Ethylene:
No ToxFAQ
HSDB:

The following information was generated from the
Hazardous Substances Data Bank (HSDB),
a database of the National Library of Medicine's TOXNET system
(http://toxnet.nlm.nih.gov) on October 30, 2006.

Query: The chemical name ethylene was identified.
The following terms were added from ChemIDplus:
ethene
olefiant gas
elayl
bicarburretted hydrogen
athylen
acetene
CAS Registry Number: 74-85-1

1
NAME: ETHYLENE

HSN: 168

RN: 74-85-1

HUMAN HEALTH EFFECTS:

EVIDENCE FOR CARCINOGENICITY:

Evaluation: There is inadequate evidence in humans for the carcinogenicity of ethylene. There is inadequate evidence in experimental animals for the carcinogenicity of ethylene. Overall evaluation: Ethylene is not classifiable as to its carcinogenicity to humans (Group 3). [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. 60 64 (1994)]**PEER REVIEWED**

A4; Not classifiable as a human carcinogen. [American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2005, p. 29]**PEER REVIEWED**

HUMAN TOXICITY EXCERPTS:

/SIGNS AND SYMPTOMS/ After prolonged use, there may be moderate hyperglycemia. Postoperative nausea and vomiting occur more frequently after ethylene than after nitrous oxide but less frequently than after cyclopropane. Unpleasant aftertaste is often experienced for a few hr following ethylene anesthesia. Diffusion hypoxia may occur at the conclusion of anesthesia ... [American Medical Association, Council on Drugs. AMA Drug Evaluations. 2nd ed. Acton, Mass.: Publishing Sciences Group, Inc., 1973., p. 227]**PEER REVIEWED**

/SIGNS AND SYMPTOMS/ Exposure at 37.5% for 15 min may result in marked memory disturbances. Humans exposed to as much as 50% ethylene in air, whereby the oxygen availability is decreased to 10%, experienced a loss of consciousness. Prolonged inhalation of 85% ethene in air is slightly toxic, whereas 94% in oxygen is fatal. Death is certain at 8% oxygen. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.77]**PEER REVIEWED**

/SIGNS AND SYMPTOMS/ Vapors are anesthetic. [U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

/SIGNS AND SYMPTOMS/ ... /In human/, Ethene may alter carbohydrate metabolism and has caused temporary hypoglycemia. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p. 78]**PEER REVIEWED**

/SIGNS AND SYMPTOMS/ In fatal /human/ intoxication, ethene affects the respiratory center of the brain and kills by suffocation. Postmortem analysis has revealed that the right side of the heart is full of blood, while the left side is empty. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.78]**PEER REVIEWED**

/CASE REPORTS/ In eight people not occupationally exposed to ethene, the DNA adduct 7-(2-hydroxyethyl)guanine was detected at a background level of 8.5 +/- 5.7 nmol/g of DNA in peripheral lymphocytes. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.78]**PEER REVIEWED**

/CASE REPORTS/ In workers chronically exposed, ethene has been associated with a decrease in maximum arterial pressure, slower pulse, lengthened later period of the visual-motor response, increased thresholds of olfaction and hearing, and in the tension of the thermoregulatory apparatus. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.78]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ It has disadvantage of providing inadequate muscle relaxation. Concentrations sufficiently high to induce hypoxia must be employed and the gas-oxygen mixtures are explosive; fatal accidents have occurred during ethylene anesthesia. Consequently, its use has declined markedly in recent years. [Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980., p. 987]**PEER REVIEWED**

SKIN, EYE AND RESPIRATORY IRRITATIONS:

... May cause... eye irriation. [European Chemicals Bureau; IUCLID Dataset, Ethylene (74-85-1) (2000 CD-ROM edition). Available from the database query page: http://ecb.jrc.it/esis/esis.php as of July 13, 2005.]**PEER REVIEWED**

DRUG WARNINGS:

Chief disadvantage ... is that it is explosive. ... Explosive range of ethylene-oxygen mixture is broad, most easily ignited range being 5 to 25% ... dilute with air or oxygen; most critical time ... is at end of anesthesia ... This fact makes ... /it/ unsuitable when it must be used intermittently, for example during labor. [Goodman, L.S., and A. Gilman.

(eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

Postanesthetic nausea and vomiting are less frequent and less severe than after ether. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

It has disadvantage of providing inadequate muscle relaxation. Concentrations sufficiently high to induce hypoxia must be employed and the gas-oxygen mixtures are explosive; fatal accidents have occurred during ethylene anesthesia. Consequently, its use has declined markedly in recent years. [Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980., p. 987]**PEER REVIEWED**

Because of the high concentration of ethylene ... Required to produce and maintain anesthesia, cyanosis is an unavoidable accompaniment of ... /its/ use. [Thienes, C., and T.J. Haley. Clinical Toxicology. 5th ed. Philadelphia: Lea and Febiger, 1972., p. 53]**PEER REVIEWED**

Blood pressure may rise moderately during induction and early phase of surgical anesthesia, but it soon returns to normal and remains there throughout anesthesia. Cardiac arrhythmias occur infrequently when ethylene is used, and cardiovascular effects of the gas are relatively benign. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

PROBABLE ROUTES OF HUMAN EXPOSURE:

NIOSH (NOES Survey 1981-1983) has statistically estimated that 12,282 workers (2,363 of these are female) are potentially exposed to ethylene in the US(1). The NOES Survey does not include farm workers. Occupational exposure to ethylene may occur through inhalation with this compound at workplaces where ethylene is produced or used(SRC). Under environmental conditions, ethylene is a gas; therefore, the most probable route of the general population to ethylene is by inhalation(SRC). [(1) NIOSH; International Safety Cards. Ethylene. CAS No. 74-85-1 Available at http//www.cdc.gov/niosh/ipcs/nicstart.html as of July 28, 2005.]**PEER REVIEWED**

On July 30, 1992, a human operating a walk-behind alkylate-fueled lawn mower was exposed to ethylene at a concn of 70 ug/cu-m(1). On September 23, 1992, a human driving a car in urban traffic was exposed to ethylene at a concn of 9 ug/cu-m(1). [(1) Ostermark U, Petersson G; Chemosphere 27: 1719-28 (1993)]**PEER REVIEWED**

BODY BURDEN:

Ethylene was detected in the expired air from 2 of 8 volunteers (1 smoker) during a test period of approximately 1 hr at quantities of 120 ug (smoker) and 0.91 ug(1). [(1) Conkle JP et al; Arch Environ Health 30: 290-5 (1975)]**PEER REVIEWED**

AVERAGE DAILY INTAKE:

An ethylene yearly mean exposure of 1.8 ug/cu m was determined for Swedish urban air samples, collected in Sveavagen from 29 November to December, 1986(1). [(1) Bostrom CE et al; Environ Health Perspect 102(Suppl 4): 39-47 (1994)]**PEER REVIEWED**

EMERGENCY MEDICAL TREATMENT:

EMERGENCY MEDICAL TREATMENT:

EMT COPYRIGHT DISCLAIMER:

Portions of the POISINDEX(R) and MEDITEXT(R) database have been provided here for general reference. THE COMPLETE POISINDEX(R) DATABASE OR MEDITEXT(R) DATABASE SHOULD BE CONSULTED FOR ASSISTANCE IN THE DIAGNOSIS OR TREATMENT OF SPECIFIC CASES. The use of the POISINDEX(R) and MEDITEXT(R) databases is at your sole risk. The POISINDEX(R) and MEDITEXT(R) databases are provided "AS IS" and "as available" for use, without warranties of any kind, either expressed or

The following Overview, *** ASPHYXIANTS, SIMPLE ***, is relevant for this HSDB record chemical.

LIFE SUPPORT:

- o This overview assumes that basic life support measures have been instituted.

CLINICAL EFFECTS:

0.2.1 SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

A) Simple asphyxiants displace oxygen from the breathing atmosphere primarily in enclosed spaces and result in hypoxia. Four stages are described, depending on the arterial oxygen saturation.

1) INDIFFERENT STAGE

1. %O2 Saturation: 90%
2. Night vision: decreased

2) COMPENSATORY STAGE

1. %O2 Saturation: 82 to 90%
2. Respiratory rate: compensatory increase
3. Pulse: compensatory increase
4. Night vision: decreased further
5. Performance ability: somewhat reduced
6. Alertness: somewhat reduced
7. Symptoms may begin in those with significant pre-existing cardiac, pulmonary, or hematologic diseases

3) DISTURBANCE STAGE

1. %O2 Saturation: 64 to 82%
2. Compensatory mechanisms become inadequate
3. Air hunger
4. Fatigue
5. Tunnel Vision
6. Dizziness
7. Headache
8. Belligerence
9. Euphoria
10. Visual acuity: reduced
11. Numbness and tingling of extremities
12. Hyperventilation
13. Poor judgement
14. Memory loss
15. Cyanosis

    16. Decreased ability for escape from toxic environment
  4) CRITICAL STAGE
    1. %O2 Saturation: 60 to 70% or less
    2. Deterioration in judgement and coordination may occur in 3 to 5 minutes or less
    3. Total incapacitation and unconsciousness follow rapidly

B) All early effects may decrease ability for self-rescue from the toxic environment.

C) Some agents causing asphyxia are stored and transported in compressed or liquid form and can cause frostbite on direct skin contact.

0.2.3 VITAL SIGNS

0.2.4 HEENT

0.2.4.1 ACUTE EXPOSURE

A) Decreases in night vision, visual acuity, and visual fields (tunnel vision) may occur.

B) Frothy mucous may be seen.

0.2.5 CARDIOVASCULAR

0.2.5.1 ACUTE EXPOSURE

A) An increased pulse rate may occur.

B) Cardiac manifestations of prolonged or severe hypoxia may include atrial or ventricular dysrhythmias, hypotension, myocardial ischemia, myocardial infarction, and eventual asystole.

C) "Sudden sniffing death", or cardiac arrest, is reported following intentional inhalation of hydrocarbons.

0.2.6 RESPIRATORY

0.2.6.1 ACUTE EXPOSURE

A) Hyperventilation may develop.

B) Cyanosis may occur.

C) Bronchoconstriction and respiratory depression may be seen.

D) Pulmonary edema and lung congestion may occur.

0.2.7 NEUROLOGIC

0.2.7.1 ACUTE EXPOSURE

A) Various disturbances including headache, dizziness, mood disturbances, numbness of the extremities, sleepiness, mental confusion, poor judgement and coordination, and memory loss may occur.

B) Prolonged or severe hypoxia results in unconsciousness.

C) Prolonged asphyxia may produce CNS injury.

D) Hemiparesis has been reported with volatile substance abuse.

E) Cerebral edema with brainstem herniation may occur.

F) Seizures have been reported following intentional inhalation.

0.2.8 GASTROINTESTINAL

0.2.8.1 ACUTE EXPOSURE

A) Nausea, vomiting, and gastrointestinal hemorrhage may develop.

0.2.11 ACID-BASE

0.2.11.1 ACUTE EXPOSURE

A) Hypercapnia may be seen.

0.2.14 DERMATOLOGIC

0.2.14.1 ACUTE EXPOSURE

A) Dermal exposure may cause frostbite injury. Severe tissue burns have been reported.

0.2.15 MUSCULOSKELETAL

0.2.15.1 ACUTE EXPOSURE

A) Rhabdomyolysis and seizures have been reported.

0.2.20 REPRODUCTIVE HAZARDS

A) Possible sequelae of oxygen deprivation in the unborn are controversial. Cerebral palsy, previously thought to be due to acute hypoxia during labor and/or childbirth, remains poorly understood.

0.2.21 CARCINOGENICITY

0.2.21.1 IARC CATEGORY

A) IARC Carcinogenicity Ratings for CAS74-86-2 (IARC, 2004):
  1) Not Listed

B) IARC Carcinogenicity Ratings for CAS7440-37-1 (IARC, 2004):
  1) Not Listed

C) IARC Carcinogenicity Ratings for CAS106-97-8 (IARC, 2004):
  1) Not Listed

D) IARC Carcinogenicity Ratings for CAS124-38-9 (IARC, 2004):
  1) Not Listed

E) IARC Carcinogenicity Ratings for CAS74-84-0 (IARC, 2004):
  1) Not Listed

F) IARC Carcinogenicity Ratings for CAS74-85-1 (IARC, 2004):
  1) IARC Classification
    a) Listed as: Ethylene
    b) Carcinogen Rating: 3
      1) The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans. This category is used most commonly for agents, mixtures and exposure circumstances for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals. Exceptionally, agents (mixtures) for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans. Agents, mixtures and exposure circumstances that do not fall into any other group are also placed in this category.

G) IARC Carcinogenicity Ratings for CAS7440-59-7 (IARC, 2004):
  1) Not Listed

H) IARC Carcinogenicity Ratings for CAS1333-74-0 (IARC, 2004):
  1) Not Listed

I) IARC Carcinogenicity Ratings for CAS74-82-8 (IARC, 2004):
  1) Not Listed

J) IARC Carcinogenicity Ratings for CAS7440-01-9 (IARC, 2004):
  1) Not Listed

- K) IARC Carcinogenicity Ratings for CAS7727-37-9 (IARC, 2004):
  - 1) Not Listed
- L) IARC Carcinogenicity Ratings for CAS74-98-6 (IARC, 2004):
  - 1) Not Listed
- M) IARC Carcinogenicity Ratings for CAS115-07-1 (IARC, 2004):
  - 1) IARC Classification
    - a) Listed as: Propylene
    - b) Carcinogen Rating: 3
      - 1) The agent (mixture or exposure circumstance) is not classifiable as to its carcinogenicity to humans. This category is used most commonly for agents, mixtures and exposure circumstances for which the evidence of carcinogenicity is inadequate in humans and inadequate or limited in experimental animals. Exceptionally, agents (mixtures) for which the evidence of carcinogenicity is inadequate in humans but sufficient in experimental animals may be placed in this category when there is strong evidence that the mechanism of carcinogenicity in experimental animals does not operate in humans. Agents, mixtures and exposure circumstances that do not fall into any other group are also placed in this category.

0.2.22 GENOTOXICITY

- A) Refer to reviews on individual simple asphyxiants for available genetic toxicity data.

LABORATORY:

- A) Arterial blood gases are useful to assess the degree of hypoxemia.

TREATMENT OVERVIEW:

0.4.3 INHALATION EXPOSURE

- A) Administer 100% humidified supplemental oxygen with assisted ventilation as required.
- B) If hypoxia has been severe or prolonged, carefully evaluate for neurologic sequelae and provide supportive treatment as indicated.
- C) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.
- D) SEIZURES: Administer a benzodiazepine IV; DIAZEPAM (ADULT: 5 to 10 mg, repeat every 10 to 15 min as needed. CHILD: 0.2 to 0.5 mg/kg, repeat every 5 min as needed) or LORAZEPAM (ADULT: 2 to 4 mg; CHILD: 0.05 to 0.1 mg/kg).
  - 1) Consider phenobarbital if seizures recur after diazepam 30 mg (adults) or 10 mg (children > 5 years).
  - 2) Monitor for hypotension, dysrhythmias, respiratory depression, and need for endotracheal intubation. Evaluate for hypoglycemia, electrolyte disturbances, hypoxia.
- E) RHABDOMYOLYSIS: Administer sufficient 0.9% saline to maintain urine output of 2 to 3 mL/kg/hr. Monitor input and output, serum electrolytes, CK, and renal function. Diuretics may be necessary to maintain urine output.

Urinary alkalinization is NOT routinely recommended.

0.4.4 EYE EXPOSURE

- A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.4.5 DERMAL EXPOSURE

- A) OVERVIEW
  - 1) Rewarming and a variety of topical treatments are indicated for frostbite injury. SEE MAIN SECTION FOR MORE INFORMATION.

RANGE OF TOXICITY:

- A) Unconsciousness leading to death will occur when the atmospheric oxygen concentration is reduced to 6 to 8% or less.
- B) Signs of asphyxia will be noted when atmospheric oxygen is displaced such that the oxygen concentration is 15 to 16% or less.
- C) At increasing altitudes the decreasing atmospheric pressure decreases the partial pressure of oxygen, decreasing the molecules of oxygen available in stipulated percentages.

EMERGENCY MEDICAL TREATMENT:

EMT COPYRIGHT DISCLAIMER:

GENERAL OR UNKNOWN CHEMICAL ***, is relevant for this HSDB record chemical.

LIFE SUPPORT:

- This overview assumes that basic life support measures have been instituted.

CLINICAL EFFECTS:

0.2.1 SUMMARY OF EXPOSURE

0.2.1.1 ACUTE EXPOSURE

A) A SPECIFIC REVIEW on the clinical effects and treatment of individuals exposed to this agent HAS NOT YET BEEN PREPARED. The following pertains to the GENERAL EVALUATION and TREATMENT of individuals exposed to potentially toxic chemicals.

B) GENERAL EVALUATION -

1) Exposed individuals should have a careful, thorough medical history and physical examination performed, looking for any abnormalities. Exposure to chemicals with a strong odor often results in such nonspecific symptoms as headache, dizziness, weakness, and nausea.

C) IRRITATION -

1) Many chemicals cause irritation of the eyes, skin, and respiratory tract. In severe cases respiratory tract irritation can progress to ARDS/acute lung injury, which may be delayed in onset for up to 24 to 72 hours in some cases.

2) Irritation or burns of the esophagus or gastrointestinal tract are also possible if caustic or irritant chemicals are ingested.

D) HYPERSENSITIVITY -

1) A number of chemical agents produce an allergic hypersensitivity dermatitis or asthma with bronchospasm and wheezing with chronic exposure.

LABORATORY:

A) A number of chemicals produce abnormalities of the hematopoietic system, liver, and kidneys. Monitoring complete blood count, urinalysis, and liver and kidney function tests is suggested for patients with significant exposure.

B) If respiratory tract irritation or respiratory depression is evident, monitor arterial blood gases, chest x-ray, and pulmonary function tests.

TREATMENT OVERVIEW:

0.4.2 ORAL EXPOSURE

A) GASTRIC LAVAGE

1) Significant esophageal or gastrointestinal tract irritation or burns may occur following ingestion. The possible benefit of early removal of some ingested material by cautious gastric lavage must be weighed against potential complications of bleeding or perforation.

2) GASTRIC LAVAGE: Consider after ingestion of a potentially life-threatening amount of poison if it can be performed soon after ingestion (generally within 1 hour). Protect airway by placement in Trendelenburg and left lateral decubitus position or by endotracheal intubation. Control any seizures first.

a) CONTRAINDICATIONS: Loss of airway protective reflexes or decreased level of consciousness in unintubated patients; following ingestion of corrosives; hydrocarbons (high aspiration potential); patients at risk of hemorrhage or gastrointestinal perforation; and trivial or non-toxic ingestion.

B) ACTIVATED CHARCOAL

1) Activated charcoal binds most toxic agents and can decrease their systemic absorption if administered soon after ingestion. In general, metals and acids are poorly bound and patients ingesting these materials will not likely benefit from activated charcoal administration.

a) Activated charcoal should not be given to patients ingesting strong acidic or basic caustic chemicals. Activated charcoal is also of unproven value in patients ingesting irritant chemicals, where it may obscure endoscopic findings when the procedure is justified.

2) ACTIVATED CHARCOAL: Administer charcoal as a slurry (240 mL water/30 g charcoal). Usual dose: 25 to 100 g in adults/adolescents, 25 to 50 g in children (1 to 12 years), and 1 g/kg in infants less than 1 year old.

C) DILUTION -

1) Immediate dilution with milk or water may be of benefit in caustic or irritant chemical ingestions.

2) DILUTION: Immediately dilute with 4 to 8 ounces (120 to 240 mL) of water or milk (not to exceed 4 ounces/120 mL in a child).

D) IRRITATION -

1) Observe patients with ingestion carefully for the possible development of esophageal or gastrointestinal tract irritation or burns. If signs or symptoms of esophageal irritation or burns are present, consider endoscopy to determine the extent of injury.

E) OBSERVATION CRITERIA -

1) Carefully observe patients with ingestion exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

2) Patients symptomatic following exposure should be observed in a controlled setting until all signs and symptoms have fully resolved.

0.4.3 INHALATION EXPOSURE

A) DECONTAMINATION -

1) INHALATION: Move patient to fresh air. Monitor for respiratory distress. If cough or difficulty breathing develops, evaluate for respiratory tract irritation, bronchitis, or pneumonitis. Administer oxygen and assist ventilation as required. Treat bronchospasm with inhaled beta2 agonist and oral or parenteral corticosteroids.

B) IRRITATION -

1) Respiratory tract irritation, if severe, can progress to pulmonary edema which may be delayed in onset up to 24 to 72 hours after exposure in some cases.

C) ACUTE LUNG INJURY -

1) ACUTE LUNG INJURY: Maintain ventilation and oxygenation and evaluate with frequent arterial blood gas or pulse

oximetry monitoring. Early use of PEEP and mechanical ventilation may be needed.

D) BRONCHOSPASM -

1) If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.

E) OBSERVATION CRITERIA -

1) Carefully observe patients with inhalation exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

2) Patients symptomatic following exposure should be observed in a controlled setting until all signs and symptoms have fully resolved.

0.4.4 EYE EXPOSURE

A) DECONTAMINATION: Irrigate exposed eyes with copious amounts of room temperature water for at least 15 minutes. If irritation, pain, swelling, lacrimation, or photophobia persist, the patient should be seen in a health care facility.

0.4.5 DERMAL EXPOSURE

A) OVERVIEW

1) DERMAL DECONTAMINATION -

a) DECONTAMINATION: Remove contaminated clothing and wash exposed area thoroughly with soap and water. A physician may need to examine the area if irritation or pain persists.

2) PESTICIDES -

a) DECONTAMINATION: Remove contaminated clothing and jewelry. Wash the skin, including hair and nails, vigorously; do repeated soap washings. Discard contaminated clothing.

3) IRRITATION -

a) Treat dermal irritation or burns with standard topical therapy. Patients developing dermal hypersensitivity reactions may require treatment with systemic or topical corticosteroids or antihistamines.

4) DERMAL ABSORPTION -

a) Some chemicals can produce systemic poisoning by absorption through intact skin. Carefully observe patients with dermal exposure for the development of any systemic signs or symptoms and administer symptomatic treatment as necessary.

RANGE OF TOXICITY:

A) No specific range of toxicity can be established for the broad field of chemicals in general.

ANTIDOTE AND EMERGENCY TREATMENT:

Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Monitor for shock and treat if necessary ... . Anticipate seizures and treat if necessary ... . For eye contamination, flush eyes immediately with water. Irrigate each eye continuously with normal saline during transport ... . Do not use emetics. For ingestion, rinse mouth and administer 5 ml/kg up to 200 ml of water for dilution if the patient can swallow, has a strong gag reflex, and does not drool. Administer activated charcoal ... . /Aliphatic hydrocarbons and related compounds/ [Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 206-7]**PEER REVIEWED**

Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory rest. Positive pressure ventilation techniques with a bag-valve-mask device may be beneficial. Monitor cardiac rhythm and treat arrhythmias as necessary ... . Start an IV with D5W /SRP: "To keep open", minimal flow rate/. Use lactated Ringer's if signs of hypovolemia are present. Watch for signs of fluid overload. Consider drug therapy for pulmonary edema ... . Treat seizures with diazepam (Valium) ... . Use proparacaine hydrochloride to assist eye irrigation ... . /Aliphatic hydrocarbons and related compounds/ [Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 207]**PEER REVIEWED**

Basic treatment: Establish a patent airway. Suction if necessary. Watch for signs of respiratory insufficiency and assist ventilations if necessary. Administer oxygen by nonrebreather mask at 10 to 15 L/min. Anticipate seizures and treat if necessary ... . Use rapid rewarming techniques if frostbite occurs ... . /Simple ashpyxiants and related compounds/ [Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 394]**PEER REVIEWED**

Advanced treatment: Consider orotracheal or nasotracheal intubation for airway control in the patient who is unconscious or in respiratory arrest.

Monitor cardiac rhythm and treat arrhythmias if necessary ... . Start an IV with D5W /SRP: "To keep open", minimal flow rate/. Treat seizures with diazepam ... . /Simple ashpyxiants and related compounds/ [Bronstein, A.C., P.L. Currance; Emergency Care for Hazardous Materials Exposure. 2nd ed. St. Louis, MO. Mosby Lifeline. 1994., p. 394]**PEER REVIEWED**

ANIMAL TOXICITY STUDIES:

EVIDENCE FOR CARCINOGENICITY:

Evaluation: There is inadequate evidence in humans for the carcinogenicity of ethylene. There is inadequate evidence in experimental animals for the carcinogenicity of ethylene. Overall evaluation: Ethylene is not classifiable as to its carcinogenicity to humans (Group 3). [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. 60 64 (1994)]**PEER REVIEWED**

A4; Not classifiable as a human carcinogen. [American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2005, p. 29]**PEER REVIEWED**

NON-HUMAN TOXICITY EXCERPTS:

/LABORATORY ANIMALS: Acute Exposure/ Treatment of rats with up to 500,000 ppm ethylene for 5 hours had no effects, however if the rats were pretreated with 500 mg/kg of Arochlor and exposed at 100,000 ppm ethylene, an increased serum glutamicpyruvic transaminase (SGPT) activity and centrolobular necrosis were observed. Similar effects were not evident with other enzyme inducers such as phenobarbital and 3-methyl cholanthrene. [American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001., p. 1]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ Male rats exposed to 10, 25 and

57x10+3 ppm for 4 hr showed increased serum pyruvate and liver weights. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ Ethylene inhaled at a dose of 11.5 g/cu m (10,000 ppm) for 4 hr is acutely hepatotoxic to rats pretreated with the polychlorinated biphenyl Aroclor 1254 given orally at a dose of 300 umol/kg bw once daily for 3 days. It is not acutely toxic without such pretreatment. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 163 (1979)]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ Exposure to 700,000-900,000 ppm causes changes in EEG activity and decrease in stomach emptying time. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ Deep anesthesia occurs in a few seconds with 95% ethene and 5% oxygen, accompanied by marked cyanosis and depression with a slow fall in blood pressure. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

/LABORATORY ANIMALS: Acute Exposure/ Male rats were pretreated by gavage with the polychlorinated biphenyl mixture (PCB) Aroclor 1254 (300 umol of PCB/kg) for 3 consecutive days. On the 4th day these rats were exposed by inhalation (4 hr) to various concentrations of ethane, ethylene, fluoride monomer (VFM), vinyl chloride monomer (VCM) or vinyl bromide monomer (VBM). Animals were sacrificed 24 hr after exposure and acute hepatic responses were estimated by measurement of serum alanine-alpha-ketoglutarate transaminase (SAKT) and light microscopy. All compounds tested, except ethane, caused significant elevations of SAKT and produced severe degeneration and necrosis of the liver. Typical SAKT values (milligrams of pyruvate per milliliter of serum per hour) were: absolute controls, 0.17 | 0.01; PCB pretreated, not exposed, 0.19 | 0.02; PCB and 50,000 ppm of ethane, 0.11 | 0.02; PCB and 25,000 ppm of ethylene, 1.98 | 0.61; PCB and 10,000 ppm of VFM 6.29 | 0.99; PCB and 10,000 ppm of VCM 1.11 | 0.32; and PCB and 33,000 ppm of VBM, 3.78 | 2.28. The relative potencies of these compounds in elevating SAKT were similar, and the spectrum of morphologic changes (e.g., midzonal ballooning of hepatocytes and centrolobular hemorrhagic necrosis) was the same. The acute hepatoxicity of ethylene plus PCB and lack of effect from ethane plus PCB indicate a role for the double bond in these toxic interactions. With the exception of ethane the compounds tested are similar in acute toxicity after PCB pretreatment. This similarity of acute action, in light of the carcinogenicity of VCM, suggests that ethylene, VMF and VBM should be evaluated for chronic effects. [Conolly RB et al; Exp Mol Pathol 28 (1): 25-33 (1978)]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Groups of male and female Sprague-Dawley rats, three to five days of age, were exposed by inhalation to 0 (5 male and 9 female rats) or 10,000 ppm (11,500 mg/cu m, 2 males and 10 females) ethylene (purity unspecified) for 8 hr/day on 5 days/wk for 3 weeks. One week later, the rats received oral administrations of 10 mg/kg body weight Clophen A 50 (a mixture of polychlorinated biphenyls (not otherwise specified) by gavage twice a week for up to eight additional weeks (promotion), at which time the experiment was terminated and the livers were examined for ATPase-deficient foci. The number of ATPase-deficient foci in the, rats exposed to ethylene did not exceed the control values. In the same experiment, ethylene oxide, administered as a positive control, produced a significant increase in the incidence of ATPase-deficient foci in females. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 53-4 (1994)]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Mice were dosed by gavage with 3.75 mg/kg bw for 4 months. The treated animals displayed no changes in behavior or in body weight gain and oxygen consumption. Gross pathology examination revealed no changes in the relative weights or in the histological structure of the visceral organs. [Sheftel, V.O.; Indirect Food Additives and Polymers. Migration and Toxicology. Lewis Publishers, Boca Raton, FL. 2000., p. 83]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Inhalation exposure to 600,000 ppm continuously for 90 days in rats caused reduced food uptake and activity, peripheral leucopenia, decreased thrombocyte and erythrocyte, count and decrease in bone marrow cellularity. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ 1-day-old and adult rats continuously exposed to 3 mg/cu m per day for 90 days exhibited hypertension, disruption of the subordination chronaxy, and decreased cholinesterase activity. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

/LABORATORY ANIMALS: Subchronic or Prechronic Exposure/ Inhalation of ethylene by Sprague Dawley rats, in concentrations of 0, 300, 1000, 3000, or 10,000 ppm, 6 hours/day, 5 days/week for 14 weeks, caused no toxic effects. [American Conference of Governmental Industrial Hygienists.

Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001., p. 1]**PEER REVIEWED**

/LABORATORY ANIMALS: Chronic Exposure or Carcinogenicity/ The toxicity and oncogenicity of inhaled ethylene were determined in Fischer-344 rats. 960 were randomly divided into 4 groups of 120 animals of each sex and were exposed 6 hours/day, 5 days/week, for up to 24 months to concentrations of ethylene in the air of 0, 300, 1000, or 3000 ppm. The maximum tolerated dose was not used as concentrations above 3000 ppm were considered hazardous because of the risks associated with ethylene's explosive properties. ... Randomly selected animals were necropsied and examined after 6, 12, and 18 months of exposure. A complete selection of tissues and organs from all animals in the control and 3000 ppm groups were examined for microscopic lesions. All animals were examined for clinical changes throughout the course of the 2 year study. Gross examination of rats dying during the study, or those that were sacrificed as scheduled, did not reveal any lesions attributable to ethylene exposure. Histologically, a variety of proliferative, degenerative, and inflammatory lesions were observed in both control and 3000 ppm groups. These lesions were typical of those seen in this strain of animal and were ... unrelated to ethylene exposure. [Hamm TE Jr et al; Fundam Appl Toxicol 4 (3): 473-8 (1984)]**PEER REVIEWED**

/LABORATORY ANIMALS: Chronic Exposure or Carcinogenicity/ Experiments proved ethylene to be converted in certain species, notably mice and rats, into the carcinogenic and mutagenic ethylene oxide. Carcinogenic effect of ethylene of endogenous origin is suggested. Whether such an effect is possible with oral administration of ethylene is not clear. [Sheftel, V.O.; Indirect Food Additives and Polymers. Migration and Toxicology. Lewis Publishers, Boca Raton, FL. 2000., p. 83]**PEER REVIEWED**

/LABORATORY ANIMALS: Developmental or Reproductive Toxicity/ The study was designed to comply with OECD Guideline 421 and thus to assess the potential of the test substance (ethylene) to affect fertility, pregnancy, maternal and suckling behavior and growth and development of the F1 offspring from conception to Day 4 post-partum, in the rat. Head-only exposure was selected so as to minimize the volume of the exposure chamber and hence the hazards associated with an explosive test article. ... The parental animals were exposed for two weeks prior to pairing, during the pairing period and until the day prior to necropsy for males (minimum 28 days) or until Day 20 of gestation. Females were allowed to litter and rear their offspring to Day 4 post-partum when dams and litters were killed and necropsied. Ten males and ten females per group were held in rodent restraint tubes connected to 1.7 L perspex chambers and exposed by head-only to concentrations of 0 (air control), 200, 1000 or 5000 ppm for 6 hours daily. A further 10 females, mated with untreated males, were maintained concurrently, under the same experimental conditions but without exposure or restraint, to provide comparative data. There were no deaths attributable to the test article and treatment did not adversely affect weight gain or food intake of males or females. All females became pregnant and there was no effect of treatment on fertility, fecundity, litter size, sex ratio, mean pup weight, pup growth or clinical condition. Macroscopic findings and histopathologic examination (including staging of the spermatogenic cycle) of parental animals revealed no treatment-related effects. Comparison of unrestrained, non-exposed animals and control animals revealed no evidence of adverse effects. In conclusion, administration of ethylene by head-only exposure revealed no potential for adverse reproductive effects as assessed by OECD Reproduction/Developmental Toxicity Screening Test 421. [Aveyard L, Collins CJ; Teratology 55 (1): 47 (1997)]**PEER REVIEWED**

/GENOTOXICITY/ Ethylene was not found to be mutagenic with or without S-9 activating system in Salmonella typhimurium strains TA 98, TA 1537, TA 100, or TA 1535. [American Conference of Governmental Industrial Hygienists. Documentation of Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices for 2001. Cincinnati, OH. 2001., p. 1]**PEER REVIEWED**

/GENOTOXICITY/ Ethylene showed no mutagenic properties toward Escherichia coli and several Bacillus species. [Clayton, G. D. and F. E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology. 3rd ed. New York: John Wiley Sons, 1981-1982., p. 3199]**PEER REVIEWED**

/GENOTOXICITY/ Mixtures of aniline/ethylene/NOx were photolyzed in 22.7 cu m Teflon reaction chamber operated in a cyanic mode. Several minor products, including nitrobenzene, azobenzene, alpha-nitraniline, phenol and benzoic acid, were identified. The production of aerosol was also observed. The product mixtures were exposed to Salmonella typhimurium strains TA 98 and TA 100 both with and without metabolic activation. Exposures of the gas mixtures alone and the aerosol plus gas mixtures were performed. In addition, filters of the aerosol were collected, extracted, and used in a plate incorporation procedure with these strains. The results show the gas phase products from the irradiated mixture to be relatively nonmutagenic in the TA 98 and TA 100. This same result was found in the aerosol exposure, although the deposition into the media may have been low. However, extracts from the aerosol when directly incorporated into the medium show mutagenic activity for TA 98. [Shepson PB et al; J Environ Sci Health Part A 20 (5): 503-519 (1985)]**PEER REVIEWED**

/GENOTOXICITY/ Male Fischer 344 rats and male B6C3F1 mice (10/species/group) were exposed to ethylene 6 hr/day 5 days/week for 4 weeks. The ethylene target concentrations were 0, 40, 1000 and 3000 ppm. An ethylene oxide control group for each species was exposed under the same conditions at a target concentration of 200 ppm. Bone marrow was collected approximately 24 hr after the final exposure. Polychromatic erythrocyte (PCE) to normochromatic erythrocyte (NCE) ratios were determined and 2000 PCE/animal were scored for the presence of micronuclei. Ethylene did not produce statistically significant exposure related increases in the frequency of micronucleated PCE (MNPCE) in the bone marrow of either rats or mice when compared to air exposed control animals. ... [Vergnes JS, Pritts IM; Mutat Res 324 (3): 87-91 (1994)]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ Various plants were exposed to different concentrations of ethylene, (0.002 - 40.0 ppm) resulting in causing numerous toxic responses. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 634-635]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ Incubation of cut spurs of Hippophae rhamnoides in atmospheres containing 1 mL ethylene/L for 120 hr induced formation of abscission layer and complete abscission of ripe fruit within 1 week. Presence of leaves decreased the abscisic effect of C_2H_4. [Demenko VI et al; Fiziol Rast (Moscow) 33 (1): 188-94 (1986)]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ Treating potato tubers with ethylene donors (Hydrel, Dihydrol or Camposan) inhibited the sprouting of the growth points and increased abscisic acid content of the meristem of the growth points and of the cortical parenchyma. However, abscisic acid content of the tubers increased less when Hydrel was used at growth-stimulating (0.05%) than at growth-inhibiting (0.5 and 1%) concentrations. Abscisic acid concentration in the tubers decreased 90-120 days after the treatment resulting in active tuber sprouting after that time when 0.05% Hydrel was used, while when the high Hydrel concentrations were applied, the abscisic acid concentration remained still at a high level inhibiting the sprouting

120-150 days after treatment and even later. Thus, the increase in abscisic acid concentration resulting from treatment with ethylene donors was the main cause of inhibition of tuber sprouting. The other ethylene donors behaved similarly as Hydrel did also increasing the abscisic acid concentration in the tuber tissues. In the control tubers (treated with 0.05% ethylene donors) the abscisic acid decreased 210 days after the treatment to 0.08 ug/g fresh matter while in tubers treated at 0.5% concentration it remained at that time at a level 10-fold that in the control. A direct relation between the concentration of ethylene donors used for treatment and abscisic acid concentration in the tubers was found. [Korableva NP et al; Fiziol Biokhim Mikrobiol 18 (1): 600-4 (1986)]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ ... Mice repeatedly exposed at minimal /CNS depressant/ concentration showed no histopathological changes in kidneys, adrenals, hearts, or lungs. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.77]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ ... Liver mitochondrial volume increased in rats treated with ethylene. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.77]**PEER REVIEWED**

/OTHER TOXICITY INFORMATION/ Easter lilies (Lilium longiflorum) were treated with ethylene or ethephon at several development stages of flower buds. C2H4 hastened flower-bud opening. The earlier C2H4 treatment during the flower-bud development stages, the earlier flowering occurred. C2H4 or ethephon treatment decreased tepal length, but increased degenerated flower buds and distorted flowers. C2H4 also hastened flower senescence to result in earlier wilting and earlier dropping of flowers. [Lee JS, Roh

SM; Han'guk Wonye Hakhoechi 26 (2): 145-9 (1985)]**PEER REVIEWED**

NON-HUMAN TOXICITY VALUES:

LD50 Mouse oral 950,000 ppm (1093 g/cu m) [OECD; Screening Information Data Set for Ethylene, 74-85-1 (October 1998). Available from: http://www.inchem.org/documents/sids/sids/74851.pdf as of July 13, 2005.
]**PEER REVIEWED**

METABOLISM/PHARMACOKINETICS:

METABOLISM/METABOLITES:

Rat liver microsomal monooxygenases transform ethylene to oxirane. ...
[Schmiedel G et al; Toxicol Lett 19 (3): 293-7 (1983)]**PEER REVIEWED**

Male CBA mice exposed to air containing 19.6 mg/cu m ... (14)C-labeled ethylene metabolized ethylene to ethylene oxide, which binds to cellular proteins. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 163 (1979)]**PEER REVIEWED**

Four male CBA mice (average body weight, 31 g) were exposed together for 1 hr in a closed glass chamber (5.6 l) to (14)C-ethylene (22 mCi/mmol) in air at 17 ppm x hr (22.3 (mg/cu m) x hr, equivalent to about 1 mg/kg bw). Blood and organs from two mice were pooled 4 hr after the end of exposure. Radioactivity was about the same in kidney (0.16 uCi/g wet weight) and liver (0.14 uCi/g) but lower in testis (0.035 uCi/g), brain (0.02 uCi/g) and Hb (0.0094 uCi/g Hb). Urine was collected from the two other mice during 48 h, and blood was collected after 21 days. 5-(2-Hydroxyethyl)cysteine was identified as a metabolite of ethylene in urine (3% of (14)C in urine) by thin-layer chromatography. The radioactivity in Hb was 0.011 uCi/g Hb. These data, together with those on specific hydroxyethyl derivatives at amino acid residues of Hb, indicated that ethylene was metabolized to ethylene oxide. [IARC. Monographs on the

Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 55 (1994)]**PEER REVIEWED**

Experiments proved ethylene to be converted in certain species, notably mice and rats, into the carcinogenic and mutagenic ethylene oxide. Carcinogenic effect of ethylene of endogenous origin is suggested. Whether such an effect is possible with oral administration of ethylene is not clear. [Sheftel, V.O.; Indirect Food Additives and Polymers. Migration and Toxicology. Lewis Publishers, Boca Raton, FL. 2000., p. 83]**PEER REVIEWED**

ABSORPTION, DISTRIBUTION & EXCRETION:

Ethylene is excreted almost quantitatively in the exhaled air and undergoes little chemical change in the body. Partition coefficients at body temperature: blood:gas= 0.15; heart:blood= 1.0; fat:blood= 6. Blood:air partition ratio= 0.14 at 37 deg C. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

When equilibrium is reached, the rate of transfer of gas molecules from the alveolar space to blood equals the rate of removal by blood from the alveolar space. For example, ... ethylene has a low (0.14) blood/gas phase solubility ratio. For a substance with a low solubility ratio such as ethylene, only a small percentage of the total gas is removed by blood during each circulation because blood is soon saturated with the gas. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 116]**PEER REVIEWED**

Ethylene has been determined in expired air of 2/8 human subjects at rate of 0.91 and 120 ug/hr. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 161 (1979)]**PEER REVIEWED**

... Excreted in urine ... [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 163 (1979)]**PEER REVIEWED**

The inhalation pharmacokinetics of ethylene have been investigated in human volunteers at atmospheric concentrations of up to 50 ppm (157.5 mg/cu m) by gas uptake in a closed spirometer system. The uptake, exhalation and metabolism of ethylene can be described by first-order kinetics. Uptake of ethylene into the body is low. Clearance due to uptake, which reflects the transfer rate of ethylene from the atmosphere into the body, was 25 l/hr for a man of 70 kg. This value represents only 5.6% of the experimentally obtained alveolar ventilation rate of 150 l/hr. The majority (94.4%) of ethylene inhaled into the lungs is exhaled again without becoming systemically available via the blood stream. Maximal accumulation of ethylene in the same man, determined as the thermodynamic partition coefficient whole body:air was 0.53. The concentration ratio at steady state was even smaller (0.33), owing to metabolic elimination. Clearance due to metabolism, in relation to the concentration in the atmosphere, was calculated to be 9.3 l/hr for a man of 70 kg. This indicates that at steady state about 36% of systemically available ethylene is eliminated metabolically and 64% is eliminated by exhalation as the unchanged substance, as can be calculated from the values of clearance of uptake and of clearance of metabolism. The biological half-life of ethylene was 0.65 hr. The alveolar retention of ethylene at steady state was calculated to be 2%. From theoretical considerations of the lung uptake of gases and vapors, it can be deduced that the low uptake rate of ethylene is due to its low solubility in blood: Ostwald's solubility coefficient for human blood at 37 deg C, 0.15. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man.

Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 53 (1994)]**PEER REVIEWED**

Four male CBA mice (average body weight, 31 g) were exposed together for 1 hr in a closed glass chamber (5.6 l) to (14)C-ethylene (22 mCi/mmol) in air at 17 ppm x hr (22.3 (mg/cu m) x hr, equivalent to about 1 mg/kg bw). Blood and organs from two mice were pooled 4 hr after the end of exposure. Radioactivity was about the same in kidney (0.16 uCi/g wet weight) and liver (0.14 uCi/g) but lower in testis (0.035 uCi/g), brain (0.02 uCi/g) and Hb (0.0094 uCi/g Hb). Urine was collected from the two other mice during 48 h, and blood was collected after 21 days. 5-(2-Hydroxyethyl)cysteine was identified as a metabolite of ethylene in urine (3% of (14)C in urine) by thin-layer chromatography. The radioactivity in Hb was 0.011 uCi/g Hb. These data, together with those on specific hydroxyethyl derivatives at amino acid residues of Hb, indicated that ethylene was metabolized to ethylene oxide. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 55 (1994)]**PEER REVIEWED**

In several experiments, disposition of (14)C-ethylene (free of (l4)C-acetylene or greater than or equal to 97% pure) in male Fischer 344 rats (170-220 g) was determined over 36 hr following 5 hr exposures in a closed chamber (35 l) to 10,000 ppm (11,500 mg/cu m). In each experiment, up to four rats were exposed together in a single chamber. Within about 1 min after the end of exposure, animals were transferred to individual all-glass metabolism cages. Most of the eliminated (14)C was exhaled as ethylene (18 umol (504 ug) per rat exposed to acetylene-containing ethylene); smaller amounts were excreted in urine (2.7 umol ethylene equivalents/rat) and feces (0.4 umol) and exhaled as CO2 (0.16 umol). Radioactivity was also found in blood (0.022 umol ethylene equivalents/mL), liver (0.047 umol ethylene equivalents/liver), gut (0.034 umol ethylene equivalents/gut) and kidney (0.006 umol ethylene equivalents/kidney). Pretreatment of animals with a mixture of polychlorinated biphenyls (Aroclor 1254; 500 mg/kg bw; single intraperitoneal injection five days before exposure) had no measurable influence on ethylene exhalation but resulted in a significant (p < 0.05) increase in exhaled (14)CO2 (2.04 umol ethylene equivalents/rat) and of (14)C in urine (11.1 umol ethylene equivalents/rat) and in blood (0.044 umol ethylene equivalents/mL). The organ burden of (14)C was one to two orders of magnitude greater in Aroclor 1254-treated than in untreated animals. Radioactivity also became detectable in lungs, brain, fat, spleen, heart and skeletal muscle. The data were interpreted as indicating that the metabolism of ethylene can be stimulated by an inducer of the mixed-function oxidase system. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 55-6 (1994)]**PEER REVIEWED**

Accumulation is impossible because of ethylene's rapid excretion from the body. [Sheftel, V.O.; Indirect Food Additives and Polymers. Migration and Toxicology. Lewis Publishers, Boca Raton, FL. 2000., p. 83]**PEER REVIEWED**

Ethene equilibrated in alveolar, arterial, brain, and muscle tissue in 2-8.2 min. [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. V4 p.76]**PEER REVIEWED**

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The inhalation pharmacokinetics of ethylene was investigated in human volunteers at atmospheric concentrations of up to 50 ppm by gas uptake in a closed spirometer system, and the uptake, exhalation and metabolism could be described by first-order kinetics. The clearance due to uptake was low, only 5.6 %, while the rest was only exhaled without entering the blood stream. Clearance due to metabolism was 36 % of systematically available ethylene. [OECD; Screening Information Data Set for Ethylene, 74-85-1 (October 1998). Available from: http://www.inchem.org/documents/sids/sids/74851.pdf as of July 13, 2005.

]**PEER REVIEWED**

BIOLOGICAL HALF-LIFE:

The biological half-life of ethylene was 0.65 hr. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V60 53 (1994)]**PEER REVIEWED**

MECHANISM OF ACTION:

Currently, general anesthetics are thought to act by fluidizing lipid (critical vol hypothesis) in membranes of nerve cells, which interferes with normal physiologic functions of membranes. This theory is compatible for all general anesthetics ... /general anesthetics/ [American Medical Association, AMA Department of Drugs. AMA Drug Evaluations. 4th ed. Chicago: American Medical Association, 1980., p. 307]**PEER REVIEWED**

Ethylene interferes with the activities of plant hormones causing growth retardation. [Waldbott GL; Health Eff Environ Pollut p.47 (1973)]**PEER REVIEWED**

INTERACTIONS:

The rate of rise of alveolar ethylene concentration will be accelerated when admin simultaneously with 70% nitrous oxide. [LaDu, B.N., H.G. Mandel, and E.L. Way. Fundamentals of Drug Metabolism and Disposition. Baltimore: Williams and Wilkins, 1971., p. 113]**PEER REVIEWED**

PHARMACOLOGY:

THERAPEUTIC USES:

Humans exposed to as much as 50% ethylene in air, whereby the oxygen availability is decreased to 10%, experience loss of consciousness, and death may follow at 8% /oxygen/ ... . Therefore, ethylene used as an anesthetic agent /SRP: Former use/ should be supplemented with the appropriate oxygen concn. [Clayton, G. D. and F. E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology.

3rd ed. New York: John Wiley Sons, 1981-1982., p. 3199]**PEER REVIEWED**

/SRP: Former use/ It is one of the preferred anesthetic agents; its advantages over comparable human anesthetics are rapid onset and recovery time after exposure termination and little or no effect on cardiac and pulmonary functions. That is, respiration, blood pressure, and pulse rates are rarely changed, even under anesthetic conditions. Cardiac arrhythmias occur infrequently and affect little the renal and hepatic functions. ... However, the disadvantage as an anesthetic is its explosion and flammability properties, which may coincide with the most commonly applied concentration ranges. [Clayton, G. D. and F. E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology. 3rd ed. New York: John Wiley Sons, 1981-1982., p. 3198]**PEER REVIEWED**

/SRP: Former use/ ... For analgesia, few inhalations of 25-35% mixture with oxygen. For induction of anesthesia, 80-90% concentration of ethylene with 10-20% oxygen ... . However, 90% concentration ... should be given for no longer than 2-3 min. Patients usually can be maintained on mixture of 80% ethylene and 20% oxygen. If satisfactory anesthesia cannot be attained with ethylene, gas must be supplemented with barbiturate, strong analgesic, or other anesthetic vapor (eg, ether, halothane). [American Medical Association, Council on Drugs. AMA Drug Evaluations. 2nd ed. Acton, Mass.: Publishing Sciences Group, Inc., 1973., p. 227]**PEER REVIEWED**

/SRP: Former use/ ... Speed of induction is rapid, exceeding that of nitrous oxide. After patient has taken six or more deep inhalations, mental clouding supervenes and unconsciousness soon follows. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 83]**PEER REVIEWED**

/SRP: Former use/ In order to speed induction, hypoxic mixtures of ethylene and oxygen (eg 85:15) are sometimes admin for few min at the beginning of anesthesia. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

/SRP: Former use/ When an anesthetic mixture of ethylene and oxygen is inhaled, surgical anesthesia ... occurs in 2 to 5 min. After adequate preanesthetic medication, ethylene can carry anesthesia to lower border of plane one ... [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

/SRP: Former use/ ...Seriously ill patients can often be anesthetized with ethylene-oxygen mixture alone. Subanesthetic concentration of ethylene are analgesic, and inhalation of 25 to 35% of gas produces maximal analgesia without loss of consciousness or cooperativeness. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

/SRP: Former use/ The respiratory mechanism of fetus and activity of uterus are not depressed when ethylene is used in obstetrics, provided precautions are taken to avoid hypoxia. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

/SRP: former use/ it permits rapid induction of anesthesia. Excitement and struggle are minimal, and recovery ... is rapid. Myocardium is not "sensitized" to catecholamines by ethylene. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

VET:... In dogs ... at 1.4% ethene was a fast acting anesthetic. It reached alveolar, arterial, brain, muscle, and CNS partial pressure in 2 to 8.2 min, even more rapidly than ethyl ether. [Clayton, G. D. and F. E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology. 3rd ed. New York: John Wiley Sons, 1981-1982., p. 3199]**PEER REVIEWED**

DRUG WARNINGS:

Chief disadvantage ... is that it is explosive. ... Explosive range of ethylene-oxygen mixture is broad, most easily ignited range being 5 to 25% ... dilute with air or oxygen; most critical time ... is at end of anesthesia ... This fact makes ... /it/ unsuitable when it must be used intermittently, for example during labor. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

Postanesthetic nausea and vomiting are less frequent and less severe than after ether. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

It has disadvantage of providing inadequate muscle relaxation. Concentrations sufficiently high to induce hypoxia must be employed and the gas-oxygen mixtures are explosive; fatal accidents have occurred during ethylene anesthesia. Consequently, its use has declined markedly in recent years. [Osol, A. (ed.). Remington's Pharmaceutical Sciences. 16th ed. Easton, Pennsylvania: Mack Publishing Co., 1980., p. 987]**PEER REVIEWED**

Because of the high concentration of ethylene ... Required to produce and maintain anesthesia, cyanosis is an unavoidable accompaniment of ... /its/ use. [Thienes, C., and T.J. Haley. Clinical Toxicology. 5th ed. Philadelphia: Lea and Febiger, 1972., p. 53]**PEER REVIEWED**

Blood pressure may rise moderately during induction and early phase of surgical anesthesia, but it soon returns to normal and remains there throughout anesthesia. Cardiac arrhythmias occur infrequently when ethylene is used, and cardiovascular effects of the gas are relatively benign. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 84]**PEER REVIEWED**

INTERACTIONS:

The rate of rise of alveolar ethylene concentration will be accelerated when admin simultaneously with 70% nitrous oxide. [LaDu, B.N., H.G. Mandel, and E.L. Way. Fundamentals of Drug Metabolism and Disposition. Baltimore: Williams and Wilkins, 1971., p. 113]**PEER REVIEWED**

ENVIRONMENTAL FATE & EXPOSURE:

ENVIRONMENTAL FATE/EXPOSURE SUMMARY:

Ethylene's production and use as a chemical intermediate and precursor in industrial organic synthesis, in the welding and cutting of metals, as a plant growth regulator, as a refrigerant, and formerly as an anesthetic may result in its release to the environment through various waste streams. Its use as a plant growth regulator will result in its direct release to the environment. Other important sources of ethylene released to the environment include the burning of biomass and combustion of fossil fuels. Ethylene is a natural product released by plants. If released to air, an estimated vapor pressure of 5.21X10+4 mm Hg at 25 deg C indicates ethylene will exist solely as a gas in the atmosphere. Gas-phase ethylene will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 1.9 days. Ethylene does not contain chromophores that absorb at wavelengths > 290 nm and therefore is not expected to be susceptible to direct photolysis by sunlight. If released to soil, ethylene is expected to have high mobility based upon an estimated Koc of 98. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 0.228

atm-cu m/mole. Ethylene will volatilize from dry soil surfaces based upon its vapor pressure. If released into water, ethylene is not expected to adsorb to suspended solids and sediment based upon the estimated Koc. Volatilization from water surfaces is expected to be an important fate process based upon this compound's Henry's Law constant. Estimated volatilization half-lives for a model river and model lake are 30 minutes and 2 days, respectively. An estimated BCF of 4 suggests the potential for bioconcentration in aquatic organisms is low. Hydrolysis is not expected to be an important environmental fate process since this compound lacks functional groups that hydrolyze under environmental conditions. Occupational exposure to ethylene may occur through inhalation with this compound at workplaces where ethylene is produced or used. Under environmental conditions, ethylene is a gas; therefore, the most probable route of the general population to ethylene is by inhalation. (SRC) **PEER REVIEWED**

PROBABLE ROUTES OF HUMAN EXPOSURE:

NIOSH (NOES Survey 1981-1983) has statistically estimated that 12,282 workers (2,363 of these are female) are potentially exposed to ethylene in the US(1). The NOES Survey does not include farm workers. Occupational exposure to ethylene may occur through inhalation with this compound at workplaces where ethylene is produced or used(SRC). Under environmental conditions, ethylene is a gas; therefore, the most probable route of the general population to ethylene is by inhalation(SRC). [(1) NIOSH; International Safety Cards. Ethylene. CAS No. 74-85-1 Available at http//www.cdc.gov/niosh/ipcs/nicstart.html as of July 28, 2005.]**PEER REVIEWED**

On July 30, 1992, a human operating a walk-behind alkylate-fueled lawn mower was exposed to ethylene at a concn of 70 ug/cu-m(1). On September 23, 1992, a human driving a car in urban traffic was exposed to ethylene at a concn of 9 ug/cu-m(1). [(1) Ostermark U, Petersson G; Chemosphere 27: 1719-28 (1993)]**PEER REVIEWED**

BODY BURDEN:

Ethylene was detected in the expired air from 2 of 8 volunteers (1 smoker) during a test period of approximately 1 hr at quantities of 120 ug (smoker) and 0.91 ug(1). [(1) Conkle JP et al; Arch Environ Health 30: 290-5 (1975)]**PEER REVIEWED**

AVERAGE DAILY INTAKE:

An ethylene yearly mean exposure of 1.8 ug/cu m was determined for Swedish urban air samples, collected in Sveavagen from 29 November to December, 1986(1). [(1) Bostrom CE et al; Environ Health Perspect 102(Suppl 4): 39-47 (1994)]**PEER REVIEWED**

NATURAL POLLUTION SOURCES:

Ethylene is a natural product emitted by fruits, flowers, leaves, roots, and tubers(1). The release rate of ethylene from plants varies during the life cycle of the plant(1). Plants that normally produce 0.6 to 6 ug ethylene/kg (fresh weight) per hour may produce up to 120 ug/kg per hour during ripening of fruits and during senescence and loss of leaves(1). Ethylene has been found in the gaseous metabolites released by germinating bean, corn, cotton, and pea seeds, from fading morning glory flowers and from ripening avocadoes and apples(2). Ethylene is released to the atmosphere from biomass combustion and volcanos(3). Photodegradation of dissolved organic material (possibly released from plankton) is expected to be the primary production mechanism of ethylene in the mid-Atlantic ocean(4). [(1) IARC; IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Ethylene 60: 45-71 (1994) (2) Mattheis JP et al; J Agric Food Chem 39: 1902-6 (1991) (3) Graedel TE et al; Atmospheric Chemical Compounds. Orlando, FL: Academic Press Inc p. 142 (1986) (4) Plass C et al; J Atmos Chem 15: 235-51 (1992)]**PEER REVIEWED**

The total annual emission of ethylene from the global surface is estimated as 18-45 million tons, of which approximately 74% is emitted from natural sources(1). [(1) IARC; IARC Monographs on the Evaluation of the

Carcinogenic Risk of Chemicals to Humans. Ethylene 60: 45-71 (1994)]**PEER REVIEWED**

ARTIFICIAL POLLUTION SOURCES:

Ethylene's production and use as a chemical intermediate and precursor in industrial organic synthesis, in the welding and cutting of metals, as a plant growth regulator, as a refrigerant(1-3), and formerly as an anesthetic(3) may result in its release to the environment through various waste streams(SRC). Its use as a plant growth regulator will result in its direct release to the environment(1,3). [(1) IARC; IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 60: 45-71 (1994) (2) Lewis RJ; Hawley's Condensed Chemical Dictionary 14th ed. NY, NY: John Wiley & Sons p.463 (2001) (3) O'Neil MJ ed; The Merck Index. 13th ed. Whitehouse Station, NJ: Merck and Co., Inc. p 674 (2001)]**PEER REVIEWED**

Ethylene is emitted from the burning of vegetation, agricultural wastes, and refuse, from the incomplete combustion of fossil fuels(1). It is believed that burning of biomass to clear land for agriculture or other uses contribute 77% of the anthropogenic emissions of ethylene , followed by combustion of fossil fuels, which contribute 21% of the anthropogenic emissions (1). Cigarette smoke contains ethylene (1-2 mg released per cigarette)(1). [(1) IARC; IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. Ethylene 60: 45-71 (1994)]**PEER REVIEWED**

Dioxolane ... the aliphatic analog of the known cytochrome inhibitor, methylenedioxybenzene ... breaks down to ethylene and carbon dioxide. [The Royal Society of Chemistry. Foreign Compound Metabolism in Mammals. Volume 6: A Review of the Literature Published during 1978 and 1979. London: The Royal Society of Chemistry, 1981., p. 332]**PEER REVIEWED**

ENVIRONMENTAL FATE:

TERRESTRIAL FATE: Based on a classification scheme(1), an estimated Koc value of 98(SRC), determined from a log Kow of 1.13(2) and a regression-derived equation(3), indicates that ethylene is expected to have high mobility in soil(SRC). Volatilization of ethylene from moist soil surfaces is expected to be an important fate process(SRC) given a Henry's Law constant of 0.228 atm-cu m/mole(4). Ethylene is expected to volatilize from dry soil surfaces(SRC) based upon an estimated vapor pressure of 5.21X10+4 mm Hg(5). [(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 4 (1995) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 4-9 (1990) (4) Wasik SP, Tsang W; J Phys Chem 74:2970-6 (1970) (5) Daubert TE, Danner RP; Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, DC: Taylor and Francis (1989)]**PEER REVIEWED**

AQUATIC FATE: Based on a classification scheme(1), an estimated Koc value of 98(SRC), determined from a log Kow of 1.13(2) and a regression-derived equation(3), indicates that ethylene is not expected to adsorb to suspended solids and sediment(SRC). Volatilization from water surfaces is expected(3) based upon a Henry's Law constant of 0.228 atm-cu m/mole(4). Using this Henry's Law constant and an estimation method(3), volatilization half-lives for a model river and model lake are 30 minutes and 2 days, respectively(SRC). According to a classification scheme(5), an estimated BCF of 4(SRC), from its log Kow(2) and a regression-derived equation(6), suggests the potential for bioconcentration in aquatic organisms is low(SRC). [(1) Swann RL et al; Res Rev 85: 17-28 (1983) (2) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 4 (1995) (3) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 4-9, 15-1 to 15-29 (1990) (4) Wasik SP, Tsang W; J Phys Chem 74:2970-6 (1970) (5)

Franke C et al; Chemosphere 29: 1501-14 (1994) (6) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999)]**PEER REVIEWED**

ATMOSPHERIC FATE: According to a model of gas/particle partitioning of semivolatile organic compounds in the atmosphere(1), ethylene, which has an estimated vapor pressure of 5.21X10+4 mm Hg at 25 deg C(2), is expected to exist solely as a gas in the ambient atmosphere. Gas-phase ethylene is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals(SRC); the half-life for this reaction in air is estimated to be 1.9 days(SRC), calculated from its rate constant of 8.52X10-12 cu cm/molecule-sec at 25 deg C(3). Gas-phase ethylene will also be degraded in the atmosphere by reaction with ozone and nitrate radicals with respective half-lives of 6.5 and 190 days(4,5,6). Ethylene does not contain chromophores that absorb at wavelengths > 290 nm and therefore is not expected to be susceptible to direct photolysis by sunlight(SRC).
[(1) Bidleman TF; Environ Sci Technol 22: 361-367 (1988) (2) Daubert TE, Danner RP; Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, DC: Taylor and Francis (1989) (3) Atkinson R; J Phys Chem Ref Data Monograph No. 1 p.99 (1989) (4) Atkinson R, Carter WPL; Chem Rev 84: 437-70 (1984) (5) Sabljic A, Guesten H; Atmos Environ 24A: 73-8 (1990) (6) Atkinson R et al; Environ Sci Technol 21: 1123-6 (1987)]**PEER REVIEWED**

ENVIRONMENTAL BIODEGRADATION:
Pure culture studies suggest that ethylene may be susceptible to microbial degradation(1-3). [(1) Hou CT et al; Appl Environ Microbiol 46: 171-7 (1983) (2) Patel RN et al; Div Ind Microbial 23: 187-205 (1982) (3) Hou CT et al; Appl Environ Microbiol 38: 127-34 (1979)]**PEER REVIEWED**

ENVIRONMENTAL ABIOTIC DEGRADATION:
Estimated lifetime under photochemical smog conditions in S.E. England: 7.2 hours. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p.

633]**PEER REVIEWED**

The rate constant for the gas-phase reaction of ethylene with photochemically-produced hydroxyl radicals is 8.52X10-12 cu cm/molecule-sec at 25 deg C(1). This corresponds to an atmospheric half-life of about 1.9 days at an atmospheric concentration of 5X10+5 hydroxyl radicals per cu cm(1). The rate constant for the vapor-phase reaction of ethylene with ozone in the troposphere is measured to be 1.75X10-18 cu cm/molecule-sec at 25 deg C(2) which corresponds to a half-life of about 6.5 days at an atmospheric concentration of 7X10+11 molecules per cu cm(2). The rate constant for the vapor-phase reaction of ethylene with nitrate radicals (NO3) is measured to be 2.14X10-16 cu cm/molecule-sec at 25 deg C(3) which corresponds to a half-life of about 190 days at an atmospheric concentration of 2X10+8 NO3 radicals per cu cm(4). Ethylene is not expected to undergo hydrolysis in the environment due to the lack of functional groups that hydrolyze under environmental conditions(5). Ethylene does not contain chromophores that absorb at wavelengths > 290 nm and therefore is not expected to be susceptible to direct photolysis by sunlight(SRC). [(1) Meylan WM, Howard PH; Chemosphere 26: 2293-99 (1993) (2) Wasik SP, Tsang W; J Phys Chem 74:2970-6 (1970) (2) Atkinson R, Carter WPL; Chem Rev 84: 437-70 (1984) (3) Sabljic A, Guesten H; Atmos Environ 24A: 73-8 (1990) (4) Atkinson R et al; Environ Sci Technol 21: 1123-6 (1987) (5) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 7-4, 7-5 (1990)]**PEER REVIEWED**

ENVIRONMENTAL BIOCONCENTRATION:

An estimated BCF of 4 was calculated for ethylene(SRC), using a log Kow of 1.13(1) and a regression-derived equation(2). According to a classification scheme(3), this BCF suggests the potential for bioconcentration in aquatic organisms is low(SRC). [(1) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 4

(1995) (2) Meylan WM et al; Environ Toxicol Chem 18: 664-72 (1999) (3) Franke C et al; Chemosphere 29: 1501-14 (1994)]**PEER REVIEWED**

SOIL ADSORPTION/MOBILITY:

The Koc of ethylene is estimated as 98(SRC), using a log Kow of 1.13(1) and a regression-derived equation(2). According to a classification scheme(3), this estimated Koc value suggests that ethylene is expected to have high mobility in soil. [(1) Hansch C et al; Exploring QSAR. Hydrophobic, Electronic, and Steric Constants. ACS Prof Ref Book. Heller SR, consult. ed., Washington, DC: Amer Chem Soc p. 4 (1995) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 4-9 (1990) (3) Swann RL et al; Res Rev 85: 17-28 (1983)]**PEER REVIEWED**

VOLATILIZATION FROM WATER/SOIL:

The Henry's Law constant for ethylene is 0.228 atm-cu m/mole(1). This Henry's Law constant indicates that ethylene is expected to volatilize rapidly from water surfaces(2). Based on this Henry's Law constant, the volatilization half-life from a model river (1 m deep, flowing 1 m/sec, wind velocity of 3 m/sec)(2) is estimated as 30 minutes(SRC). The volatilization half-life from a model lake (1 m deep, flowing 0.05 m/sec, wind velocity of 0.5 m/sec)(2) is estimated as 2 days(SRC). Ethylene's Henry's Law constant indicates that volatilization from moist soil surfaces may occur(SRC). Ethylene is expected to volatilize from dry soil surfaces(SRC) based upon an estimated vapor pressure of 5.21X10+4 mm Hg(3). [(1) Wasik SP, Tsang W; J Phys Chem 74: 2970-6 (1970) (2) Lyman WJ et al; Handbook of Chemical Property Estimation Methods. Washington, DC: Amer Chem Soc pp. 15-1 to 15-29 (1990) (3) Daubert TE, Danner RP; Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, DC: Taylor and Francis (1989)]**PEER REVIEWED**

ENVIRONMENTAL WATER CONCENTRATIONS:

SURFACE WATER: Ethylene was found at a concn range of 63-246 pMol/L in sea water from the mid-Atlantic ocean during September and October of 1988(2).

In April of 1985, ethylene was detected in several water samples taken from the Indian Ocean along the coast of Madagascar and Africa at a concn range of 6-36 ppbV(1). In June of 1976, ethylene was found in South Texas Coastal waters at a concn range of 5.8-13.2 nl/L; the major source of ethylene in this area is expected to be offshore petroleum operations(3). In 1977, concns of ethylene (20.1 and 20.7 nl/L) were detected in the Gulf of Mexico near the outflow of the Mississippi River and the discharge of formation waters and hydrocarbon venting from offshore oil production; other concns monitored in the Gulf of Mexico ranged from 0.6-5 nl/L(4). Ethylene concns in the Caribbean Sea were monitored to be 3.7-4.7 nl/L in 1977(4). [(1) Bonsang B et al; J Atmos Chem 6: 3-20 (1988) (2) Plass C et al; J Atmos Chem 15: 235-51 (1992) (3) Brooks JM et al; pp. 373-83 in Fate and Effects of Petroleum Hydrocarbons in Marine Organisms and Ecosystems. Wolfe DA, Ed. NY, NY: (1977) (4) Sauer TCJR; Limnol Oceanogr 25: 338-51 (1980)]**PEER REVIEWED**

SURFACE WATER: During 1966-1973, ethylene was found in several surface waters (concn): Gulf of Mexico (1.7-35 nl/L), Caribbean Sea (2.2-12 nl/L), Atlantic Ocean (1.1-11 nl/L), Pacific Ocean (2-11 nl/L), York River, VA (13 nl/L), Potomac River (11 nl/L), and the lower Chesapeake Bay (9 nl/L)(1). [(1) Swinnerton JW, Lamontagne RA; Environ Sci Technol 8: 657-63 (1974)]**PEER REVIEWED**

RAIN/SNOW/FOG: Ethylene concentration in interstitial air within the Arctic snowpack was 0.14 ppbv, collected from ice camp NARWHAL in April, 1994(1). [(1) Ariya PA et al; J Atmos Chem 34: 55-64 (1999)]**PEER REVIEWED**

EFFLUENT CONCENTRATIONS:

In May of 1983, emissions of ethylene from automobile exhaust ranged from 4.45 to 7.44 %TNMHC (total non-methane hydrocarbon) at 6 sites on U.S. Highway 70, Raleigh, NC(1). Emissions of ethylene from various gasoline fueled engines ranged from 108-135 mg/km driven(2). In another study, emissions of ethylene from various gasoline fueled engines averaged 211.94 mg/km driven in an urban area, 123.2 mg/km driven in a suburban area, 93.39 mg/km driven in a rural area, and 82.58-102.26 mg/km driven on a motorway(3). Furthermore, emissions of ethylene increased from about 6.2 to about 13 % of total hydrocarbon content (THC) when the speed increased from 20 km/hr to about 115 km/hr(3). Ethylene concns ranged from 0.04-1.06 ppm in air containing automotive emissions(4). Ethylene was qualitatively identified in emissions from burning polyethylene(5) and it has been detected in emissions from alkylate-powered lawn mowers and mopeds(7). The average concn of ethylene in the Lincoln Tunnel (connecting Weehawhen, NJ with Manhattan Island, NY) was 1,374.9 ppbC in 1970 and 408.7 ppbC in 1982(6). [(1) Zweidinger RB et al; Environ Sci Technol 22: 956-62 (1988) (2) Westerholm RN et al; Environ Sci Technol 22: 925-30 (1988) (3) Bailey JC et al; Atmos Environ 24A: 43-52 (1990) (4) Bellar T et al; Anal Chem 34: 763-5 (1962) (5) Hodgkin JH et al; J Macromol Sci-Chem A17: 35-44 (1982) (6) Lonneman WA et al; Environ Sci Technol 20: 790-6 (1986) (7) Ostermark U, Petersson G; Chemosphere 27: 1719-28 (1993)]**PEER REVIEWED**

Ethylene was detected in 9 jet engine emission samples at a concn range of 0.27-731.3 ppmC(1). Ethylene was detected at a concn range of 537-847 ppb in 3 wood combustion emissions(2). Ethylene was qualitatively identified in stack emissions from waste incineration(3). Emissions of ethylene from various gasoline fueled cars were: 3.02-5.31 % of total hydrocarbon content (THC) in a 1987 Toyota Camry, 3.55-7.04 %THC in a 1986 GM Grand Am, 3.8-5.91 %THC in a 1986 Ford Mustang, 5.32-9.27 %THC in a 1984 GM Cavalier, 3.13-4.75 %THC in a 1986 Chrysler Omni, 2.84-5.61 %THC in a 1987 Nissan Sentra, 4.04-6.71 %THC in a 1985 Honda Accord, 3.42-5.82 %THC in a 1987 Toyota Corolla, and 4.27- 6.37 %THC in a 1987 Dodge Caravelle(4). An average high-volume roadway concentration measured during August, 1990 in Atalanta, GA was 4.34 ppbc; the weighted average whole gas concentration was 0.00631 ppbC(5). Average ethylene emissions from two passenger ferries operating in the Skagerak-Kattegatt-Oresund region of Sweden were reported as 2.4 and 5.3 mg/cu nm during low speed manoeuvring and 4.6 and 4.7 during crossings(6). Ethylene emissions from cookstoves in common use in China that are fueled with briquettes, coal, wood, wheat residue, maize residue, kerosene, liquified petroleum gas, coal gas, and natural gas were 1.52-8.87, 54.9-2856, 257-612, 699, 296-334, 185, 0.885, 6.87, and 5.72 ng/kg dry fuel, respectively(7). Median concentrations of ethylene emissions from residential fireplaces using softwood and hardwood fuel were 715.05 and 1069.78 mg/kg, respectively; a concentration of 2528.65 mg/kg was measured from a woodstove using hardwood fuel(8). Ethylene was detected not quantified using a synthetic log fuel(8). [(1) Katzman H, Libby WF; Atmos Environ 9: 839-42 (1975) (2) Kleindienst TE et al; Environ Sci Technol 20: 493-501 (1986) (3) Junk GA, Ford CS; Chemosphere 9: 187-230 (1980) (4) Stump F et al; Atmos Environ 23: 307-20 (1989) (5) Conner TL et al; J Air Waste Manage Assoc 45: 383-94 (1995) (6) Cooper DA et al; Atmos Environ 30: 2463-73 (1996) (7) Tsai SM et al; Environ Sci Technol 37: 2869-77 (2003) (8) McDonald JD et al; Environ Sci Technol 34: 2080-91 (2000)]**PEER REVIEWED**

SEDIMENT/SOIL CONCENTRATIONS:

SEDIMENT: In 1977, ethylene concns in core samples taken from the Bearing shelf, Bearing slope, and Aleutian basin were: 10-131, 11-91, and 9-150 ml/L interstitial water, respectively(1). [(1) Kvenvolden KA, Redden GD; Geochim Cosmochim ACTA 44: 1145-50 (1980)]**PEER REVIEWED**

ATMOSPHERIC CONCENTRATIONS:

... Detected in average community air at very low levels, but is more prevalent in the air of large metropolitan areas. [Clayton, G. D. and F.

E. Clayton (eds.). Patty's Industrial Hygiene and Toxicology: Volume 2A, 2B, 2C: Toxicology. 3rd ed. New York: John Wiley Sons, 1981-1982., p. 3198]**PEER REVIEWED**

Urban air: 12-250 ppb; downtown Los Angeles, California: 20-102 ppb; East San Gabriel Valley: 15-37 ppb. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 633]**PEER REVIEWED**

URBAN/SUBURBAN: In September of 1969, ethylene was detected in the ambient air of Pt. Barrow, AK at an average concn of 0.5 ppb(1). Ethylene was detected in the ambient air of Jetmore, KA and San Jose, CA at respective concns of 383 and 6796 parts per trillion(2). The average ethylene concn monitored in the ambient air of Harwell, England was 2.3 ppb(3). The concn range of ethylene in Houston air, which includes industrial locations and tunnels, was monitored to be 3.15-682 ppb during September of 1973-April of 1974(4). Ethylene concns over a 10 day period ranged from 6 to 8 ppb, sampled at Sveavagen Sweden from November 29 to December 9, 1986(5). Mass concns of ethylene/CO were 5.7X10-3, 6.1X10-3 to 8.6X10-3, and 14.9X10-3 in Swedish urban air samples from Sveavagen, Horsngratan, and car exhausts, respectively(5). [(1) Cavanaugh LA et al; Environ Sci Technol 3: 251-7 (1969) (2) Singh HB et al; Atmospheric Distributions, Sources and Sinks of Selected Halocarbon, Halocarbons, SF6 + N2O .USEPA-600/3-79-107 (1979) (3) Cox RA et al; AERE-R8324, Harwell, Oxfordshire: UK Atomic Energy Authority (1976) (4) Lonneman WA et al; Hydrocarbons in Houston Air, USEPA-600/3-79/018 (1979) (5) Bostrom CE et al; Environ Health Perspect 102(Suppl 4): 39-47 (1994)]**PEER REVIEWED**

INDOOR AIR: Ethylene was qualitatively identified in trace amounts in nuclear submarine atmospheres(1). Ethylene was detected at an average concn of 490 ppbV in the indoor air of a house in Sundarijal, Nepal during December of 1982-January of 1983; the use of biomass fuels is expected to be responsible for the high ethylene concn(2). [(1) Schaefer KE; Arch Environ Health 9: 320-31 (1964) (2) Davidson CI et al; Environ Sci Technol 20: 561-567 (1986)]**PEER REVIEWED**

RURAL/REMOTE: In January of 1980, ethylene was detected at concns of 50 and 200 parts per trillion in trace gases from the South Pole and the Pacific Northwest (approximately 45 deg N), respectively(1). Ethylene was detected at an average concn range of 0.6-1.7 ppb in ambient air samples taken in Exelberg, Austria during July 15-August 22, 1987(2). Ethylene was detected at a concn range of 2.7-16.2 in 15 of 15 ambient air samples from both picnic and interior forest sites taken at Jones State Forest, TX in January of 1978(3). Ethylene was detected in the ambient air of Tulsa, OK at a concn range of 6.5-11.5 ppbC on July 27, 1978; 37 km downwind from this site, in a rural atmosphere, ethylene was detected at a concn of 1 ppbC(4). Ethylene was detected in the ambient air of Smoky Mountain National Park, TN at a concn range of 1.4-7.4 ppbC in September of 1978(4). Ethylene was detected in the ambient air of Rio Blanco county, CO at a concn range of 1.2-1.4 ppbC in September of 1978(4). Ethylene concentrations in Arctic air samples ranged from 0.014 to 1.7 ppbv, collected in April, 1994(5). Mean concn ranges from four rural locations across Canada were 0.20-1.15 ppbv, 0.12-1.04 ppbv, 0.29-1.35 ppbv, and 0.23-1.17 ppbv for Kejimkujil National Park, Nova Scotia, Lac la Flamme Province Quebec, Egbert Ontario, and Saturna Island, British Columbia, respectively(6). [(1) Rasmussen RA et al; Science 211: 285-87 (1981) (2) Puxbaum H et al; Atmos Environ 22: 2841-50 (1988) (3) Seila RL; Non-Urban Hydrocarbon Concentrations in Ambient Air North of Houston, Texas, USEPA-500/3-79-010 (1979) (4) Arnts RR, Meeks SA; Biogenic Hydrocarbon Contribution to the Ambient Air of Selected Areas, USEPA-600/3-80-023 (1980) (5) Ariya PA et al; J Atmos Chem 34: 55-64 (1999) (6) Bottenheim

JW, Shepard MF; Atmos Environ 29: 647-64 (1995)]**PEER REVIEWED**

SOURCE DOMINATED: The mass concentration of ethylene/CO was 14.9X10-3 from car exhausts sampled in Sveavagen, Sweden(1). [(1) Bostrom CE et al; Environ Health Perspect 102(Suppl 4): 39-47 (1994)]**PEER REVIEWED**

FOOD SURVEY VALUES:

Ethylene was detected at concns of 2.27 and 9.32 uL/l in internal samples of Bisbee Delicious apples from 2 orchards during fruit growth and maturation in 1990(1). Ethylene has been found in the gaseous metabolites released by germinating bean, corn, cotton, and pea seeds(2). [(1) Mattheis JP et al; J Agric Food Chem 39: 1902-6 (1991) (2) IARC; IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. 19: 157-86 (1979)]**PEER REVIEWED**

PLANT CONCENTRATIONS:

Ethylene is produced by all plant tissue in significant amounts and acts as an endogenous plant growth regulator(1). [(1) IARC; IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans 19: 157-86 (1979)]**PEER REVIEWED**

OTHER ENVIRONMENTAL CONCENTRATIONS:

The average airborne yield of ethylene was measured to be 1,200 ug/cigarette(1). [(1) Lofroth G et al; Environ Sci Technol 23: 610-14 (1989)]**PEER REVIEWED**

ENVIRONMENTAL STANDARDS & REGULATIONS:

FIFRA REQUIREMENTS:

Section 4(g)(2)(A) of FIFRA requires the Agency to determine, after submission of relevant data concerning an active ingredient, whether products containing the active ingredient are eligible for reregistration.

The Agency has waived all generic (ie, active ingredient specific) data requirements except for technical chemistry data and additionally has relied on public literature for mammalian toxicology. The Agency has completed its review of this information data and other factors and considerations, and has determined this information is sufficient to support reregistration of all products containing ethylene for all uses. ... The Agency therefore finds that products containing only ethylene as an active ingredient are eligible for reregistration and may be reregistered once the confidential statements of formula and amended labeling are received and accepted by the Agency. [USEPA/Office of Pesticide Programs; Reregistration Eligibility Decision Document - Ethylene. Available from the Database Query page at http://cfpub.epa.gov/oppref/rereg/status.cfm?show=rereg as of June 1, 2005]**PEER REVIEWED**

As the federal pesticide law FIFRA directs, EPA is conducting a comprehensive review of older pesticides to consider their health and environmental effects and make decisions about their future use. Under this pesticide reregistration program, EPA examines health and safety data for pesticide active ingredients initially registered before November 1, 1984, and determines whether they are eligible for reregistration. In addition, all pesticides must meet the new safety standard of the Food Quality Protection Act of 1996. Pesticides for which EPA had not issued Registration Standards prior to the effective date of FIFRA '88 were divided into three lists based upon their potential for human exposure and other factors, with List B containing pesticides of greater concern and List D pesticides of less concern. Ethylene is found on List C. Case No: 3071; Pesticide type: herbicide; Case Status: RED Approved 9/92; OPP has made a decision that some/all uses of the pesticide are eligible for reregistration, as reflected in a Reregistration Eligibility Decision (RED) document .; Active ingredient (AI): ethylene; AI Status: OPP has completed a Reregistration Eligibility Decision (RED) for the case/AI.. [United States Environmental Protection Agency/ Prevention, Pesticides and Toxic Substances; Status of Pesticides in Registration, Reregistration, and Special Review. (1998) EPA 738-R-98-002, p.

254]**PEER REVIEWED**

Ethylene is exempted from the requirement of a tolerance for residues when: (a) For all food commodities, it is used as a plant regulator on plants, seeds, or cuttings and on all food commodities after harvest and when applied in accordance with good agricultural practices. (b) Injected into the soil to cause premature germination of witchweed in bean (lima and string), cabbage, cantaloupe, collard, corn, cotton, cucumber, eggplant, okra, onion, pasture grass, pea (field and sweet), peanut, pepper, potato, sweet potato, sorghum, soybean, squash, tomato, turnip, and watermelon fields as part of the U.S. Department of Agriculture witchweed control program. [40 CFR 180.1016; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from: http://www.gpoaccess.gov/ecfr as of June 1, 2005]**PEER REVIEWED**

ALLOWABLE TOLERANCES:

Ethylene is exempted from the requirement of a tolerance for residues when: (a) For all food commodities, it is used as a plant regulator on plants, seeds, or cuttings and on all food commodities after harvest and when applied in accordance with good agricultural practices. (b) Injected into the soil to cause premature germination of witchweed in bean (lima and string), cabbage, cantaloupe, collard, corn, cotton, cucumber, eggplant, okra, onion, pasture grass, pea (field and sweet), peanut, pepper, potato, sweet potato, sorghum, soybean, squash, tomato, turnip, and watermelon fields as part of the U.S. Department of Agriculture witchweed control program. [40 CFR 180.1016; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from: http://www.gpoaccess.gov/ecfr as of June 1, 2005]**PEER REVIEWED**

CHEMICAL/PHYSICAL PROPERTIES:

MOLECULAR FORMULA:

C2-H4 **PEER REVIEWED**

MOLECULAR WEIGHT:

28.05 [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

COLOR/FORM:

Colorless gas [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

Monoclinic prisms when it solidifies at -181 deg C [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

ODOR:

Sweet [Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 14th Edition. John Wiley & Sons, Inc. New York, NY 2001., p. 462]**PEER REVIEWED**

Olefinic, hedonic tone: unpleasant to neutral [Que Hee, S. (ed.). Biological Monitoring an Introduction. New York, NY: Van Nostrand Reinhold Co., 1993., p. 1089]**PEER REVIEWED**

BOILING POINT:

-102.4 deg C at 700 mm Hg [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

MELTING POINT:

-169 deg C [Lide, DR (ed.). CRC Handbook of Chemistry and Physics. 81st Edition. CRC Press LLC, Boca Raton: FL 2000, p. 3-163]**PEER REVIEWED**

CORROSIVITY:

Ethylene is a noncorrosive gas. [General Electric Co; Material Safety Data Sheet #457 (1981)]**PEER REVIEWED**

CRITICAL TEMPERATURE & PRESSURE:

Critical temperature: +9.6 deg C; critical pressure: 50.7 atm [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

DENSITY/SPECIFIC GRAVITY:

50.5678 g/cu cm at -104 deg C [Lide, DR (ed.). CRC Handbook of Chemistry and Physics. 81st Edition. CRC Press LLC, Boca Raton: FL 2000, p. 3-163]**PEER REVIEWED**

HEAT OF COMBUSTION:

-11,272 cal/g = -471.94x10+5 J/kg [U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

HEAT OF VAPORIZATION:

207.7 Btu/lb = 115.4 cal/g = 4.832x10+5 J/kg [U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

OCTANOL/WATER PARTITION COEFFICIENT:

log Kow = 1.13 [Hansch, C., Leo, A., D. Hoekman. Exploring QSAR - Hydrophobic, Electronic, and Steric Constants. Washington, DC: American Chemical Society., 1995., p. 4]**PEER REVIEWED**

SOLUBILITIES:

1 vol dissolves in about 4 vol water at 0 deg C, in about 9 vol water at 25 deg C, in about 0.5 vol alcohol at 25 deg C, in about 0.05 vol ether at 15.5 deg C [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

Sol in acetone, benzene [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

In water, 131 mg/L at 25 deg C [McAuliffe C; J Phys Chem 70: 1267-75 (1966)]**PEER REVIEWED**

SPECTRAL PROPERTIES:

MAX ABSORPTION (GAS): 161.5 NM (LOG E= 3.92) [Weast, R.C. (ed.). Handbook of Chemistry and Physics. 60th ed. Boca Raton, Florida: CRC Press Inc., 1979., p. C-298]**PEER REVIEWED**

Index of refraction: 1.363 at 100 deg C/D [Lide, DR (ed.). CRC Handbook of Chemistry and Physics. 81st Edition. CRC Press LLC, Boca Raton: FL 2000, p. 3-163]**PEER REVIEWED**

IR: 1131 (Sadtler Research Laboratories Prism Collection) [Lide, D.R., G.W.A. Milne (eds.). Handbook of Data on Organic Compounds. Volume I. 3rd ed. CRC Press, Inc. Boca Raton ,FL. 1994., p. V3: 2758]**PEER REVIEWED**

UV: 3-3 (Organic Electronic Spectral Data, Phillips et al, John Wiley & Sons, New York) [Lide, D.R., G.W.A. Milne (eds.). Handbook of Data on Organic Compounds. Volume I. 3rd ed. CRC Press, Inc. Boca Raton ,FL. 1994., p. V3: 2758]**PEER REVIEWED**

MASS: 184 (Atlas of Mass Spectral Data, John Wiley & Sons, New York); 61310 (NIST/EPA/MSDC Mass Spectral Database, 1990 version) [Lide, D.R., G.W.A. Milne (eds.). Handbook of Data on Organic Compounds. Volume I. 3rd ed. CRC Press, Inc. Boca Raton ,FL. 1994., p. V3: 2758]**PEER REVIEWED**

13C NMR: 184 (Stothers, Carbon-13 NMR Spectroscopy, Academic Press, NY) [Lide, D.R., G.W.A. Milne (eds.). Handbook of Data on Organic Compounds. Volume I. 3rd ed. CRC Press, Inc. Boca Raton ,FL. 1994., p. V3: 2758]**PEER REVIEWED**

SURFACE TENSION:

16 dynes/cm = 0.016 N/m at -104 deg C [U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

VAPOR DENSITY:

0.978 (Air= 1) [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ:

Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

VAPOR PRESSURE:

5.21X10+4 mm Hg at 25 deg C /Extrapolated/ [Daubert, T.E., R.P. Danner. Physical and Thermodynamic Properties of Pure Chemicals Data Compilation. Washington, D.C.: Taylor and Francis, 1989., p.]**PEER REVIEWED**

VISCOSITY:

0.01 mPa.s 20 deg C [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.4 (1981)]**PEER REVIEWED**

OTHER CHEMICAL/PHYSICAL PROPERTIES:

1 mg/cu m = 0.86 ppm; 1 ppm = 1.17 mg/cu m [Que Hee, S. (ed.). Biological Monitoring an Introduction. New York, NY: Van Nostrand Reinhold Co., 1993., p. 1089]**PEER REVIEWED**

Burns with a luminous flame [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

Specific gravity: 0.57 at -130.8 deg C [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 225]**PEER REVIEWED**

Latent heat of fusion 3.33 kj/mole (-169.4 deg C). Latent heat of vaporization 13.6 kj/mole (-103.8 deg C). Heat of formation 52.47 kj/mole (25 deg C). Ionization potential 10.51 eV. Heat capacity, constant pressure: 1.516 J/g deg C; Heat capacity, constant volume: 1.220 J/g deg C. Coefficient of thermal expansion 3.7x10-3 at 20 deg C. Heat of combustion 1,411 Kj/mole [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.4 (1981)]**PEER REVIEWED**

POLYMERIZES AT HIGH PRESSURES [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 158 (1979)]**PEER REVIEWED**

Vapor pressure 4,040 kPa (-1.5 deg C) [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.3 (1981)]**PEER REVIEWED**

Henry's Law constant = 0.228 atm-cu m/mole at 25 deg C [Wasik SP, Tsang W; J Phys Chem 74: 2970-6 (1970)]**PEER REVIEWED**

Hydroxyl radical reaction rate constant = 8.52X10-12 cu cm/molec-sec at 25 deg C [Atkinson R; J Chem Phys Ref Data Monograph 1 (1989)]**PEER REVIEWED**

Ozone rate constant = 0.175X10-17 cu cm/molec-sec at 25 deg C (est) [US EPA; Estimation Program Interface (EPI) Suite. Ver.3.11. June 10, 2003. Available at http://www.epa.gov/oppt/exposure/docs/episuitedl.htm as of Jul 27, 2005.]**PEER REVIEWED**

CHEMICAL SAFETY & HANDLING:

DOT EMERGENCY GUIDELINES:

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Fire or Explosion: EXTREMELY FLAMMABLE. Will be easily ignited by heat, sparks or flames. Will form explosive mixtures with air. Vapors from liquefied gas are initially heavier than air and spread along ground. ... Vapors may travel to source of ignition and flash back. Cylinders exposed to fire may vent and release flammable gas through pressure relief devices. Containers may explode when heated. Ruptured cylinders may rocket. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Health: Vapors may cause dizziness or asphyxiation without warning. Some may be irritating if inhaled at high concentrations. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite. Fire may produce irritating and/or toxic gases. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency

Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Public Safety: CALL Emergency Response Telephone Number. ... As an immediate precautionary measure, isolate spill or leak area for at least 100 meters (330 feet) in all directions. Keep unauthorized personnel away. Stay upwind. Many gases are heavier than air and will spread along ground and collect in low or confined areas (sewers, basements, tanks). Keep out of low areas. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Protective Clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. Always wear thermal protective clothing when handling refrigerated/cryogenic liquids. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Evacuation: Large spill: Consider initial downwind evacuatin for at least 800 meters (1/2 mile). Fire: If tank, rail car or tank truck is involved in a fire, ISOLATE for l600 meters (1 mile) in all directions; also, consider initial evacuation for 1600 meters (1 mile) in all directions. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First

Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Fire: DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. ... Small fires: Dry chemical or CO2. Large fires: Water spray or fog. Move containers from fire area if you can do it without risk. Fire involving tanks: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ Spill or Leak: ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if you can do it without risk. If possible, turn leaking containers so that gas escapes rather than liquid. Use water spray to reduce vapors or divert vapor cloud drift. Avoid allowing water runoff to contact spilled material. Do not direct water at spill or source of leak. Prevent spreading of vapors through sewers, ventilation systems and confined areas. Isolate area until gas has dispersed. CAUTION: When in contact with refrigerated/cryogenic liquids, many materials become brittle and are likely to break without warning. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response

Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 115: GASES - FLAMMABLE (INCLUDING REFRIGERATED LIQUIDS)/ First Aid: Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. Clothing frozen to the skin should be thawed before being removed. In case of contact with liquefied gas, thaw frosted parts with lukewarm water. In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adhering to skin. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. /Etylene, refrigerated liquid (cryogenic liquid)/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-115]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Fire or Explosion: EXTREMELY FLAMMABLE. Will be easily ignited by heat, sparks or flames. Will form explosive mixtures with air. ... Those substances designated with a "P" may polymerize explosively when heated or involved in a fire. Vapors from liquefied gas are initially heavier than air and spread along ground. Vapors may travel to source of ignition and flash back. Cylinders exposed to fire may vent and release flammable gas through pressure relief devices. Containers may explode when heated. Ruptured cylinders may rocket. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Health: Vapors may cause dizziness or asphyxiation without warning. Some may be toxic if inhaled at high concentrations. Contact with gas or liquefied gas may cause burns, severe injury and/or frostbite. Fire may produce irritating and/or toxic gases. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

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/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Protective Clothing: Wear positive pressure self-contained breathing apparatus (SCBA). Structural firefighters' protective clothing will only provide limited protection. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Evacuation: Large spill: Consider initial downwind evacuation for at least 800 meters (1/2 mile). 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. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a

Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Fire: DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED. Small fires: Dry chemical or CO2. Large fires: Water spray or fog. Move containers from fire area if you can do it without risk. Fire involving tanks: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles, if this is impossible, withdraw from area and let fire burn. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ Spill or Leak: ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). All equipment used when handling the product must be grounded. Stop leak if you can do it without risk. Do not touch or walk through spilled material. 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. 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. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

/GUIDE 116: GASES - FLAMMABLE (UNSTABLE)/ First Aid: Move victim to fresh air. Call 911 or emergency medical service. Give artificial respiration if victim is not breathing. Administer oxygen if breathing is difficult. Remove and isolate contaminated clothing and shoes. In case of contact with liquefied gas, thaw frosted parts with lukewarm water. In case of burns, immediately cool affected skin for as long as possible with cold water. Do not remove clothing if adherencing to skin. Keep victim warm and quiet. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves. /Ethylene; Ethylene, compressed/ [U.S. Department of Transportation. 2004 Emergency Response Guidebook. A Guide book for First Responders During the Initial Phase of a Dangerous Goods/Hazardous Materials Incident. Washington, D.C. 2004G-116P]**QC REVIEWED**

ODOR THRESHOLD:

Odor Index at 20 deg C = 57,100 [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 633]**PEER REVIEWED**

Detection in air by odor (purity not specified) 2.60x10+2 ppm. [ASTM; Compilation of Odor and Taste Threshold Values Data p.71 (1978)]**PEER REVIEWED**

SKIN, EYE AND RESPIRATORY IRRITATIONS:

... May cause... eye irriation. [European Chemicals Bureau; IUCLID Dataset, Ethylene (74-85-1) (2000 CD-ROM edition). Available from the database query page: http://ecb.jrc.it/esis/esis.php as of July 13, 2005.]**PEER REVIEWED**

FIRE POTENTIAL:

Flammable gas [Fire Protection Guide to Hazardous Materials. 12 ed. Quincy, MA: National Fire Protection Association, 1997., p. 49-66]**PEER REVIEWED**

A very dangerous fire hazard when exposed to heat or flame ... [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes

      1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER
REVIEWED**

NFPA HAZARD CLASSIFICATION:
      Health: 2. 2= Materials that, on intense or continued (but not
chronic)
      exposure, could cause temporary incapacitation or possible
residual
      injury, including those requiring the use of respiratory
protective
      equipment that has an independent air supply. These materials are
      hazardous to health, but areas may be entered freely if personnel
are
      provided with full-face mask self-contained breathing apparatus
that
      provides complete eye protection. [Fire Protection Guide to
Hazardous
      Materials. 13 ed. Quincy, MA: National Fire Protection
Association, 2002.,
      p. 325-60]**PEER REVIEWED**

      Flammability: 4. 4= This degree includes flammable gases,
pyrophoric
      liquids, and Class IA flammable liquids. The preferred method of
fire
      attack is to stop the flow of material or to protect exposures
while
      allowing the fire to burn itself out. [Fire Protection Guide to
Hazardous
      Materials. 13 ed. Quincy, MA: National Fire Protection
Association, 2002.,
      p. 325-60]**PEER REVIEWED**

      Instability: 2. 2= Materials that can undergo violent chemical
changes at
      elevated temperatures and pressures. This also includes
materials that
      may react violently with water or that may form potentially
explosive
      mixtures with water. In advanced or massive fires involving these
      materials, fire fighting should be done from a safe distance or
a
      protected location. [Fire Protection Guide to Hazardous
Materials. 13 ed.
      Quincy, MA: National Fire Protection Association, 2002., p. 325-
60]**PEER
      REVIEWED**

FLAMMABLE LIMITS:
      Lower flammable limit: 2.7% by volume; Upper flammable limit:
36.0% by
      volume [Fire Protection Guide to Hazardous Materials. 13 ed.
Quincy, MA:
      National Fire Protection Association, 2002., p. 325-60]**PEER
REVIEWED**

AUTOIGNITION TEMPERATURE:

842 deg F (450 deg C) [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 325-60]**PEER REVIEWED**

FIRE FIGHTING PROCEDURES:

To fight fire, stop flow of gas, use CO2, alcohol foam or dry chemical. [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

If material on fire or involved in fire: Do not extinguish fire unless flow can be stopped. Use water in flooding quantities as fog. Cool all affected containers with flooding quantities of water. Apply water from as far a distance as possible. /Ethylene, compressed; ethylene, refrigerated liquid/ [Association of American Railroads/Bureau of Explosives; Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads. Pueblo, CO. 2002., p. 424]**PEER REVIEWED**

Evacuation: If fire becomes uncontrollable or container is exposed to direct flame; consider evacuation of one-third (1/3) mile radius. /Ethylene, compressed; ethylene, refrigerated liquid/ [Association of American Railroads/Bureau of Explosives; Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads. Pueblo, CO. 2002., p. 424]**PEER REVIEWED**

Stop flow of gas before extinguishing fire. Use water spray to keep fire-exposed containers cool. Use fine spray or fog to control fire by preventing its spread and absorbing some of its heat. Dry chemical or carbon dioxide may be appropriate. Fight fire from protected location or maximum possible distance. Use remote equipment wherever possible. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-73]**PEER REVIEWED**

FIREFIGHTING HAZARDS:

Flashback along vapor trail may occur. [U.S. Coast Guard, Department of

Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

Closed containers may rupture violently when heated. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-74]**PEER REVIEWED**

Ethylene floats and boils on water. [U.S. Coast Guard, Department of Transportation. CHRIS - Hazardous Chemical Data. Volume II. Washington, D.C.: U.S. Government Printing Office, 1984-5., p.]**PEER REVIEWED**

EXPLOSIVE LIMITS & POTENTIAL:

3.1-32% [International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 792]**PEER REVIEWED**

Ethylene-air mixture of from 3-28% ethylene and ethylene-O2 mixture of from 3-80% ethylene are explosive. [Thienes, C., and T.J. Haley. Clinical Toxicology. 5th ed. Philadelphia: Lea and Febiger, 1972., p. 54]**PEER REVIEWED**

Explosive decomposition occurred at 350 deg C under a pressure of 170 bar. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 258]**PEER REVIEWED**

The limiting pressures and temperatures for explosive decomposition of ethylene with electric initiation were determined in the ranges 100-250 bar and 120-250 deg C. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 258]**PEER REVIEWED**

HAZARDOUS REACTIVITIES & INCOMPATIBILITIES:

Reacts vigorously with oxidizing materials. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-74]**PEER REVIEWED**

In absence of nitrogen as a diluent, interaction with /trifluoromethyl hypofluorite/ ... /and/ ethylene is explosive on mixing. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 127]**PEER REVIEWED**

Explosive reaction with chlorine is possible. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-74]**PEER REVIEWED**

A violent explosion occurred when a mixture of tetrafluoroethylene and excess ethylene was heated at 160 deg C and 480 bar. Traces of oxygen must be vigorously excluded. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 261]**PEER REVIEWED**

Mixtures of ethylene and aluminum chloride, initially after 30-60 bar, rapidly heat and explode in presence of supported nickel catalyst, methyl chloride, or nitromethane. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 259]**PEER REVIEWED**

A gaseous alkene was passed into a cooled autoclave containing the complex, initially with agitation, and later without. Later, when the alkene was admitted to a pressure of 5.6 bar at 2 deg C, a slight exotherm occurred, followed by an explosion. The autoclave contents were completely carbonized. Mixtures of ethylene, aluminum chloride and nitromethane had exploded previously, but at 75 deg C. /Aluminum chloride-nitromethane/ [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 39]**PEER REVIEWED**

AITs for ethylene-oxygen mixtures at 1 bar in stainless steel were reduced by 30-40 deg C by coating the vessel walls with boron trioxide. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

Following a literature method for preparation of 1-bromo-3,3,3-trichloropropane, the reagents were being heated at 120 deg C/51 bar. During the fourth preparation, a violent explosion occurred.

[Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

Mixtures of ethylene and carbon tetrachloride can be initiated to explode at temperatures between 25 adn 105 deg C and pressures of 30-80 bar, causing a six-fold pressure increase. At 100 deg C and 60 bar, explosion initiated in the gas phase propagated into the liquid phase. Increase of halocarbon conc. in the gas phase decreased the limiting decomposition pressure. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

Interaction /with chlorine/ is explosive when catalysed by sunlight or UV irradiation, or in presence of mercury(I) oxide, mercury(II) oxide or silver oxide. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

Mixtures containing ratios of about 20:1 and 12:1 of ethylene:chlorotrifluoroethylene undergoing polymerization under gamma irradiation at 308 krad/hr exploded violently after a total dose of 50 krad. Dose rate and chlorotrifluoroethylene concentration were both involved in the initiation process. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

Polymerization of ethylene in presence of metallic copper becomes violent above a pressure of 54 bar at about 400 deg C, much carbon being deposited. [McEvoy, G.K. (ed.). American Hospital Formulary Service - Drug Information 92. Bethesda, MD: American Society of Hospital Pharmacists, Inc., 1992 (Plus Supplements 1992)., p. 260]**PEER REVIEWED**

Passage of the gas over heated lithium causes the latter to incandesce, producing a mixture of lithium hydride and lithium acetylide. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1314]**PEER REVIEWED**

Molecular sieve, not previously soaked in dilute ethylene, was used to dry compressed ethylene gas in a flow system. An exothermic reaction attained red heat and caused explosive failure of the dryer. They smaller-pored 3A sieve is not catalytically active towards ethylene. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 1688]**PEER REVIEWED**

Two hours after a road tanker had crashed, causing the load of liquid ethylene to leak, one of the tires of the tanker burst and ignited the spill, eventually causing the whole tanker to explode. The tire failed because it froze and became embrittled, an it is known that such failure of steel-braced tires gives off showers of sparks. This could therefore be a common ignition source in cryogenic transportation spillage incidents. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 261]**PEER REVIEWED**

A violent explosion occurred when a mixture of terafluoroethylene and excess ethylene was heated at 160 deg C and 480 bar. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 261]**PEER REVIEWED**

HAZARDOUS DECOMPOSITION:

When heated to decomposition it emit acrid smoke and irritating fumes. [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

HAZARDOUS POLYMERIZATION:

Hazardous polymerization may occur. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-74]**PEER REVIEWED**

Polymerization of ethylene in presence of metallic copper becomes violent above a pressure of 54 bar at about 400 deg C, much carbon being deposited. [Bretherick, L. Handbook of Reactive Chemical Hazards. 4th ed. Boston, MA: Butterworth-Heinemann Ltd., 1990, p. 260]**PEER REVIEWED**

PREVENTIVE MEASURES:

SRP: The scientific literature for the use of contact lenses in industry is conflicting. The benefit or detrimental effects of wearing contact lenses depend not only upon the substance, but also on factors including the form of the substance, characteristics and duration of the exposure, the uses of other eye protection equipment, and the hygiene of the lenses. However, there may be individual substances whose irritating or corrosive properties are such that the wearing of contact lenses would be harmful to the eye. In those specific cases, contact lenses should not be worn. In any event, the usual eye protection equipment should be worn even when contact lenses are in place. **PEER REVIEWED**

Personnel protection: Avoid breathing vapors. Keep upwind. ... Do not handle broken packages unless wearing appropriate personal protective equipment. Approach fire with caution. /Ethylene, compressed; ethylene, refrigerated liquid/ [Association of American Railroads/Bureau of Explosives; Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads. Pueblo, CO. 2002., p. 424]**PEER REVIEWED**

If material not on fire and not involved in fire: Keep sparks, flames, and other sources of ignition away. Keep material out of water sources and sewers. Attempt to stop leak if without undue personnel hazard. Use water spray to knock-down vapors. /Ethylene, compressed; ethylene, refrigerated liquid/ [Association of American Railroads/Bureau of Explosives; Emergency Handling of Hazardous Materials in Surface Transportation. Association of American Railroads. Pueblo, CO. 2002., p. 424]**PEER REVIEWED**

Evacuation: If material leaking (not on fire) consider evacuation from downwind area ased on amount of material spilled, location and weather conditions. /Ethylene, compressed; ethylene, refrigerated liquid/ [Association of American Railroads/Bureau of Explosives; Emergency Handling of Hazardous Materials in Surface Transportation. Association of

American Railroads. Pueblo, CO. 2002., p. 424]**PEER REVIEWED**

SRP: Local exhaust ventilation should be applied wherever there is an incidence of point source emissions or dispersion of regulated contaminants in the work area. Ventilation control of the contaminant as close to its point of generation is both the most economical and safest method to minimize personnel exposure to airborne contaminants. **PEER REVIEWED**

SRP: Contaminated protective clothing should be segregated in such a manner so that there is no direct personal contact by personnel who handle, dispose, or clean the clothing. Quality assurance to ascertain the completeness of the cleaning procedures should be implemented before the decontaminated protective clothing is returned for reuse by the workers. Contaminated clothing should not be taken home at end of shift, but should remain at employee's place of work for cleaning. **PEER REVIEWED**

SHIPMENT METHODS AND REGULATIONS:

No person may /transport,/ offer or accept a hazardous material for transportation in commerce unless that person is registered in conformance ... and the hazardous material is properly classed, described, packaged, marked, labeled, and in condition for shipment as required or authorized by ... /the hazardous materials regulations (49 CFR 171-177)./ [49 CFR 171.2; U.S. National Archives and Records Administration's Electronic Code of Federal Regulations. Available from: http://www.gpoaccess.gov/ecfr/ as of February 5, 2004]**PEER REVIEWED**

The International Air Transport Association (IATA) Dangerous Goods Regulations are published by the IATA Dangerous Goods Board pursuant to IATA Resolutions 618 and 619 and constitute a manual of industry carrier regulations to be followed by all IATA Member airlines when transporting hazardous materials. [International Air Transport Association. Dangerous Goods Regulations. 47th Edition. Montreal, Quebec Canada. 2006., p.

188]**PEER REVIEWED**

The International Maritime Dangerous Goods Code lays down basic principles for transporting hazardous chemicals. Detailed recommendations for individual substances and a number of recommendations for good practice are included in the classes dealing with such substances. A general index of technical names has also been compiled. This index should always be consulted when attempting to locate the appropriate procedures to be used when shipping any substance or article. [International Maritime Organization. International Maritime Dangerous Goods Code. London, UK. 2004., p. 43, 95]**PEER REVIEWED**

STORAGE CONDITIONS:

Store in cool dry, well-ventilated location. Protect against static electricity and lightning. Isolate from oxidizing materials, halogens, and other combustibles. [Fire Protection Guide to Hazardous Materials. 13 ed. Quincy, MA: National Fire Protection Association, 2002., p. 49-74]**PEER REVIEWED**

For use as an anesthetic, ethylene is purified and stored as a gas in steel cylinders. [Goodman, L.S., and A. Gilman. (eds.) The Pharmacological Basis of Therapeutics. 5th ed. New York: Macmillan Publishing Co., Inc., 1975., p. 83]**PEER REVIEWED**

Protect containers against physical damage. Outdoor or detached storage is preferred. For indoor storage, use a fireproof, well-ventilated, area isolated from any sources of ignition. [ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1988., p. 225]**PEER REVIEWED**

CLEANUP METHODS:

Spills on land: Contain if possible, by forming mechanical and/or chemical barriers to prevent spreading. [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.49 (1981)]**PEER REVIEWED**

Spills on water: Contain if possible. If solubilized in water, apply activated carbon at 10% of the spill amount over the region occupied by 10 mg/L or greater concentrations. Mechanical dredges or lifts may then be used to remove immobilized masses of pollutants. Peat moss is also recommended as a sorbent. [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.49 (1981)]**PEER REVIEWED**

By forced ventilation, maintain concentration of gas below the range of explosive mixture. Remove the tank or cylinder to an open area. Leave to bleed off in the atmosphere. [ITII. Toxic and Hazardous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1988., p. 225]**PEER REVIEWED**

Evacuate danger area! Ventilation. Remove all ignition sources and turn off gas at source if possible. Personal protection: chemical protection suit including self-contained breathing apparatus. [IPCS, CEC; International Chemical Safety Card on Ethylene. (March 1996). Available from http://www.inchem.org/documents/icsc/icsc/eics0475.htm as of July 13, 2005.]**PEER REVIEWED**

DISPOSAL METHODS:

SRP: The most favorable course of action is to use an alternative chemical product with less inherent propensity for occupational exposure or environmental contamination. Recycle any unused portion of the material for its approved use or return it to the manufacturer or supplier. Ultimate disposal of the chemical must consider: the material's impact on air quality; potential migration in soil or water; effects on animal, aquatic, and plant life; and conformance with environmental and public health regulations. [ ]**PEER REVIEWED**

Do not discharge ethylene directly into sewers or surface waters. Dispose of by incineration. If necessary, a flammable solvent may be added to aid in burning. [Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) p.49 (1981)]**PEER REVIEWED**

OCCUPATIONAL EXPOSURE STANDARDS:

THRESHOLD LIMIT VALUES:

8 hr Time Weighted Avg (TWA): 200 ppm [American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2005, p. 29]**PEER REVIEWED**

Excursion Limit Recommendation: Excursions in worker exposure levels may exceed 3 times the TLV-TWA for no more than a total of 30 minutes during a work day, and under no circumstances should they exceed 5 times the TLV-TWA, provided that the TLV-TWA is not exceeded. [American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2005, p. 5]**PEER REVIEWED**

A4; Not classifiable as a human carcinogen. [American Conference of Governmental Industrial Hygienists TLVs and BEIs. Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati, OH, 2005, p. 29]**PEER REVIEWED**

OTHER OCCUPATIONAL PERMISSIBLE LEVELS:

Russia STEL 100 mg/cu m [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 1166]**PEER REVIEWED**

Switzerland TWA 10,000 ppm (11500 mg/cu m) [Bingham, E.; Cohrssen, B.; Powell, C.H.; Patty's Toxicology Volumes 1-9 5th ed. John Wiley & Sons. New York, N.Y. (2001)., p. 1166]**PEER REVIEWED**

MANUFACTURING/USE INFORMATION:

MAJOR USES:

For ethylene (USEPA/OPP Pesticide Code: 041901) ACTIVE products with label matches. /SRP: Registered for use in the U.S. but approved pesticide uses may change periodically and so federal, state and local authorities must be consulted for currently approved uses./ [U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on Ethylene (74-85-1). Available from the Database Query page at http://www.cdpr.ca.gov/docs/epa/epamenu.htm as of June 1, 2005]**PEER REVIEWED**

Oxyethylene welding and cutting metals; manufacture of alcohol, mustard gas, and many other organics. Manufacture of ethylene oxide (for plastics), "Polythene", polystyrene and other plastics. Plant growth regulator; used commercially to accelerate the ripening of various fruits. [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

REFRIGERANT [International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 792]**PEER REVIEWED**

CHEM INT FOR ETHYLENE OXIDE, ETHYLENE DICHLORIDE, ETHYLBENZENE, ETHYL ALCOHOL, ACETALDEHYDE, LINEAR PRIMARY ALCOHOLS & VINYL ACETATE MONOMER; MONOMER FOR POLYETHYLENE **PEER REVIEWED**

Manufacture of ethyl chloride [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 224]**PEER REVIEWED**

Raw material for anesthetics [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 224]**PEER REVIEWED**

Cooling medium [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 224]**PEER REVIEWED**

Solvent [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 224]**PEER REVIEWED**

/SRP2005: Former/ Manufacture of tetraethyl lead [ITII. Toxic and Hazarous Industrial Chemicals Safety Manual. Tokyo, Japan: The International Technical Information Institute, 1982., p. 224]**PEER REVIEWED**

THE PRINCIPAL INDUSTRIAL USE OF ETHYLENE IS AS A "BUILDING BLOCK" FOR CHEMICAL RAW MATERIALS WHICH IN TURN ARE USED TO MFR A LARGE VARIETY OF SUBSTANCES AND PRODUCTS. SOME OF MAJOR CHEM & MATERIALS DERIVED FROM ETHYLENE ARE: VINYL CHLORIDE MONOMER OR 1,2-DICHLOROETHANE ... STYRENE MONOMER ... ACETALDEHYDE ... [International Labour Office. Encyclopedia of Occupational Health and Safety. Vols. I&II. Geneva, Switzerland: International Labour Office, 1983., p. 792]**PEER REVIEWED**

Compressed gas used to initiate degreening & ripening of bananas, citrus fruits, honeydew melons, pears, & pineapples. Applied before harvest of pineapples to induce flowering. [Farm Chemicals Handbook 1994. Willoughby, OH: Meister, 1994., p. C-149]**PEER REVIEWED**

MEDICATION: Anesthetic (inhalation) [O'Neil, M.J. (ed.). The Merck Index - An Encyclopedia of Chemicals, Drugs, and Biologicals. 13th Edition, Whitehouse Station, NJ: Merck and Co., Inc., 2001., p. 674]**PEER REVIEWED**

A monomer in the production of polyolefins and copolymers intended for use in contact with food or drink. [Sheftel, V.O.; Indirect Food Additives and Polymers. Migration and Toxicology. Lewis Publishers, Boca Raton, FL. 2000., p. 82]**PEER REVIEWED**

MANUFACTURERS:

BASF FINA Petrochemicals LP, P.O. Box 2506, Port Arthur, TX 77643 (409) 960-5000; Production site: Port Arthur, TX 77643 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Chevron Phillips Chemical Co. LP., 10001 Six Pines Dr., The Woodlands, TX 77380, (832) 813-4100. Olefins and Polyolefins Business Unit; Production sites: Baytown, TX 77521; Port Arthur, TX 77641; Sweeny, TX 77480 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

The Dow Chemical Co., 2030 Dow Center, Midland, MI 48642, (989) 636-1000; Production sites: Freeport, TX 77541; Plaquemine, LA 70764; Taft, LA 70057 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

E.I. duPont de Nemours and Co., 1007 Market St., Milmington, DE 19898, (302) 774-1000. DuPont Performance Materials, DuPont Packaging and Industrial Polymers; Production site: Orange, TX 77631 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Eastman Chemical Co., P.O. Box 511, Kingsport, TN 37662, (432) 229-2000. Vorifian Div.; Longview, TX 75607 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Equistar Chemicals LP, One Houston Center, 1221 McKinney St., Suite 700, Houston, TX 77010, (713) 652-7200; Production sites: Alvin, TX 77512; Channelview, TX 77350; Clinton, IA 52732; Corpus Christi, TX 78460; La Porte, TX 77571; Morris, IL 60450; Sulphur, LA 70663 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

ExxonMobil Chemical Co., 13501 Katy Freeway, Houston, TX 77079, (281) 870-6000; Production sites: Baton Rouge, LA 70805; Baytown, TX 77520; Beaumont, TX 77704-3868; Houston, TX 77017 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Flint Hills Resources LP, 4111 East 37th St. North, Wichita, KS 67220,

(316) 828-6080; Production site: Corpus Christi, TX 78409 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Formosa Plastics, Corp., USA, 9 Peach Tree Rd., Livingston, NJ 07039 (973) 992-2090; Production site: Port Comfort, TX 77978 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Huntsman LLC, 10003 Woodloch Forest Dr., The Woodlands, TX 77380, (713) 235-6000; Production sites: Odessa, TX 79766; Port Arthur, TX 77640 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Innovene, 200 East Randolph St., Chicago, IL 60601 (800) 231-6313; Production site: Alvin, TX 77512-1488 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Javelina Co., 5438 Union St., Corpus Christi, TX 78407, (361) 289-4900; Production site: Corpus Christi, TX 78407 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Sasol North America, Inc., 900 Threadneedle, Houston, TX 77079-2990, (281) 588-3000; Production site: Westlake, LA 70699-0727 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Shell Chemical Co., One Shell Plaza, P.O. Box 2463, Houston, TX 77252-2463, (713) 241-6161; Production sites: Deer Park, TX 77536; Norco, LA 70079 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Sunoco, Inc., Ten Penn Center, 1801 Market St., Philadelphia, PA 19103-1699, (215) 977-3000; Production site: Claymount, DE 19703 [SRI

Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Westlake Petrochemicals Corp., Westlake Center, 2801 Post Oak Blvd., Houston, TX 77056, (713) 960-9111; Production site: Sulphur, LA 70664 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

Westlake Vinyls, Inc., Westlake Center, 2801 Post Oak Blvd., Houston, TX 77056, (713) 960-9111; Production site: Calvert City, KY 42029 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

The Williams Co., Inc., One Williams Center, Tulsa, OK 74172, (918) 573-2000. Williams Olefins LLC; Production site: Geismar, LA 70734 [SRI Consulting. 2005 Directory of Chemical Producers - United States, Menlo Park, CA. 2005, p. 590]**PEER REVIEWED**

METHODS OF MANUFACTURING:

CRACKING OF ETHANE, PROPANE AND BUTANE RECOVERED FROM PROCESSING OF NATURAL GAS AND OF HEAVIER FEEDSTOCKS SUCH AS NAPHTHA. RECLAMATION FROM THE BY PRODUCT OFF-GASES GENERATED DURING THE CRACKING OF PETROLEUM IN GASOLINE REFINING **PEER REVIEWED**

BY ABSTRACTING 1 MOLECULE OF WATER FROM 1 MOLECULE OF ETHYL ALCOHOL. THIS MAY BE ACCOMPLISHED BY PASSING ALCOHOL THROUGH A RED-HOT TUBE CONTAINING ALUMINUM OXIDE OR THROUGH A TOWER OF COKE IMPREGNATED WITH GLACIAL PHOSPHORIC ACID (METAPHOSPHORIC ACID). [Osol, A. and J.E. Hoover, et al. (eds.). Remington's Pharmaceutical Sciences. 15th ed. Easton, Pennsylvania: Mack Publishing Co., 1975., p. 981]**PEER REVIEWED**

Although ethylene is produced by various methods as follows, only a few are commercially proven: thermal cracking of hydrocarbons /the principal route for the industrial production of ethylene/, catalytic pyrolysis, membrane dehydrogenation of ethane, oxydehydrogenation of ethane, oxidative coupling of methane, methanol to ethylene, dehydration of ethanol, ethylene from coal, disproportionation of propylene, and ethylene as a by-product. [Kirk-Othmer Encyclopedia of Chemical Technology. 4th ed. Volumes 1: New York, NY. John Wiley and Sons, 1991-Present., p. V9 883 (1994)]**PEER REVIEWED**

GENERAL MANUFACTURING INFORMATION:

ETHYLENE, NF /IS/ MARKETED UNDER GENERIC NAME AS COMPRESSED GAS @ 750 PSI IN RED (WHO, VIOLET) METAL CYLINDERS. [American Medical Association, Council on Drugs. AMA Drug Evaluations. 2nd ed. Acton, Mass.: Publishing Sciences Group, Inc., 1973., p. 227]**PEER REVIEWED**

6th highest-volume chemical produced in US (1979) [Sax, N.I. and R.J. Lewis, Sr. (eds.). Hawley's Condensed Chemical Dictionary. 11th ed. New York: Van Nostrand Reinhold Co., 1987., p. 484]**PEER REVIEWED**

FORMULATIONS/PREPARATIONS:

Grade: Technical (95% min); 99.5 min; 99.9 mole %; NF. [Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 14th Edition. John Wiley & Sons, Inc. New York, NY 2001., p. 463]**PEER REVIEWED**

IMPURITIES:

Purity not less than 96% ethylene by gas volume, not more than 0.5% acetylene, not more than 4% methane & ethane. [Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 14th Edition. John Wiley & Sons, Inc. New York, NY 2001., p. 463]**PEER REVIEWED**

CONSUMPTION PATTERNS:

40.5% FOR POLYETHYLENE; 19.5% FOR ETHYLENE OXIDE; 14% FOR ETHYLENE DICHLORIDE; 8.5% FOR ETHYLBENZENE; 5.5% FOR ETHYL ALCOHOL; 4% FOR ACETALDEHYDE; 2% FOR LINEAR PRIMARY ALCOHOLS; 2% FOR VINYL ACETATE MONOMER; 4% FOR MISC APPLICATIONS (1973) **PEER REVIEWED**

... LESS THAN 0.5 MILLION KG ETHYLENE ARE USED ANNUALLY TO RIPEN FRUITS & VEGETABLES. [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19

159 (1979)]**PEER REVIEWED**

Polyethylene resins, 48%; Ethylene oxide, 18%; Ethylene dichloride, 13%; Ethylbenzene, 8%; Linear alcohols, 5%; Vinyl Acetate, 2%; Ethyl alcohol, 2%; Miscellaneous, 4% (1984) [CHEMICAL PRODUCTS SYNOPSIS: Ethylene, 1984]**PEER REVIEWED**

CHEMICAL PROFILE: Ethylene. Low-density polyethylene (including linear low-density polyethylene), 28%; high-density polyethylene, 24%; ethylene oxide, 14.8%; ethylene dichloride, 12.3%; ethylbenzene, 8%; linear olefins and alcohols, 6%; vinyl acetate monomer, 2.6%; acetaldehyde, 1.3%; ethyl alcohol, 1%; ethylene-propylene elastomers, 1%; miscellaneous, 1%. [Kavaler AR; Chemical Marketing Reporter 233 (6): 21 (1988)]**PEER REVIEWED**

CHEMICAL PROFILE: Ethylene. Demand: 1987: 35.1 billion lb; 1988: 36 billion lb; 1991 /projected/: 40 billion lb (Foreign trade is negligible). [Kavaler AR; Chemical Marketing Reporter 233 (6): 21 (1988)]**PEER REVIEWED**

Uses: Low-density polyethylene (including linear low-density polyethylene), 28%; high-density polyethylene, 25%; ethylene oxide, 14 %; ethylene dichloride, 13%; ethylbenzene, 7%; linear olefins and alcohols, 6%; vinyl acetate monomer, 3%; acetaldehyde, 1%; ethyl alcohol, 1%; ethylene-propylene elastomers, 1%; miscellaneous, 1%. [Chemical Marketing Reporter p.19, CHEMICAL PROFILE: Ethylene 2/28/94 (1994)]**PEER REVIEWED**

U. S. PRODUCTION:

This chemical is listed as a High Production Volume (HPV) (65FR81686; http://www.epa.gov/opptintr/chemrtk/hpvchmlt.htm). Chemicals listed as HPV were produced in or imported into the U.S. in > 1 million pounds in 1990. The HPV list is based on the 1990 Inventory Update Rule. (IUR) (40 CFR part 710 subpart B; 51FR21438; http://www.epa.gov/oppt/iur/index.htm). [EPA/Office of Pollution Prevention and Toxics; High Production Volume

(HPV) Challenge Program's Robust Summaries and Test Plans. Available from: http://www.epa.gov/opptintr/chemrtk/hpvchmlt.htm as of December 19, 2005]**PEER REVIEWED**

(1972) 9.47X10+12 GRAMS **PEER REVIEWED**

(1975) 9.31X10+12 GRAMS **PEER REVIEWED**

(1985) 1.39X10+12 g [Chem. Eng. News 64(16): 13 1986]**PEER REVIEWED**

(1990) 36.47 billion lb [Chem & Engineering News 70 (15): 17 (4/13/92)]**PEER REVIEWED**

(1991) 39.96 billion lb [Chem & Engineering News 71 (15): 11 (4/12/93)]**PEER REVIEWED**

(1992) 40.93 billion lb [Chem & Engineering News 72 (15): 13 (4/11/94)]**PEER REVIEWED**

(1993) 41.25 billion lb [Chem & Engineering News 72 (15): 13 (4/11/94)]**PEER REVIEWED**

(1986) > 1 billion pounds [US EPA; Non-confidential Production Volume Information Submitted by Companies for Chemicals Under the 1986-2002 Inventory Update Rule (IUR). Ethylene (74-85-1). Available at http://www.epa.gov/oppt/iur/iur02/search03.htm as of July 28, 2005.]**PEER REVIEWED**

(1990) > 1 billion pounds [US EPA; Non-confidential Production Volume Information Submitted by Companies for Chemicals Under the 1986-2002 Inventory Update Rule (IUR). Ethylene (74-85-1). Available at http://www.epa.gov/oppt/iur/iur02/search03.htm as of July 28, 2005.]**PEER REVIEWED**

(1994) > 1 billion pounds [US EPA; Non-confidential Production Volume Information Submitted by Companies for Chemicals Under the 1986-2002 Inventory Update Rule (IUR). Ethylene (74-85-1). Available at http://www.epa.gov/oppt/iur/iur02/search03.htm as of July 28, 2005.]**PEER REVIEWED**

(1998) > 1 billion pounds [US EPA; Non-confidential Production Volume Information Submitted by Companies for Chemicals Under the 1986-2002 Inventory Update Rule (IUR). Ethylene (74-85-1). Available at

http://www.epa.gov/oppt/iur/iur02/search03.htm as of July 28, 2005.
]**PEER REVIEWED**

(2002) > 1 billion pounds [US EPA; Non-confidential Production Volume Information Submitted by Companies for Chemicals Under the 1986-2002 Inventory Update Rule (IUR). Ethylene (74-85-1). Available at http://www.epa.gov/oppt/iur/iur02/search03.htm as of July 28, 2005.
]**PEER REVIEWED**

U. S. IMPORTS:

(1972) NEGLIGIBLE **PEER REVIEWED**

(1984) 1.50X10+9 g [CHEMICAL PRODUCTS SYNOPSIS: Ethylene, 1984]**PEER REVIEWED**

Imports grew from 20 million pounds in 1991 to 95 million pounds in 1992. [Chemical Marketing Reporter p.19, CHEMICAL PROFILE: Ethylene 2/28/94 (1994)]**PEER REVIEWED**

U. S. EXPORTS:

(1972) NEGLIGIBLE **PEER REVIEWED**

(1975) 1.41X10+9 GRAMS **PEER REVIEWED**

Exports rose from barely 1 million pounds in 1991 to over 35 million pounds in 1992. [Chemical Marketing Reporter p.19, CHEMICAL PROFILE: Ethylene 2/28/94 (1994)]**PEER REVIEWED**

LABORATORY METHODS:

CLINICAL LABORATORY METHODS:

ASSAY METHOD INTENDED FOR MEDICINAL USE INVOLVES GC & THERMAL CONDUCTIVITY DETECTOR (CARSON, NA; J ASSOC OFF ANAL CHEM; 55, 1067 (1972)). [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 161 (1979)]**PEER REVIEWED**

ANALYTIC LABORATORY METHODS:

METHODS OF DETECTING UNSATURATED HYDROCARBONS, INCL ETHYLENE, IN AIR ...

INFRA-RED SPECTROPHOTOMETRY HAS BEEN USED TO DETECT ETHYLENE IN GASEOUS MIXTURES, WITH LIMIT OF DETECTION OF 50 UG. GAS CHROMATOGRAPHY COMBINED WITH MASS SPECTROMETRY ... [IARC. Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man. Geneva: World Health Organization, International Agency for Research on Cancer, 1972-PRESENT. (Multivolume work)., p. V19 161 (1979)]**PEER REVIEWED**

Nondispersive IR: Minimum full scale: 500 ppm. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 633]**PEER REVIEWED**

... /The/ ethane and ethylene formed and expired into hydrocarbon-purified air were sampled and analyzed by gas chromatography. [Ando K et al; Osaka-furitsu Koshu Eisei Kenkyusho Kenkyu Hokoku, Rodo Eisei Hen 21: 35-39 (1983)]**PEER REVIEWED**

ASTM Method D4490; Toxic gas vapor detector tube, Detection limit = 0.1 ppm. [Environmental Technology, Volume 11.03 Atmospheric Analysis; Occupational health and Safety, ASTM, 1916 Race Street, Philadelphia, PA 19103-1187 (1990)]**PEER REVIEWED**

SAMPLING PROCEDURES:

UNICO detector tube: 0.5 ppm; AVER detector tube: 10 ppm; DRAGER detector tube: 5,000 ppm. [Verschueren, K. Handbook of Environmental Data of Organic Chemicals. 2nd ed. New York, NY: Van Nostrand Reinhold Co., 1983., p. 634]**PEER REVIEWED**

SPECIAL REFERENCES:

SPECIAL REPORTS:

Toxicology Review: Clinical Pharmacology & Therapeutics 8: 91 (1967)

Environment Canada; Tech Info for Problem Spills: Ethylene (Draft) (1981)

Hopkins J; Food Chem Toxicol 32 (2): 191-3 (1994). Review of the carcinogenic potential of ethylene.

OECD; Screening Information Data Set for Ethylene, 74-85-1 (October 1998). Available from: http://www.inchem.org/documents/sids/sids/74851.pdf as of July 13, 2005

European Chemicals Bureau; IUCLID Dataset, Ethylene (74-85-1) (2000 CD-ROM edition). Available from the database query page: http://ecb.jrc.it/esis/esis.php as of December 21, 2005.

SYNONYMS AND IDENTIFIERS:

RELATED HSDB RECORDS:

175 [PROPYLENE]

941 [ETHANE]

167 [METHANE] (impurity)

SYNONYMS:

ACETENE [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

ATHYLEN (GERMAN) [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

BICARBURRETTED HYDROGEN [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

ELAYL [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

ETHENE [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

ETILENO [Blacow, N. W. (ed.). Martindale: The Extra Pharmacopoeia. 26th ed. London: The Pharmaceutical Press, 1972., p. 833]**PEER REVIEWED**

LIQUID ETHYLENE [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

OLEFIANT GAS [Lewis, R.J. Sax's Dangerous Properties of Industrial Materials. 9th ed. Volumes 1-3. New York, NY: Van Nostrand Reinhold, 1996., p. 1541]**PEER REVIEWED**

USEPA/OPP Pesticide Code: 041901 [U.S. Environmental Protection Agency/Office of Pesticide Program's Chemical Ingredients Database on Ethylene (74-85-1). Available from the Database Query page at http://www.cdpr.ca.gov/docs/epa/epamenu.htm as of June 1, 2005]**PEER REVIEWED**

FORMULATIONS/PREPARATIONS:

Grade: Technical (95% min); 99.5 min; 99.9 mole %; NF. [Lewis, R.J. Sr.; Hawley's Condensed Chemical Dictionary 14th Edition. John Wiley & Sons, Inc. New York, NY 2001., p. 463]**PEER REVIEWED**

SHIPPING NAME/ NUMBER DOT/UN/NA/IMO:

UN 1962; Ethylene

IMO 2.1; Ethylene, compressed; ethylene, refrigerated liquid

UN 1038; Ethylene, refrigerated liquid (cryogenic liquid)

STANDARD TRANSPORTATION NUMBER:

49 057 34; Ethylene, compressed

49 057 35; Ethylene, refrigerated liquid

ADMINISTRATIVE INFORMATION:

HAZARDOUS SUBSTANCES DATABANK NUMBER: 168

LAST REVISION DATE: 20060414

LAST REVIEW DATE: Reviewed by SRP on 9/15/2005

UPDATE HISTORY:

Complete Update on 2006-04-14, 66 fields added/edited/deleted

Complete Update on 2005-06-24, 14 fields added/edited/deleted

Field Update on 2005-01-29, 2 fields added/edited/deleted

Complete Update on 02/14/2003, 1 field added/edited/deleted.

Complete Update on 11/08/2002, 1 field added/edited/deleted.

Complete Update on 10/16/2002, 1 field added/edited/deleted.

Complete Update on 07/22/2002, 2 fields added/edited/deleted.

Complete Update on 01/18/2002, 11 fields added/edited/deleted.

Field Update on 08/08/2001, 1 field added/edited/deleted.

Field Update on 05/15/2001, 1 field added/edited/deleted.

Complete Update on 02/08/2000, 1 field added/edited/deleted.

Complete Update on 02/02/2000, 1 field added/edited/deleted.

Complete Update on 11/18/1999, 1 field added/edited/deleted.

Complete Update on 09/21/1999, 1 field added/edited/deleted.

Complete Update on 03/19/1999, 1 field added/edited/deleted.

Complete Update on 11/12/1998, 1 field added/edited/deleted.

Complete Update on 10/17/1997, 1 field added/edited/deleted.

Complete Update on 03/27/1997, 2 fields added/edited/deleted.

Complete Update on 03/11/1997, 2 fields added/edited/deleted.

Complete Update on 01/09/1997, 1 field added/edited/deleted.

Complete Update on 05/14/1996, 1 field added/edited/deleted.

Complete Update on 01/18/1996, 1 field added/edited/deleted.

Complete Update on 10/02/1995, 92 fields added/edited/deleted.

Complete Update on 06/07/1995, 30 fields added/edited/deleted.

Field Update on 05/26/1995, 1 field added/edited/deleted.

Complete Update on 01/20/1995, 82 fields added/edited/deleted.

Field Update on 12/19/1994, 1 field added/edited/deleted.

Complete Update on 10/13/1994, 2 fields added/edited/deleted.

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Field Update on 03/21/1994, 1 field added/edited/deleted.

Field Update on 08/03/1993, 1 field added/edited/deleted.

Complete Update on 02/05/1993, 1 field added/edited/deleted.

Complete Update on 01/29/1993, 4 fields added/edited/deleted.

Field update on 12/11/1992, 1 field added/edited/deleted.

Complete Update on 12/10/1992, 1 field added/edited/deleted.

Complete Update on 11/25/1992, 1 field added/edited/deleted.

Complete Update on 05/29/1992, 1 field added/edited/deleted.

Complete Update on 01/23/1992, 1 field added/edited/deleted.

Complete Update on 10/22/1990, 6 fields added/edited/deleted.

Field Update on 05/04/1990, 1 field added/edited/deleted.

Field Update on 01/15/1990, 1 field added/edited/deleted.

Complete Update on 01/11/1990, 3 fields added/edited/deleted.

Field Update on 05/05/1989, 1 field added/edited/deleted.

Field Update on 03/01/1989, 1 field added/edited/deleted.

Complete Update on 03/08/1988, 3 fields added/edited/deleted.

Complete Update on 03/09/1987

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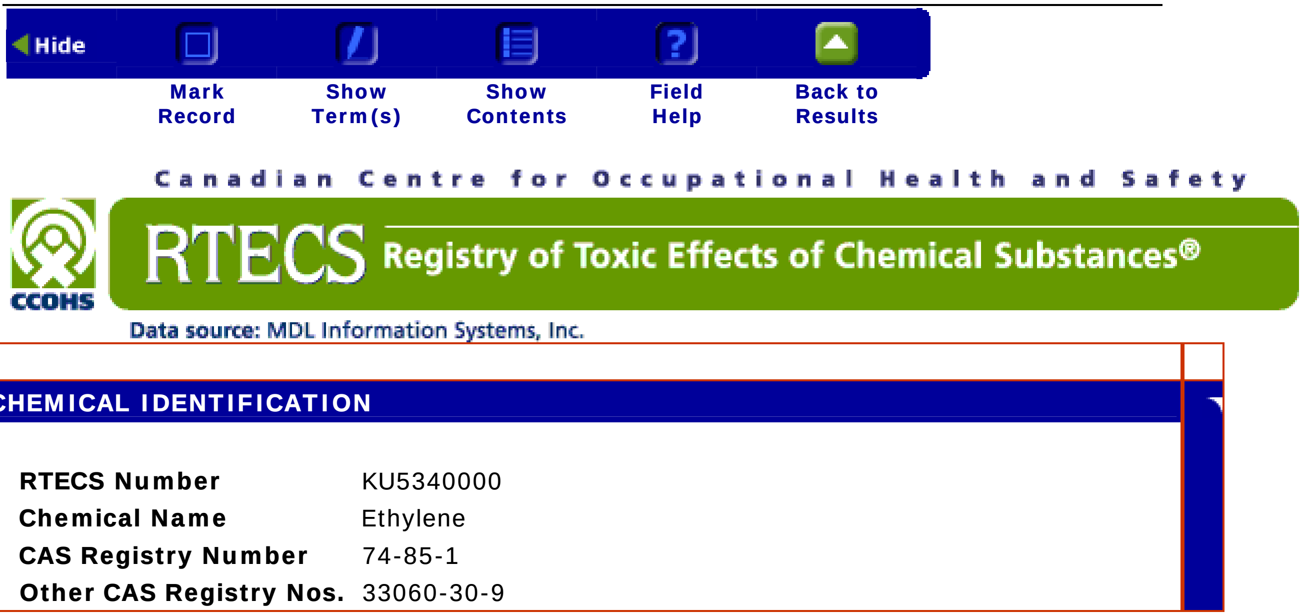
RTECS:



CHEMICAL IDENTIFICATION

RTECS Number	KU5340000
Chemical Name	Ethylene
CAS Registry Number	74-85-1
Other CAS Registry Nos.	33060-30-9

	87701-64-2 87701-65-3
Last Updated	200602
Data Items Cited	33
Molecular Formula	C2-H4
Molecular Weight	28.06
Wiswesser Line Notation	1U1
Compound Descriptor	Agricultural Chemical Tumorigen

Synonyms/Trade Names

Athylen
Ethene
Acetene
Bicarburretted hydrogen
Elayl
Liquid ethyene
Ethylene
Olefiant gas

HEALTH HAZARD DATA

ACUTE TOXICITY DATA

Type of Test	Route of Exposure	Species Observed	Dose Data	Toxic Effects	Reference
LCLo - Lowest published lethal concentration	Inhalation	Mammal - species unspecified	950000 ppm/5M	Details of toxic effects not reported other than lethal dose value	AEPPAE Naunyn-Schmiedeberg's Archiv fuer Experimentelle Pathologie und Pharmakologie. (Berlin, Ger.) V.110-253, 1925-66. For publisher information, see NSAPCC. Volume(issue)/page/year: 138,65,1928
LC50 - Lethal concentration, 50 percent kill	Inhalation	Rodent - mouse	95 ppm/2H	Details of toxic effects not reported other than lethal dose value	VCVGH* "Vrednie chemichescie veshestva, galogenproisvodnie uglevodorodov". (Hazardous substances: Galogenated hydrocarbons) Bandman A.L. et al., Chimia, 1990. Volume(issue)/page/year: -,46,1990
TCLo - Lowest published toxic concentration	Inhalation	Rodent - mouse	350000 mg/m3/2H	Behavioral - general anesthetic	VCVGH* "Vrednie chemichescie veshestva, galogenproisvodnie uglevodorodov". (Hazardous substances: Galogenated hydrocarbons) Bandman A.L. et al., Chimia, 1990. Volume(issue)/page/year: -

,46,1990

REVIEWS

ACGIH TLV-Simple asphyxiant	DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) booklet issues by American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati, OH, 1996 Volume(issue)/page/year: TLV/BEI,2005
ACGIH TLV-TWA 200 ppm	DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) booklet issues by American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati, OH, 1996 Volume(issue)/page/year: TLV/BEI,2005
ACGIH TLV-Not classifiable as a human carcinogen	DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) booklet issues by American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati, OH, 1996 Volume(issue)/page/year: TLV/BEI,2005
IARC Cancer Review:Animal No Adequate Data	IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210) V.1- 1972- Volume(issue)/page/year: 19,157,1979
IARC Cancer Review:Human No Adequate Data	IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210) V.1- 1972- Volume(issue)/page/year: 19,157,1979
IARC Cancer Review:Human Inadequate Evidence	IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210) V.1- 1972- Volume(issue)/page/year: 60,45,1994
IARC Cancer Review:Animal Inadequate Evidence	IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210) V.1- 1972- Volume(issue)/page/year: 60,45,1994
IARC Cancer Review:Group 3	IMEMDT IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man. (WHO Publications Centre USA, 49 Sheridan Ave., Albany, NY 12210) V.1- 1972- Volume(issue)/page/year: 60,45,1994
TOXICOLOGY REVIEW	CLPTAT Clinical Pharmacology and Therapeutics. (American Society for Clinical Pharmacology and Therapeutics, St. Louis Mo Mosby-Year Book) V.1- 1960- Volume(issue)/page/year: 8,91,1967
TOXICOLOGY REVIEW	TOLED5 Toxicology Letters. (Elsevier Science Pub. B.V., POB 211, 1000 AE Amsterdam, Netherlands) V.1- 1977- Volume(issue)/page/year: 138,1,2003

U.S. STANDARDS AND REGULATIONS

EPA FIFRA 1988 PESTICIDE SUBJECT TO REGISTRATION OR RE-REGISTRATION
FEREAC Federal Register. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) V.1- 1936- Volume(issue)/page/year: 54,7740,1989
EPA FIFRA 1998 STATUS OF PESTICIDES: RED Completed
RBREV* Status of Pesticides in Registration, Reregistration, and Special Review (Rainbow Report), Special Review and Reregistration Division Office of Pesticide

Programs U.S. Environmental Protection Agency, 401 M. Street, S.W., Washington, D.C. 20460, Spring 1998 Volume(issue)/page/year: -,254,1998
MSHA STANDARD:ASPHYXIANTS/GASES
DTLWS* "Documentation of the Threshold Limit Values for Substances in Workroom Air," Supplements. For publisher information, see 85INA8. Volume(issue)/page/year: 3,19,1973
OSHA PEL (Construc)simple asphyxiant-inert gases and vapors
CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 29,1926.55,1994
OSHA PEL (Shipyard):Simple asphyxiants - inert gas and vapor
CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 29,1915.1000,1993

OCCUPATIONAL EXPOSURE LIMITS

OEL-AUSTRALIA: Asphyxiant, JAN1993
OEL-BELGIUM: Asphyxiant, JAN1993
OEL-GERMANY: Carcinogen, JAN1999
OEL-HUNGARY: Asphyxiant, JAN1993
OEL-RUSSIA: STEL 100 mg/m3, JUN2003
OEL-SWITZERLAND: MAK-W 10000 ppm (11500 mg/m3), JAN1999
OEL-UNITED KINGDOM: Asphyxiant, SEP2000
OEL-THE NETHERLANDS: MAC-TGG 330 mg/m3, 2003
OEL IN ARGENTINA, BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV;
OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGIH TLV

STATUS IN U.S.

EPA TSCA Section 8(b) CHEMICAL INVENTORY
EPA TSCA Section 8(d) unpublished health/safety studies
EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JANUARY 2001

END OF RECORD

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