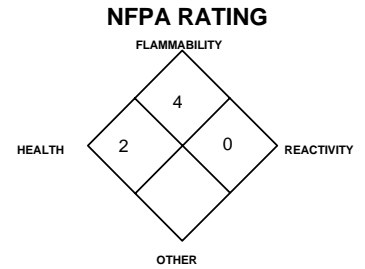




MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

FLAMMABLE GAS MIXTURE

SYNONYMS:

BTU GAS STANDARD

January 7, 1999

MIXTURE DESCRIPTION:

Flammable, compressed gas

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

MESA Specialty Gases & Equipment

ADDRESS:

3619 Pendleton Avenue, Suite C

Santa Ana, CA 92704

BUSINESS PHONE:

1-714-434-7102

EMERGENCY PHONE:

INFOTRAC: 1-800-535-5053

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER ppm
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Oxygen	7782-44-7	0-1	There are no specific exposure limits for Oxygen.					
Nitrogen	7727-37-9	0-10	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA).					
Carbon Dioxide	124-38-9	0-25	5000	30,000	5000 10,000 (Vacated 1989 PEL)	30,000 (Vacated 1989 PEL)	40,000	DFG-MAK: 5000 NIOSH REL: TWA =10000 STEL = 30000
Hydrogen	1333-74-0	0-5	There are no specific exposure limits for Hydrogen. Hydrogen is a simple asphyxiant.					
Ethane	74-84-0	0-40	There are no specific exposure limits for Ethane. Ethane is a simple asphyxiant.					
Propane	74-98-6	0-25	Simple Asphyxiant	NE	1000	NE	2100 (Based on LEL)	NIOSH REL: 1000 ppm DFG MAK: 1000 ppm
Isobutane	75-28-5	0-10	Simple Asphyxiant	NE	800 (Vacated 1989 PEL)	NE	NE	NIOSH REL: 800 DFG MAK: 1000
n-Butane	106-97-8	0-10	800	NE	800 (Vacated 1989 PEL)	NE	NE	NIOSH REL: 800 DFG MAK: 1000

2. COMPOSITION and INFORMATION ON INGREDIENTS (Continued)

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER ppm
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
neo-Pentane	463-82-1	0-5	600	750	1000 600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500	NIOSH REL: 120 STEL: 610, C-15 min DFG MAK: 1000
Isopentane	78-78-4	0-5	600	750	1000 600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500 (Based on LEL)	NIOSH REL: 350 TWA: 610, C (15 min) DFG MAK: 1000
n-Pentane	109-66-0	0-5	600	750	1000 600 (Vacated 1989 PEL)	750 (Vacated 1989 PEL)	1500 (Based on LEL)	NIOSH REL: 120 STEL: 610, C-15 min DFG MAK: 1000
Hexane (This information is for Hexane & other isomers)	110-54-3	0-3	50	NE	500 50 (Vacated 1989 PEL)	NE	1100 (Based on LEL)	NIOSH REL: 50 TWA; DFG MAK: 50
Heptane (This information is for Heptane & other isomers)	142-82-5	0-2	400	500	500 400 (Vacated 1989 PEL)	500 (Vacated 1989 PEL)	750	NIOSH REL: TWA: 85; C: 440 DFG MAK: 500
Octane (This information is for Octane & other isomers)	111-65-9	0-1	300	375	500 300 (Vacated 1989 PEL)	375 (Vacated 1989 PEL)	1000 (Based on LEL)	NIOSH REL: 75 TWA; 385 C DFG MAK: 500
Methane	74-82-8	Balance	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This product is a colorless, flammable gas with a sweet odor (due to the presence of Ethylene). Exposure to Carbon Monoxide, a component of this product, can cause nausea, dizziness, headaches, and collapse. This gas mixture can also cause symptoms of oxygen deprivation (e.g., dizziness, breathing rate increase). Severe inhalation overexposures may be fatal. This gas is lighter than air and may spread long distances. Distant ignition and flashback are possible. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to rupture without activating the cylinder's relief devices. Emergency responders must wear personal protective equipment appropriate for the situation to which they are responding.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this product is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Inhalation of a small amount of Carbon Monoxide, a component of this product, can be harmful and possibly fatal. Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. The effects of exposure in humans can be summarized as follows:

CONCENTRATION	SYMPTOMS OF EXPOSURE
All exposure levels: 200 ppm:	Lips and fingernails turn bright red. Slight symptoms (headache, discomfort) after several hours of exposure.
400 ppm:	Headache and discomfort experienced within 2-3 hours of exposure.
1,000 -2000 ppm:	Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger. Within 2 hours, there is mental confusion, headaches, and nausea.
200-2500 ppm: >2500 ppm:	Unconsciousness within 30 minutes. Potential for collapse and death before warning symptoms are produced.

INHALATION (continued): This product can also cause symptoms of oxygen deprivation (asphyxiation) when presented in high enough concentrations to significantly lower oxygen concentration. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of overexposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION	SYMPTOMS OF EXPOSURE
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.



OTHER POTENTIAL HEALTH EFFECTS: Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in **Lay Terms.** Overexposure to this product may cause the following health effects:

ACUTE: Symptoms of overexposure to this gas mixture can include lips and fingernails turning bright red, respiratory difficulty, headaches, shortness of breath, blurred vision, memory loss, and nausea. This gas mixture can also cause symptoms of oxygen deprivation and presents a health hazard by displacing the oxygen in the atmosphere. At high concentrations, unconsciousness or death may occur, due to the effects of Carbon Monoxide poisoning or oxygen deprivation. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite.

CHRONIC: Clinical studies indicate that there is a relationship between exposure to Carbon Monoxide, a component of this product, in specific occupations (e.g., fire-fighters, foundry workers) and an increased incidence of cardiovascular problems. Additionally, Carbon Monoxide is a reproductive toxin. Refer to Section 11 (Toxicological Information) of this MSDS for further information.

TARGET ORGANS: Respiratory system

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	2
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			B
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications
See Section 16 for Definition of Ratings

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus Personal Protective equipment should be worn.

Remove victim(s) to fresh air, as quickly as possible. In case of eye contact which leads to irritation, immediately flush eyes with copious amounts of water for at least 15 minutes. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Only trained personnel should administer supplemental oxygen. In case of frostbite, place the frostbitten part in warm water. **DO NOT USE HOT WATER.** If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

See Section 16 for Definition of Ratings

5. FIRE-FIGHTING MEASURES

The following information is for Methane, the main component of this gas mixture.

FLASH POINT (Closed Cup): -187°C (-306°F)

AUTOIGNITION TEMPERATURE: 650°C (1202°F)

FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): 5.0%

Upper (UEL): 15.0%

The following information is for Methane this gas mixture.

FIRE EXTINGUISHING MATERIALS: Extinguish fire by shutting off the source of the gas. Use water spray to cool fire-exposed containers, structures, and equipment.

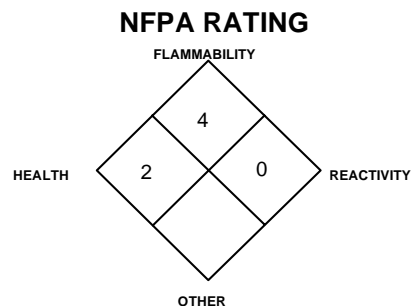
UNUSUAL FIRE AND EXPLOSION HAZARDS: This is a flammable gas. When involved in a fire, this material may decompose and produce toxic gases including carbon monoxide and carbon dioxide. Additionally, when involved in fire, the cylinders may rupture.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause this product to ignite explosively.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected pressure storage vessels of this product can be very dangerous. Direct flame exposure on the cylinder wall can cause an exothermic decomposition of the contents resulting in cylinder rupture. This is a catastrophic failure of the vessel releasing the contents into a massive fireball and explosion. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

SPECIAL FIRE-FIGHTING PROCEDURES: The best fire-fighting technique may be simply to let the burning gas escape from the pressurized cylinder, tank car, or pipeline. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still-leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation (in enclosed areas) to prevent flammable or explosive mixture formation. Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook for recommended isolation distance.



6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be **Level B: Fire retardant protective clothing, mechanically-resistant gloves and Self-Contained Breathing Apparatus.** Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Monitor the surrounding area for combustible gas, Carbon Monoxide, and Oxygen levels. Combustible gas concentrations must be below 10% of the LEL (LEL = 5.0% for Methane) prior to entry. Colorimetric tubes are available for Carbon Monoxide. Carbon Monoxide readings should be lower than the limits indicated in Section 2 (Composition and Information on Ingredients) before non-emergency personnel are allowed to enter area. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of overexposure (see Section 3, Hazard Information); exposures to fatal concentrations of this product could occur without any significant warning symptoms. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Store cylinders of this gas mixture away from incompatible materials.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Use a check valve or trap in the discharge line to prevent hazardous backflow. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. The following rules are applicable to situations in which cylinders are being used :

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS (continued):

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation to ensure compliance with exposure limits described in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents dispersion of this gas mixture into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of combustible gas, Carbon Monoxide, and Oxygen. Eye wash stations/safety showers should be near areas where this product is used or stored.

RESPIRATORY PROTECTION: Maintain levels of components of this gas mixture below the limits indicated in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following are NIOSH recommendations for Carbon Monoxide:

<u>CONCENTRATION</u>	<u>RESPIRATORY EQUIPMENT</u>
UP TO 350 ppm:	Supplied Air Respirator (SAR).
UP TO 875 ppm:	SAR operated in a continuous flow mode.
UP TO 1200 ppm:	Gas mask with canister to protect against carbon monoxide or full-facepiece Self-Contained Breathing Apparatus (SCBA) or full-facepiece SAR.
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions:	Positive pressure, full-facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA.
Escape:	Gas mask with canister to protect against carbon monoxide or escape-type SCBA.
NOTE:	NOTE: End of Service Life Indicator (ESLI) required for gas masks. The IDLH concentration for Carbon Monoxide is 1200 ppm.
EYE PROTECTION: Splash goggles, face-shields or safety glasses.	
HAND PROTECTION: Wear mechanically-resistant gloves when handling cylinders of this product. Wear chemically-resistant gloves when using this gas mixture. Butyl rubber, chlorinated polyethylene, neoprene nitrile, and polyvinyl rubber are recommended.	
BODY PROTECTION: Use body protection appropriate for task.	

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Methane, the main component of this product, unless otherwise stated:

VAPOR DENSITY: 0.6784 kg/m³ (0.042 35 lb/ft³)

SPECIFIC VOLUME: 23.7

SPECIFIC GRAVITY (air = 1): 0.555

FREEZING POINT: -182.2°C (-296°F)

SOLUBILITY IN WATER: Very slight.

BOILING POINT @ 1 atm: -161°C (-258.7°F)

EXPANSION RATIO: Not applicable.

EVAPORATION RATE (n-BuAc): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE (psia): Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable. pH: Not applicable.

The following information is pertinent to this product:

ODOR THRESHOLD: N/A

APPEARANCE AND COLOR: This product is a colorless gas with a sweet odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor may be a distinguishing characteristic of this product.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE. This product is not compatible with strong oxidizers. Nitrogen, a component of this mixture, is not compatible with lithium and titanium. The Carbon Dioxide in this mixture is incompatible with powdered aluminum, beryllium, cerium alloys, chromium, magnesium-aluminum alloys, manganese, thorium, titanium, and zirconium. In the presence of moisture, Carbon Dioxide will ignite with cesium oxide.

HAZARDOUS POLYMERIZATION: Will not occur. However Carbon Dioxide, a component of this product, acts to catalyze the polymerization of acryldehyde and aziridine.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are for the components of this gas mixture present at a level greater than or equal to 1 mole %:

OXYGEN:

cyt-ham: lung 80 pph

TCLo (inhalation, woman) 12 pph/10 minutes
has shown teratogenic effects.

TCLo (inhalation, human) 100 pph/14 hours
has shown pulmonary effects

CARBON DIOXIDE: This gas is a simple asphyxiant with physiological effects at high concentration

TCLo(inhalation, rat) = 6 pph/24 hours;
reproductive and teratogenic effects

LCLo(inhalation, human) = 9 pph/ 5 minutes

LCLo(inhalation, mammal) = 90,000 ppm/5 minutes

PROPANE: Guinea-pigs breathing 5.5% propane developed tremors after 5 minutes. Nausea, retching, and stupefaction after 30-120 minutes. All the animals survived a two-hour exposure and had no significant tissue damage.

ISOBUTANE: The toxicological properties of iso-butane will be very similar to those of n-Butane.

n-BUTANE:

LC₅₀ (inhalation-rat) = 658,000 mg/m³

LC₅₀ (inhalation-mouse) = 680,000 mg/m³

n-PENTANE:

LD₅₀ (intravenous, mouse) = 446 mg/kg.

LC₅₀ (inhalation, rat) = 364 g/m³/4 hours

LCLo (inhalation, mouse) = 325 g/m³/2 hours

ISOPENTANE:

LC₅₀ (mice): 140000 ppm, 2-hour

HEXANE:

Eye, rabbit = 10 mg/ mild

TCLo (inhalation, rat) = 10,000 ppm/7 hrs

TCLo (inhalation, rat) = 5000 ppm/20 hours;
teratogenic effects

LD50 (oral, rat) = 28710 mg/kg

LDLo (intraperitoneal, rat) = 9100 mg/kg

LCLo (inhalation, mouse) = 120,000 g/m³

Eye Irritancy (rabbit) = 10 mg; mild

Cytogenic Analysis (fibroblast, hamster) =
500 mg/L

HEPTANE:

LCLo (inhalation, human) = 1000 ppm/ 6 minutes; central nervous system effects

LC₅₀ (inhalation, rat) = 103 mg/m³/ 4 hours

LC₅₀ (inhalation, mouse) = 75 mg/m³/ 2 hours

LD₅₀ (intravenous, mouse) = 222 mg/kg

LD₅₀ (oral, rat) >15 g/kg

OCTANE:

LD₅₀ (oral, rat) = 5,630 mg/kg

Mice exposed to 6,600 to 13,700 ppm Octane showed signs of narcosis within 30 to 90 minutes. Anesthesia was caused in mice

exposed to 7,500 ppm for 2 hours. Central Nervous System Depression occurs at 8,000-10,000 ppm. The lethal concentration is near 13,500 ppm.

11. TOXICOLOGICAL INFORMATION (Continued)

NITROGEN: There are no specific toxicology data for Hydrogen. Hydrogen is a simple asphyxiant, which acts to displace oxygen in the environment

ETHANE: Guinea pigs breathing about 2.2 to 5% Ethane for 2 hours showed signs of irregular breathing and slight drowsiness, but no other health effects. At concentrations of 15-19%, when mixed with oxygen, Ethane is a weak cardiac sensitizer.

METHANE: There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment

SUSPECTED CANCER AGENT: The components of this gas mixture are listed as follows: NONE

The other components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore are not considered to be, nor suspected to be cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can cause frostbite and damage to exposed skin and eyes.

SENSITIZATION OF PRODUCT: Components of this product) are not known to cause sensitization in humans; however, some animals studies indicate that exposure to these gases can cause weak cardiac sensitization, usually at levels higher than present in this gas mixture.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this product and its components on the human reproductive system.

Mutagenicity: This product is not reported to cause mutagenic effects in humans.

Embryotoxicity: This product is not reported to cause embryotoxic effects in humans. Refer to following paragraph for additional information.

Teratogenicity: This product is not expected to cause teratogenic effects in humans. Clinical studies involving test animals exposed to high concentrations of Carbon Dioxide indicate teratogenic effects (e.g., cardiac and skeletal malformations, stillbirths).

Reproductive Toxicity: This product is not expected to cause adverse reproductive effects in humans. Studies involving test animals exposed to high concentrations of Carbon Dioxide indicate reproductive effects (e.g. changes in testes).

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Disorders involving the "Target Organs" (see Section 3, Hazard Information) may be aggravated by overexposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Be observant for initial signs of pulmonary edema.

BIOLOGICAL EXPOSURE INDICES: Biological Exposure Indices (BEIs) associated with the components of this product as follows: None

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas. The components of this gas mixture are stable in the environment. Additional environmental data for the components of this product is available as follows:

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen deficient environments, as a well as respiratory system damage. An excess of 0.5 ppm of Ethylene, a component of this product, in the air may injure crops over a 24-hour exposure period. Additionally, frost produced in the presence of rapidly expanding gases may adversely affect plant life. The following toxicity data are available for the effects of the components on plant life.

CARBON DIOXIDE: Aquatic toxicity: 100-200 mg/l/no time specified/various organisms/fresh water. Waterfowl toxicity: Inhalation 5-8%, no effect.

PROPANE: Log K_{ow} = 2.36. Water Solubility = 2.62.4 ppm at 25°C. Log BCF = calculated, 1.56 and 1.78, respectively. The bioconcentration in aquatic organisms is not expected to be important.

BUTANE: Log K_{ow} = 2.89. Water Solubility = 6.4 ppm at 25°C. Log BCF (n-butane) = calculated, 1.78 and 1.97, respectively. Expected Half-life = 0.13 hr. Bioconcentration factors do not indicate that bioconcentration in aquatic organisms is important.

PENTANE: Log K_{ow} = 3.57. Water Solubility = 0.6 g/L K_{oc} = 580-1600. LOG BCF (n-pentane) = calculated, 1.90 and 2.35, respectively. Photolysis, hydrolysis, and bioconcentration are not anticipated to be important fate processes. Biodegradation and soil adsorption are anticipated to be more important processes for this compound.

n-HEXANE: Log K_{ow} = 4.11. Water Solubility = 9.5 mg/L at 25°C. Log BCF (n-hexane) = calculated, 2.24 and 2.89, respectively. The bioconcentration

HEPTANE: Log K_{ow} = 4.66. Water Solubility = 2.93 mg/L at 25°C. Log BCF (n-heptane) = calculated, 2.53 and 3.31. BOD (theoretical, n-heptane) = 28, 63, 70 and 70% after 2, 5, 10 and 20 days. The potential for bioconcentration in the environment may be important.factor is not expected to be important in aquatic organisms.

OCTANE: Log K_{ow} = 5.18 Water Solubility = 0.66 mg/L at 25°C. Log BCF (n-octane) = calculated, 2.89 and 3.71, respectively. BOD (n-octane, theoretical) = 1.0%, 4.6%, and 28.4%, respectively, after 6, 24 and 72 hours. Bioconcentration factors indicate that bioconcentration may be important.

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF MATERIAL ON PLANTS or ANIMALS (continued)

PENTANE:

LC₅₀ (daphnia): 135 mmol/m³/ 48 hours
LC₅₀ (daphnia): 10.02 mg/L/ 96 hours
LC₅₀ (catfish): 9.92 mg/L/ 96 hours
LC₅₀ (fathead minnow): 11.59 mg/L
LC₅₀ (goldfish): 13.56 mg/L/ 96 hours
LC₅₀ (mosquitofish): 12.00 mg/L/ 96 hours
LC₅₀ (rainbow trout): 9.87 mg/L/ 96 hours
LC₅₀ (bluegill): 9.99 mg/L/ 96 hours

n-HEXANE:

LC₅₀ (silver or golden orfe): 4480 mg/L
LC₅₀ (silver or golden orfe): 150–210 mg/L
LC₅₀ (goldfish): 4 mg/L/ 24 hours
LC₅₀ (daphnia): 45 mmol/m³/ 48 hours
LC₅₀ (daphnia): 4.59 mg/L/ 96 hours
LC₅₀ (catfish): 4.34 mg/L/ 96 hours
LC₅₀ (fathead minnow): 5.10 mg/L/ 96 hours
LC₅₀ (goldfish): 5.82 mg/L/ 96 hours
LC₅₀ (mosquitofish): mg/L/ 96 hours
LC₅₀ (rainbow trout): 4.14 mg/L/ 96 hours
LC₅₀ (bluegill) 4.12 mg/L/ 96 hours

HEPTANE:

TLm (*Daphnia magna*, mosquito fish): 4924 mg/L/ 24 hours
EC₅₀ (*Daphnia magna*, mosquito fish): 1.5 mg/L/ 48 hours
LC₅₀ (*Chaetogammarus marinus*): 0.2 mg/L/ 96 hours
LC₅₀ (*Mysidopsis bahia*): 0.1 mg/L/ 96 hours
EC₀ (*Gambusia affinis*): 5600 mg/L
EC₁₀₀ (*Gambusia affinis*): 10,000 mg/L
LC₅₀ (*Gambusia affinis*): 4924 mg/L/ 24 & 96 hours
LC₅₀ (goldfish): 4 mg/L/ 24 hours
LC₅₀ (*Leuciscus idus*): 220 & 270 mg/L

OCTANE:

NOEL (Coho salmon): 100 ppm

CARBON DIOXIDE:

Aquatic toxicity: 100-200 mg/l/no time specified/various organisms/fresh water.
Waterfowl toxicity: Inhalation 5-8%, no effect.

Any adverse effect on animals would be related to oxygen deficient environments, as a well as respiratory system damage. Additionally, frost produced in the presence of rapidly expanding gases may adversely affect plant life. Additional plant toxicity data are available for the components of this product as follows:

n-HEXANE:

(giant kelp) = 10 mg/L, little or no effect on photosynthesis
EC₅₀ photosynthesis (diatom) = 0.3 mg/L, 8 hours
EC₅₀ photosynthesis (green algae) = 8.1 mg/L, 3 hours
EC₅₀ photosynthesis (green algae) = 12.8 mg/L, 3 hours

n-HEXANE (continued):

EC₅₀ photosynthesis (green algae) = 206 mg/L, 3 hours
EC₅₀ photosynthesis (green algae) = 114 mg/L

PENTANE:

EC₅₀ (algae) = 1 mg/L, 8 hours, photosynthesis

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to MESA Specialty Gases & Equipment Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:

Compressed gases, flammable n.o.s. (List 2 Major Components)

HAZARD CLASS NUMBER and DESCRIPTION:

2.1 (Flammable Gas)

UN IDENTIFICATION NUMBER:

UN 1954

PACKING GROUP:

Not Applicable

DOT LABEL(S) REQUIRED:

Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 115

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows.

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
HEXANE	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are on the TSCA Inventory.

15. REGULATORY INFORMATION (Continued)

OTHER U.S. FEDERAL REGULATIONS: Methane, Ethane, Propane, Isobutane, Butane, neo-Pentane, Isopentane, Pentane and Hexane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for these gases is 10,000 lb. Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation the components of this gas mixture are not listed in Appendix A, however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Methane, Propane, Butane, Carbon Dioxide, Ethane

California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen, Methane, Propane, Butane, Carbon Dioxide, Ethane

Florida - Substance List: Carbon Dioxide

Illinois - Toxic Substance List: Methane, Butane, Carbon Dioxide, Ethane

Kansas - Section 302/313 List: Carbon Dioxide, Ethane

Massachusetts - Substance List: Methane, Propane, Butane, Ethane,

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Carbon Dioxide, Methane, Propane, Butane

Missouri - Employer Information/Toxic Substance List: Carbon Dioxide, Methane, Propane, Butane, Ethane,

New Jersey - Right to Know Hazardous Substance List: Nitrogen, Carbon Dioxide, Methane, Propane, Butane, Ethane

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Nitrogen, Carbon Dioxide.

Pennsylvania - Hazardous Substance List: Nitrogen, Methane, Propane, Butane, Ethane

Rhode Island - Hazardous Substance List: Methane, Propane, Butane, Ethane,

Texas - Hazardous Substance List: Propane.

West Virginia - Hazardous Substance List: Propane.

Wisconsin - Toxic and Hazardous Substances: Propane.

CALIFORNIA PROPOSITION 65: No component of this product is on the California Proposition 65 lists.

LABELING (For Compressed Gas):

LABELING:

DANGER:

FLAMMABLE HIGH PRESSURE GAS.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.

Keep away from heat, flames, and sparks.
Store and use with adequate ventilation.
Use equipment rated for cylinder pressure.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

FIRST-AID:

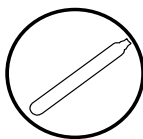
IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

WHMIS SYMBOLS:

Class A: Compressed Gas
Class B1: Flammable Gas

TARGET ORGANS: Respiratory system.

WHMIS SYMBOLS:



16. OTHER INFORMATION

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. MESA Specialty Gases & Equipment assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, MESA Specialty Gases & Equipment assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued):

Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: EC is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.