June 3, 1994

MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PENNGAS® - 2
(Ethylene Oxide Sterilant Mixture)

Pennsylvania Engineering Co.
1107-21 N. Howard Street
Philadelphia, PA 19123

Emergency Phone: 1-800-424-9300 (CHEMTREC)
(24 hours, toll free)

Phone Number for
Additional
Information: (215) 627-3636
(Monday-Friday 9:00 a.m. - 5:00 p.m. EST)

Date: 6/1/94

2. COMPOSITION INFORMATION ON INGREDIENTS

(% CHEMICAL COMPONENTS BY WEIGHT)

Ingredient / CAS Number	Concentration
Ethylene Oxide (75-21-8)	10%
Hydrochlorofluorocarbons (Trade Secret)	90%

(See Section 8 for Exposure Guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Sweet smelling clear compressed gas. High concentrations in immediate area can reduce oxygen and result in dizziness, unconsciousness, and death due to asphyxiation. Acute effects from inhalation of ethylene oxide vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis (blue or purple coloring of skin). Exposure to ethylene oxide is also suspected to be associated with the occurrence of cancer, reproductive effects, neurotoxicity, and sensitization. Eye exposure to liquid can cause eye irritation and injury to the cornea, and frostbite. Skin contact can result in frostbite, severe irritation, and blistering of the skin upon prolonged or continued contact. Can decompose at high temperatures, yielding toxic gases.

POTENTIAL HEALTH EFFECTS:

EYE: Mixture can cause eye irritation and injury to the cornea.

SKIN: Although exposure in liquid from is unlikely to its low boiling point, exposure in liquid from can cause frostbite and sever irritation and blistering of the skin upon prolonged or continued contact.

INGESTION: Ingestion is an unlikely route of exposure due to its low boiling point. See section 11, toxicological information, for additional information.

INHALATION: Hydrochlorofluorocarbons are low in inhalation toxicity in concentrations as high as 4% (40,000 ppm). Acute effects from inhalation of ethylene oxide vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis (blue or purple coloring of skin). Exposure to ethylene oxide is suspected to be associated with the occurrence of cancer, reproductive effects, neurotoxicity, and sensitization.

SIGNS AND SYMPTOMS OF EXPOSURE: The early effects of acute overexposure to ethylene oxide are nausea and vomiting, headache, and irritation of the eyes and respiratory

passages. The patient may notice a "peculiar taste" in the mouth. Delayed effects can include pulmonary edema, drowsiness, weakness, and incoordination. When oxygen levels in air are reduced, symptoms of asphyxiation will occur: loss of coordination,increased pulse rate, and deeper respiration. Studies suggest that blood cell changes, and increase in chromosomal aberrations, and spontaneous abortion may also be casually related to acute overexposure to ethylene oxide. Skin contact with liquid or gaseous ethylene oxide causes characteristic burns and possibly even all allergic-type sensitization. Contact with the mixture may cause frostbite because of rapid evaporation. Mixture can cause eye irritation and injury to the cornea. Animal studies suggest that high hydrochlorofluorocarbon concentrations may reduce heart efficiency and may cause cardiac sensitization to epinephrine.

CHRONIC EFFECTS / CARCINOGENICITY: Ethylene oxide is listed by IARC as a known human carcinogen (Group 1). Exposure to ethylene oxide is also suspected to be associated with the occurrence of reproductive effects, neurotoxicity, and sensitization.

FOR A COMPLETE DISCUSSION OF THE TOXICITY OF THIS PRODUCT, PLEASE REFER TO SECTION 11.

4. FIRST AID MEASURES

EYE: Wash eyes immediately with large amounts of water, lifting the lower and upper eyelids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

SKIN: Wash the contaminated skin with water. If the mixture soaks through clothing, especially shoes, remove the clothing and shoes immediately and wash the skin with water using an emergency deluge shower. Get medical attention immediately. Thoroughly wash contaminated clothing before reusing. Immediately bathe (do not rub) any frostbite with lukewarm (not hot) water. In the absence of water, cover with soft wool or other suitable material. Contact a physician for any low temperature burns from liquid contact.

INGESTION: Although unlikely to be ingested due to its low boiling point, if ingested, give the person, if conscious, large quantities of water immediately. Do not make an unconscious person vomit. Get medical attention immediately.

INHALATION: If overcome, move the exposed person to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Keep the affected person warm and at rest. Get medical attention immediately.

NOTE TO PHYSICIAN: Do not give epinephrine (adrenaline).

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: Penngas® - 2 is approved by the U.S. Dept. of Transportation as a green label, non-flammable, non-explosive, non-poisonous formula.

FLASH POINT: Not applicable.
FLASH POINT METHOD: Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
UPPER FLAME LIMIT (Volume % in air): 23.5% (E-681 Spark Ignition)
22.0% (E-681 Fused Wire Ignition)
LOWER FLAME LIMIT (Volume % in air): 22.7% (E-681 Spark Ignition)
20/5% (E-681 Fused Wire Ignition)
FLAME PROPAGATION RATE (Solids): Not applicable.
OSHA FLAMMABILITY CLASS: Not flammable.

EXTINGUISHING MEDIA:

- Use media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Container may rupture due to heat of fire. No part of a container should be subjected to a temperature higher than 52°C (approximately 125°F). Containers are designed to vent contents when they are exposed to elevated temperatures. Avoid exposing stored Penngas®-2T. Sterilant Mixture to heat or sources of ignition.

SPECIAL FIREFIGHTING PRECAUTIONS / INSTRUCTIONS: Evacuate all personnel from danger area. Immediately cool containers with water spray from maximum distance until cool. Use self-contained breathing apparatus operated in the pressure demand mode and appropriate protective clothing. Stop flow of gas if without risk, while continuing cooling water spray. Remove all containers from area of fire without risk.

6. ACCIDENTAL RELEASE MEASURES

Product is a compressed gas. The area should be evacuated at once and re-entered only after the area has been thoroughly ventilated. Persons not wearing appropriate protective equipment should be restricted from areas of spills or leaks until thoroughly ventilated.

7. HANDLING AND STORAGE

Store cylinders in a cool, well-ventilated area, away from heat. Do not store over 140°F. (Longer shelf life if stored under 100°F). Store cylinders upright in a rack or wall to prevent tipping. Cylinders should not be subjected to rough handling or mechanical shock such as dripping, bumping, dragging, or sliding. Do not use rope slings, hooks, tongs, or similar devices to unload cylinders. Transport cylinders using hand truck, fork truck, or other devices to which the cylinder can be firmly secured.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

RESPIRATORY PROTECTION: Respirators should be selected in conformance with 29 C.F.R. § 1910.1047 (g). If air-purifying respirators are worn, they must be approved by the National Institute for Occupational Safety and Health (NIOSH) for use with ethylene oxide. For effective protection, respirators must fit the face and head snugly. Respirators should not be loosened for removed in work situations where their use is required. Ethylene oxide does not have a detectable odor except at levels well above the permissible exposure limit; above approximately 700 ppm. If ethylene oxide can be smelled while wearing a respirator, proceed immediately to fresh air. If breathing becomes difficult while wearing a respirator, inform your employer.

SKIN PROTECTION: Impermeable clothing, gloves, a face shield, or other appropriate protective clothing should be worn to prevent skin contact. Clean garments should be provided as necessary to assure that the clothing provides adequate protection. Replace or repair protective clothing that has become torn or otherwise damaged. Liquid mixture should never be allowed to remain on the skin. Clothing and shoes which are not impermeable to the mixture should not be allowed to become contaminated. If contamination occurs, clothing should be promptly removed and decontaminated. Contaminated leather shoes should be discarded. Once the mixture penetrates shoes or other leather articles, they should not be worn again.

EYE PROTECTION: Safety goggles must be worn in areas where mixture may contact eyes. In addition, contact lenses should not be worn in areas where eye contact with mixture can occur.

EXPOSURE GUIDELINE(S):

Ingredient / CAS Number	Exposure Limits	Concentration
Ethylene Oxide (75-21-8)	OSHA: PEL 1 ppm (v/v) (8-hour TWA) Excursion Limit: 5 ppm (v/v) (15 minute) ACGIH: TLV: 1 ppm (v/v) 8-hour TWA)	10%
Hydrochlorofluorocarbons (Trade Secret)	OSHA: N.E. ACGIH: N.E.	90%

N.E. = not established for the hydrochlorofluorocarbon mixture. Both of the hydrochlorofluorocarbons has an OSHA PEL and an ACGIH, or a PAFT TLV of 1000 ppm.

ENGINEERING CONTROLS: General and local ventilation systems should be used to maintain airborne levels of ethylene oxide below applicable exposure limits. Eyewash stations, emergency deluge showers and washing facilities should be available in all areas where ethylene oxide is used or handled. Do not eat, drink, or smoke in any work area. See 29 C.F.R. § 1910.1047 for additional information concerning the use of ethylene oxide in hospitals and health care facilities.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Colorless compressed gas
ODOR:	Slight ethereal
BOILING POINT:	-15.9°F
VAPOR PRESSURE:	61 psig at 70°F
VAPOR DENSITY: (air =1)	3.5
SOLUBILITY IN WATER:	Ethylene Oxide: Complete. Hydroclorofluorocarbons: Slight
SPECIFIC GRAVITY:	1.28

FREEZING POINT:	N/A
pH:	no pH
% VOLATILE:	100%

10. STABILITY AND REACTIVITY

STABILITY: (CONDITIONS TO AVOID) Ethylene oxide will polymerize violently if contaminated with aqueous alkalies, amines, mineral acids, metal chlorides, or metal oxides. Ethylene oxide will violently decompose at temperatures above 800°F. Hydrochlorofluorocarbons may decompose at very high temperatures, yielding toxic gases.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Ethylene oxide reacts with active catalysts which can promote explosive, exothermic polymerization. Such substances include potassium; anhydrous chlorides of tin, aluminum, and iron; alcohols; mercaptans; copper; pure oxides of iron or aluminum; magnesium perchlorate; and acids and bases such as sodium and potassium hydroxide. Hydrochloroflourocarbons are incompatible with strong oxidants, and chemically active metals such as alkali metals, alkaline earth metals, powered aluminum, magnesium and zinc (may cause exothermic reaction).

HAZARDOUS DECOMPOSITION PRODUCTS:
Ethylene oxide: Carbon monoxide and carbon dioxide.
Hydrochlorofluorocarbons: Halogens, halogen acids, carbon dioxide, carbon monoxide, and possibly carbonyl halides such as phosgene.

HAZARDOUS POLYMERIZATION: May occur.

11. TOXICOLOGICAL INFORMATION:

INGESTION: Ingestion is an unlikely route of exposure due to its low boiling point. Should ingestion occur, discomfort in the gastrointenstinal tract would result from the rapid evaporation of the liquid. Frostbite could also occur. Ingestion of ethylene oxide can cause anemia, gastrointestinal irritation, and liver, kidney, and adrenal gland effects.

SKIN AND EYE: Mixture can cause eye irritation and injury to the cornea, frostbite, sever irritation, and blistering of the skin upon prolonged or confined contact.

CHRONIC EFFECTS / CARCINOGENICITY: Ethylene oxide has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Adverse reproductive effects and chromosome damage may also occur from ethylene oxide exposure. Exposure to ethylene oxide in studies is associated with an increased incidence of cancer in laboratory animals (leukemia, stomach, brain), mutation in offspring in animals, and resorptions and spontaneous abortions in animals and human populations, respectively. Findings in humans and experimental animals exposed to airborne concentrations of ethylene oxide also indicate damage to the genetic material (DNA). These include hemoglobin alkylation, unscheduled DNA synthesis, sister chromatid exchange chromosomal aberration, and functional sperm abnormalities.

Ethylene oxide is listed as a cancer/reproductive hazard under OSHA; a suspected human carcinogen by ACGIH.; an anticipated human carcinogen by NTP; and a known human carcinogen (Group 1) by IARC.

Hydrocholorfluorocarbons are low in inhalation toxicity in animals at concentrations of up to 4% (40,000 ppm); however, when oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur. Many chlorofluorocarbon and hydrochlorofluorocarbon gases have been demonstrated to induce cardiac sensitization to epinephrine. A two-year inhalation study of one of the hydrochlorofluorocarbons indicated a slight increase in salivary gland tumors (rat) at the highest level of exposure tested (50,000 ppm). There was no observable results in rats at exposure levels of 1000 ppm and 10,000 ppm, and none in mice at any dose level.

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: N/A

DISTRIBUTION: N/A

CHEMICAL FATE INFORMATION: No appreciable bioconcentration is expected in the environment.

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food or feed by storage or disposal.

Pesticide Disposal: Waste should not be discarded or released to the environment, but returned in cylinders with valves closed and plugs inserted.

Container Disposal: Return empty cylinders for reuse with valves closed and plugs inserted.

Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representatives of the nearest EPA Regional Office for guidance.

14. TRANSPORT INFORMATION

Either of the following shipping descriptions may be used:

Liquefied gases, n.o.s. (ethylene oxide, chlorofluorohydrocarbon gases)
2.2 UN 1956

Liquefied gases, n.o.s. (ethylene oxide, chlorofluorohydrocarbon gases),
2.2 UN3163

15. REGULATORY INFORMATION

OSHA: OSHA CHEMICAL SPECIFIC STANDARD FOR ETHYLENE OXIDE, 29 C.F.R. § 1910.1047.
Ethylene oxide is a highly hazardous chemical for the purposes of process safety management under 29 C.F.R. § 1910.119.

CERCLA, SUPERFUND, 40 C.F.R. § § 117, 302: Releases of ethylene oxide are reportable under Section 103 of CERCLA. 40 C.R.F. § 302. The reportable quantity (RQ) is 10 pounds (4.54 kg). The threshold planning quantity is 1,000 pounds. 40 C.F.R. § 355.

SARA § 311/312 HAZARD CATEGORY:

1) Sudden release of pressure.
2) Toxicity: Immediate (Acute)
   Delayed (Chronic)

SARA § 313 INFORMATION: Ethylene oxide is subject to the requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 C.F.R. Part 372.

TOXIC SUBSTANCES CONTROL ACT (TSCA): The ingredients of this product are all included on the TSCA Inventory.

CALIFORNIA PREPOSITION 65: Ethylene oxide is a chemical known to cause cancer and female reproductive toxicity for the purposes of California Proposition 65.^N.

June 3, 1994

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Date: 6/1/94

2. COMPOSITION INFORMATION ON INGREDIENTS

(% CHEMICAL COMPONENTS BY WEIGHT)

Ingredient / CAS Number	Concentration
Ethylene Oxide (75-21-8)	10%
Hydrochlorofluorocarbons (Trade Secret)	90%

(See Section 8 for Exposure Guidelines)

3. HAZARDS IDENTIFICATION

EMERGENCY OVERVIEW

Sweet smelling clear compressed gas. High concentrations in immediate area can reduce oxygen and result in dizziness, unconsciousness, and-death due to asphyxiation. Acute effects from inhalation of ethylene oxide vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis (blue or purple coloring of skin). Exposure to ethylene oxide is also suspected to be associated with the occurrence of cancer, reproductive effects, neurotoxicity, and sensitization. Eye exposure to liquid can cause eye irritation and injury to the cornea, and frostbite. Skin contact can result in frostbite, severe irritation, and blistering of the skin upon prolonged or continued contact. Can decompose at high temperatures, yielding toxic gases.

POTENTIAL HEALTH EFFECTS:

EYE: Mixture can cause eye irritation and injury to the cornea.

SKIN: Although exposure in liquid from is unlikely to its low boiling point, exposure in liquid from can cause frostbite and sever irritation and blistering of the skin upon prolonged or continued contact.

INGESTION: Ingestion is an unlikely route of exposure due to its low boiling point. See section 11, toxicological information, for additional information.

INHALATION: Hydrochlorofluorocarbons are low in inhalation toxicity in concentrations as high as 4% (40,000 ppm). Acute effects from inhalation of ethylene oxide vapors include respiratory irritation and lung injury, headache, nausea, vomiting, diarrhea, shortness of breath, and cyanosis (blue or purple coloring of skin). Exposure to ethylene oxide is suspected to be associated with the occurrence of cancer, reproductive effects, neurotoxicity, and sensitization.

SIGNS AND SYMPTOMS OF EXPOSURE: The early effects of acute overexposure to ethylene oxide are nausea and vomiting, headache, and irritation of the eyes and respiratory

passages. The patient may notice a "peculiar taste" in the mouth. Delayed effects can include pulmonary edema, drowsiness, weakness, and incoordination. When oxygen levels in air are reduced, symptoms of asphyxiation will occur: loss of coordination,increased pulse rate, and deeper respiration. Studies suggest that blood cell changes, and increase in chromosomal aberrations, and spontaneous abortion may also be casually related to acute overexposure to ethylene oxide. Skin contact with liquid or gaseous ethylene oxide causes characteristic burns and possibly even all allergic-type sensitization. Contact with the mixture may cause frostbite because of rapid evaporation. Mixture can cause eye irritation and injury to the cornea. Animal studies suggest that high hydrochlorofluorocarbon concentrations may reduce heart efficiency and may cause cardiac sensitization to epinephrine.

CHRONIC EFFECTS / CARCINOGENICITY: Ethylene oxide is listed by IARC as a known human carcinogen (Group 1). Exposure to ethylene oxide is also suspected to be associated with the occurrence of reproductive effects, neurotoxicity, and sensitization.

FOR A COMPLETE DISCUSSION OF THE TOXICITY OF THIS PRODUCT, PLEASE REFER TO SECTION 11.

4. FIRST AID MEASURES

EYE: Wash eyes immediately with large amounts of water, lifting the lower and upper eyelids. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

SKIN: Wash the contaminated skin with water. If the mixture soaks through clothing, especially shoes, remove the clothing and shoes immediately and wash the skin with water using an emergency deluge shower. Get medical attention immediately. Thoroughly wash contaminated clothing before reusing. Immediately bathe (do not rub) any frostbite with lukewarm (not hot) water. In the absence of water, cover with soft wool or other suitable material. Contact a physician for any low temperature burns from liquid contact.

INGESTION: Although unlikely to be ingested due to its low boiling point, if ingested, give the person, if conscious, large quantities of water immediately. Do not make an unconscious person vomit. Get medical attention immediately.

INHALATION: If overcome, move the exposed person to fresh air at once. If breathing has stopped, perform cardiopulmonary resuscitation. Keep the affected person warm and at rest. Get medical attention immediately.

NOTE TO PHYSICIAN: Do not give epinephrine (adrenaline).

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES: Penngas® - 2 is approved by the U.S. Dept. of Transportation as a green label, non-flammable, non-explosive, non-poisonous formula.

FLASH POINT: Not applicable.
FLASH POINT METHOD: Not applicable.
AUTOIGNITION TEMPERATURE: Not applicable.
UPPER FLAME LIMIT (Volume % in air): 23.5% (E-681 Spark Ignition)
22.0% (E-681 Fused Wire Ignition)
LOWER FLAME LIMIT (Volume % in air): 22.7% (E-681 Spark Ignition)
20/5% (E-681 Fused Wire Ignition)
FLAME PROPAGATION RATE (Solids): Not applicable.
OSHA FLAMMABILITY CLASS: Not flammable.

EXTINGUISHING MEDIA:
Use media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Container may rupture due to heat of fire. No part of a container should be subjected to a temperature higher than 52°C (approximately 125°F). Containers are designed to vent contents when they are exposed to elevated temperatures. Avoid exposing stored Penngas®-2™ Sterilant Mixture to heat or sources of ignition.

SPECIAL FIREFIGHTING PRECAUTIONS / INSTRUCTIONS: Evacuate all personnel from danger area. Immediately cool containers with water spray from maximum distance until cool. Use self-contained breathing apparatus operated in the pressure demand mode and appropriate protective clothing. Stop flow of gas if without risk, while continuing cooling water spray. Remove all containers from area of fire without risk.

6. ACCIDENTAL RELEASE MEASURES

Product is a compressed gas. The area should be evacuated at once and re-entered only after the area has been thoroughly ventilated. Persons not wearing appropriate protective equipment should be restricted from areas of spills or leaks until thoroughly ventilated.

7. HANDLING AND STORAGE

Store cylinders in a cool, well-ventilated area, away from heat. Do not store over 140°F. (Longer shelf life if stored under 100°F). Store cylinders upright in a rack or wall to prevent tipping. Cylinders should not be subjected to rough handling or mechanical shock such as dripping, bumping, dragging, or sliding. Do not use rope slings, hooks, tongs, or similar devices to unload cylinders. Transport cylinders using hand truck, fork truck, or other devices to which the cylinder can be firmly secured.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

RESPIRATORY PROTECTION: Respirators should be selected in conformance with 29 C.F.R. § 1910.1047 (g). If air-purifying respirators are worn, they must be approved by the National Institute for Occupational Safety and Health (NIOSH) for use with ethylene oxide. For effective protection, respirators must fit the face and head snugly. Respirators should not be loosened for removed in work situations where their use is required. Ethylene oxide does not have a detectable odor except at levels well above the permissible exposure limit; above approximately 700 ppm. If ethylene oxide can be smelled while wearing a respirator, proceed immediately to fresh air. If breathing becomes difficult while wearing a respirator, inform your employer.

SKIN PROTECTION: Impermeable clothing, gloves, a face shield, or other appropriate protective clothing should be worn to prevent skin contact. Clean garments should be provided as necessary to assure that the clothing provides adequate protection. Replace or repair protective clothing that has become torn or otherwise damaged. Liquid mixture should never be allowed to remain on the skin. Clothing and shoes which are not impermeable to the mixture should not be allowed to become contaminated. If contamination occurs, clothing should be promptly removed and decontaminated. Contaminated leather shoes should be discarded. Once the mixture penetrates shoes or other leather articles, they should not be worn again.

EYE PROTECTION: Safety goggles must be worn in areas where mixture may contact eyes. In addition, contact lenses should not be worn in areas where eye contact with mixture can occur.

EXPOSURE GUIDELINE(S):

Ingredient / CAS Number	Exposure Limits	Concentration
Ethylene Oxide (75-21-8)	OSHA: PEL 1 ppm (v/v) (8-hour TWA) Excursion Limit: 5 ppm (v/v) (15 minute) ACGIH: TLV: 1 ppm (v/v) 8-hour TWA)	10%
Hydrochlorofluorocarbons (Trade Secret)	OSHA: N.E. ACGIH: N.E.	90%

N.E. = not established for the hydrochlorofluorocarbon mixture. Both of the hydrochlorofluorocarbons has an OSHA PEL and an ACGIH, or a PAFT TLV of 1000 ppm.

ENGINEERING CONTROLS: General and local ventilation systems should be used to maintain airborne levels of ethylene oxide below applicable exposure limits. Eyewash stations, emergency deluge showers and washing facilities should be available in all areas where ethylene oxide is used or handled. Do not eat, drink, or smoke in any work area. See 29 C.F.R. § 1910.1047 for additional information concerning the use of ethylene oxide in hospitals and health care facilities.

9. PHYSICAL AND CHEMICAL PROPERTIES

APPEARANCE:	Colorless compressed gas
ODOR:	Slight ethereal
BOILING POINT:	-15.9°F
VAPOR PRESSURE:	61 psig at 70°F
VAPOR DENSITY: (air = 1)	3.5
SOLUBILITY IN WATER:	Ethylene Oxide: Complete. Hydroclorofluorocarbons: Slight
SPECIFIC GRAVITY:	1.28

FREEZING POINT:	N/A
pH:	no pH
% VOLATILE:	100%

10. STABILITY AND REACTIVITY

STABILITY: (CONDITIONS TO AVOID) Ethylene oxide will polymerize violently if contaminated with aqueous alkalies, amines, mineral acids, metal chlorides, or metal oxides. Ethylene oxide will violently decompose at temperatures above 800°F. Hydrochlorofluorocarbons may decompose at very high temperatures, yielding toxic gases.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Ethylene oxide reacts with active catalysts which can promote explosive, exothermic polymerization. Such substances include potassium; anhydrous chlorides of tin, aluminum, and iron; alcohols; mercaptans; copper; pure oxides of iron or aluminum; magnesium perchlorate; and acids and bases such as sodium and potassium hydroxide. Hydrochloroflourocarbons are incompatible with strong oxidants, and chemically active metals such as alkali metals, alkaline earth metals, powered aluminum, magnesium and zinc (may cause exothermic reaction).

HAZARDOUS DECOMPOSITION PRODUCTS:
Ethylene oxide: Carbon monoxide and carbon dioxide.
Hydrochlorofluorocarbons: Halogens, halogen acids, carbon dioxide, carbon monoxide, and possibly carbonyl halides such as phosgene.

HAZARDOUS POLYMERIZATION: May occur.

11. TOXICOLOGICAL INFORMATION:

INGESTION: Ingestion is an unlikely route of exposure due to its low boiling point. Should ingestion occur, discomfort in the gastrointenstinal tract would result from the rapid evaporation of the liquid. Frostbite could also occur. Ingestion of ethylene oxide can cause anemia, gastrointestinal irritation, and liver, kidney, and adrenal gland effects.

SKIN AND EYE: Mixture can cause eye irritation and injury to the cornea, frostbite, sever irritation, and blistering of the skin upon prolonged or confined contact.

CHRONIC EFFECTS / CARCINOGENICITY: Ethylene oxide has been shown to cause cancer in laboratory animals and has been associated with higher incidences of cancer in humans. Adverse reproductive effects and chromosome damage may also occur from ethylene oxide exposure. Exposure to ethylene oxide in studies is associated with an increased incidence of cancer in laboratory animals (leukemia, stomach, brain), mutation in offspring in animals, and resorptions and spontaneous abortions in animals and human populations, respectively. Findings in humans and experimental animals exposed to airborne concentrations of ethylene oxide also indicate damage to the genetic material (DNA). These include hemoglobin alkylation, unscheduled DNA synthesis, sister chromatid exchange chromosomal aberration, and functional sperm abnormalities.

Ethylene oxide is listed as a cancer/reproductive hazard under OSHA; a suspected human carcinogen by ACGIH.; an anticipated human carcinogen by NTP; and a known human carcinogen (Group 1) by IARC.

Hydrocholorfluorocarbons are low in inhalation toxicity in animals at concentrations of up to 4% (40,000 ppm); however, when oxygen levels in air are reduced to 12-14% by displacement, symptoms of asphyxiation, loss of coordination, increased pulse rate and deeper respiration will occur. At high levels, cardiac arrhythmia may occur. Many chlorofluorocarbon and hydrochlorofluorocarbon gases have been demonstrated to induce cardiac sensitization to epinephrine. A two-year inhalation study of one of the hydrochlorofluorocarbons indicated a slight increase in salivary gland tumors (rat) at the highest level of exposure tested (50,000 ppm). There was no observable results in rats at exposure levels of 1000 ppm and 10,000 ppm, and none in mice at any dose level.

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL INFORMATION: N/A

DISTRIBUTION: N/A

CHEMICAL FATE INFORMATION: No appreciable bioconcentration is expected in the environment.

13. DISPOSAL CONSIDERATIONS

Do not contaminate water, food or feed by storage or disposal.

Pesticide Disposal: Waste should not be discarded or released to the environment. but returned in cylinders with valves closed and plugs inserted.

Container Disposal: Return empty cylinders for reuse with valves closed and plugs inserted.

Pesticide wastes are toxic. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste representatives of the nearest EPA Regional Office for guidance.

14. TRANSPORT INFORMATION

Either of the following shipping descriptions may be used:

Liquefied gases, n.o.s. (ethylene oxide, chlorofluorohydrocarbon gases)
2.2 UN 1956

Liquefied gases, n.o.s. (ethylene oxide, chlorofluorohydrocarbon gases),
2.2 UN3163

15. REGULATORY INFORMATION

OSHA: OSHA CHEMICAL SPECIFIC STANDARD FOR ETHYLENE OXIDE, 29 C.F.R. § 1910.1047.
Ethyiene oxide is a highly hazardous chemical for the purposes of process safety management under 29 C.F.R. § 1910.119.

CERCLA, SUPERFUND, 40 C.F.R. § § 117, 302: Releases of ethylene oxide are reportable under Section 103 of CERCLA. 40 C.R.F. § 302. The reportable quantity (RQ) is 10 pounds (4.54 kg). The threshold planning quantity is 1,000 pounds. 40 C.F.R. § 355.

SARA § 311/312 HAZARD CATEGORY:

1) Sudden release of pressure.
2) Toxicity: Immediate (Acute)
   Delayed (Chronic)

SARA § 313 INFORMATION: Ethylene oxide is subject to the requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 C.F.R. Part 372.

TOXIC SUBSTANCES CONTROL ACT (TSCA): The ingredients of this product are all included on the TSCA Inventory.

CALIFORNIA PREPOSITION 65: Ethylene oxide is a chemical known to cause cancer and female reproductive toxicity for the purposes of California Proposition 65.^N.