
Density	:	1.824 kg/m³ (0.1139 lb/ft3) (at 21.1 °C (70 °F))
Relative gas density	:	1.52 (Air = 1) (at 21.1 °C (70 °F))
Solubility	:	Water: No data available
Log Pow	:	Not applicable.
Log Kow	:	Not applicable.
Viscosity, kinematic	:	Not applicable.
Viscosity, dynamic	:	Not applicable.
Explosive properties	:	Forms explosive mixtures with air and oxidizing agents.
Oxidizing properties	:	None.

Explosion limits : No data available

9.2. Other information

No additional information available

SECTION 10: Stability and reactivity

10.1. Reactivity

Exothermic polymerization is possible (see incompaitible materials).

10.2. Chemical stability

Stable under normal conditions.

10.3. Possibility of hazardous reactions

May occur.

10.4. Conditions to avoid

Contamination, especially by incompatible materials (see 10.5). Heat. Sparks. Ignition sources.

Pure ethylene oxide decomposes violently if exposed to a high enough temperature. The temperature required for decomposition can vary depending on time, pressure, and conditions within the system and is reduced as pressure and volume-to-surface ratios are increased. Decomposition temperatures ranging from 842ºF-1040ºF (450ºC-560ºC) have been observed in experimental apparatus.

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10.5. Incompatible materials

Oxidizing agents. Mercaptans. Alcohols. Alkali metals, Alkaline earth metals, Acetylide forming metals, Chromium, Titanium > 1022°F (550°C), Uranium (U) > 1382°F (750°C), Magnesium > 1427°F (775°C). . **Will polymerize violently if contaminated with:**. Amines. alkalis. Acids. Mineral acids. Metal chlorides. Metal oxides. Water. Organic materials.

10.6. Hazardous decomposition products

Carbon dioxide. Carbon monoxide.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: TOXIC IF INHALED.

Ethylene oxide (\f)75-21-8	
LC50 inhalation rat (ppm)	2920 ppm/1h
ATE US (gases)	1460.000 ppmV/4h

Skin corrosion/irritation : CAUSES SKIN IRRITATION.

pH: Not applicable.

Serious eye damage/irritation : CAUSES SERIOUS EYE IRRITATION.

pH: Not applicable.

Respiratory or skin sensitization : MAY CAUSE AN ALLERGIC SKIN REACTION.

Germ cell mutagenicity : MAY CAUSE GENETIC DEFECTS.

Carcinogenicity : MAY CAUSE CANCER.

Ethylene oxide (75-21-8)	
IARC group	1 - Carcinogenic to humans
National Toxicology Program (NTP) Status	2 - Known Human Carcinogens

Reproductive toxicity : MAY DAMAGE FERTILITY OR THE UNBORN CHILD.

Specific target organ toxicity (single exposure) : MAY CAUSE RESPIRATORY IRRITATION.

Specific target organ toxicity (repeated exposure) : CAUSES DAMAGE TO ORGANS (NERVOUS SYSTEM, KIDNEYS) THROUGH PROLONGED OR REPEATED EXPOSURE.

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

Ethylene oxide (75-21-8)	
Persistence and degradability	No ecological damage caused by this product.

12.3. Bioaccumulative potential

Ethylene oxide (75-21-8)	
Log Pow	Not applicable.
Log Kow	Not applicable.
Bioaccumulative potential	No ecological damage caused by this product.

12.4. Mobility in soil

Ethylene oxide (75-21-8)	
Mobility in soil	No data available.

12.5. Other adverse effects

Effect on ozone layer : None.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

Additional information : This chemical is a pesticide product registered by the United States Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.

STORAGE AND DISPOSAL:
Do not contaminate water, food, or feed by storage and disposal.
Pesticide Storage: Cylinders should be stored in a well ventilated area.
Pesticide Disposal: Return cylinder with residual product to supplier.
Container Handling: Do not reuse this container for any other purpose. Do not refill this cylinder; return to supplier.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN1040 Ethylene oxide (up to a total pressure of 1MPa (10 bar) at 50 degrees C), 2.3

UN-No.(DOT) : UN1040

Proper Shipping Name (DOT) : Ethylene oxide
up to a total pressure of 1MPa (10 bar) at 50 degrees C

Transport hazard class(es) (DOT) : 2.3 - Class 2.3 - Poisonous gas 49 CFR 173.115

Hazard labels (DOT) : Poison Gas
2.3 - Poison gas
2.1 - Flammable gas

DOT Special Provisions (49 CFR 172.102)	:	4 - This material is poisonous by inhalation (see 171.8 of this subchapter) in Hazard Zone D (see 173.116(a) of this subchapter), and must be described as an inhalation hazard under the provisions of this subchapter. 342 - Glass inner packaging (such as ampoules or capsules) intended only for use in sterilization devices, when containing less than 30 mL of ethylene oxide per inner packaging with not more than 300 mL per outer packaging, may be transported in accordance with §173.4a of this subchapter, irrespective of the restriction of §173.4a(b) provided that: a. After filling, each glass inner packaging must be determined to be leak-tight by placing the glass inner packaging in a hot water bath at a temperature and for a period of time sufficient to ensure that an internal pressure equal to the vapor pressure of ethylene oxide at 55 °C is achieved. Any glass inner packaging showing evidence of leakage, distortion or other defect under this test must not be transported under the terms of this special provision;b. In addition to the packaging required in §173.4a, each glass inner packaging must be placed in a sealed plastic bag compatible with ethylene oxide and capable of containing the contents in the event of breakage or leakage of the glass inner packaging; andc. Each glass inner packaging is protected by a means of preventing puncture of the plastic bag (e.g., sleeves or cushioning) in the event of damage to the packaging (e.g., by crushing). T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter. TP20 - This hazardous material must only be transported in insulated tanks under a nitrogen blanket.

Additional information

Other information	:	No supplementary information available.
Special transport precautions	:	Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG)	:	1040
Proper Shipping Name (IMDG)	:	ETHYLENE OXIDE
Class (IMDG)	:	2 - Gases

Air transport

UN-No. (IATA)	:	1040
Proper Shipping Name (IATA)	:	Ethylene oxide
Class (IATA)	:	2

SECTION 15: Regulatory information

15.1. US Federal regulations

Ethylene oxide (75-21-8)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Subject to reporting requirements of United States SARA Section 313	
RQ (Reportable quantity, section 304 of EPA's List of Lists)	10 lb
SARA Section 302 Threshold Planning Quantity (TPQ)	1000 lb
SARA Section 311/312 Hazard Classes	Delayed (chronic) health hazard Fire hazard Immediate (acute) health hazard Reactive hazard Sudden release of pressure hazard

15.2. International regulations

CANADA

EU-Regulations

15.2.2. National regulations

Ethylene oxide (75-21-8)
Listed on IARC (International Agency for Research on Cancer) Listed as carcinogen on NTP (National Toxicology Program)

15.3. US State regulations

Ethylene oxide(75-21-8)	
U.S. - California - Proposition 65 - Carcinogens List	Yes
U.S. - California - Proposition 65 - Developmental Toxicity	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Female	Yes
U.S. - California - Proposition 65 - Reproductive Toxicity - Male	Yes
No significant risk level (NSRL)	20
State or local regulations	U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List

SECTION 16: Other information

Revision date : 7/9/2015 12:00:00 AM

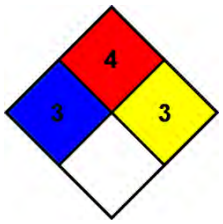
Other information : When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product.

Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc., P.O. Box 44, Tonawanda, NY 14151-0044).

NFPA health hazard	:	3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.
NFPA fire hazard	:	4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
NFPA reactivity	:	3 - Capable of detonation or explosive reaction, but requires a strong initiating source or must be heated under confinement before initiation, or reacts explosively with water.



HMIS III Rating

Health	:	1 Slight Hazard - Irritation or minor reversible injury possible
Flammability	:	4 Severe Hazard
Physical	:	3 Serious Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.