

# MATERIAL SAFETY DATA SHEET

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

## 1. PRODUCT IDENTIFICATION

**CHEMICAL NAME; CLASS:** NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:

n-Pentane 0.0-0.75%, n-Hexane 0.0-1.1%, Oxygen 0.0-23.5%

**SYNONYMS:** Not Applicable

**CHEMICAL FAMILY NAME:** Not Applicable

**FORMULA:** Not Applicable

**U.S. NUMBER:** UN 1956

**U.N. DANGEROUS GOODS CLASS/SUBSIDIARY RISK:** 2.2 (Non-Flammable Gas)

**Document Number:** 50011 (Replaces ISC MSDS No.1810-0271,1810-0289,1810-0693,1810-1162,1810-1238,1810-1584, 1810-2234, 1810-2249,1810-2320,1810-3127, 1810-7565, 1810-7987, 1810-4216, 1810-8953, 1810-7987, 1810-9173, 1810-9198)

**Note:** The Material Safety Data Sheet is for this gas mixture supplied in both refillable and non-refillable cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 3 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

<b>PRODUCT USE:</b>	Calibration of Monitoring and Research Equipment
<b>U.S. SUPPLIER/MANUFACTURER'S NAME:</b>	CALGAZ
<b>ADDRESS:</b>	821 Chesapeake Drive Cambridge, MD 21613
<b>BUSINESS PHONE:</b>	1-410-228-6400 (Monday – Friday 8am-5pm EST)
General MSDS Information:	1-713-868-0440
Fax on Demand:	1-800-231-1366
<b>EMERGENCY PHONE:</b>	
Chemtrec: United States/Canada/Puerto Rico:	1-800-424-9300 [24-hours]
Chemtrec International:	1-703-527-3887 [24-hours]

NOTE: ALL Canadian WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2004 format. This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

## 2. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW: Product Description:** This is a colorless gas mixture that may be odorless or have a gasoline-like odor when the n-Hexane component is at high concentration. **Health Hazards:** This gas mixture may cause adverse effects to the central nervous system if released in confined space. Releases of this gas mixture may also produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Rapidly released gas can cause frostbite. **Flammability Hazards:** This gas is not flammable. A cylinder rupture hazard exists when this gas mixture, which is under pressure, is subject to heat or flames. **Reactivity Hazards:** This gas mixture is not reactive. **Environmental Hazards:** Release of this gas mixture is not expected to cause harm to the environment or to plants and animals, except for possible frost and freezing from rapid release of a cylinder. **Emergency Response Procedures:** Emergency responders must wear the proper personal protective equipment suitable for the situation to which they are responding. **WARNING** - If rescue personnel need to enter an area suspected of having a low level of Oxygen, they should be equipped with Self-Contained Breathing Apparatus (SCBA).

## 3. COMPOSITION and INFORMATION ON INGREDIENTS

Chemical Name	Chemical Formula	CAS #	% Composition
n-Pentane	C <sub>5</sub> H <sub>12</sub>	109-66-0	0.0-0.75%
n-Hexane	C <sub>6</sub> H <sub>14</sub>	110-54-3	0.0-1.1%
Oxygen	O <sub>2</sub>	7782-44-7	0.0-23.5%
Nitrogen	N <sub>2</sub>	7727-37-9	Balance

## 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn.**

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Contaminated person(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Acute or chronic respiratory conditions or central nervous system disorders may be aggravated by over-exposure to this gas mixture.

**RECOMMENDATIONS TO PHYSICIANS:** Administer oxygen, if necessary; treat symptoms and eliminate exposure.

## 5. FIRE-FIGHTING MEASURES

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):** Not applicable.

**FIRE EXTINGUISHING MATERIALS:** Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

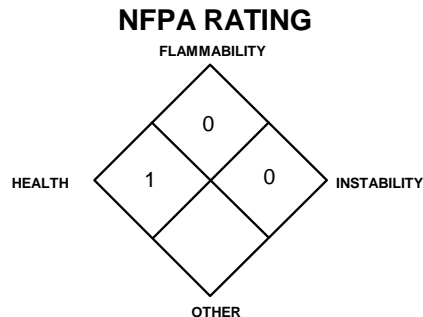
**FIRE EXTINGUISHING MATERIALS NOT TO BE USED:** None known.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. If water is not available for cooling or protection of cylinder exposures, evacuate the area.



## 6. ACCIDENTAL RELEASE MEASURES

**LEAK RESPONSE:** Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

6. ACCIDENTAL RELEASE MEASURES (Continued)

**LEAK RESPONSE (continued):** Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.  
If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

**WORK PRACTICES AND HYGIENE PRACTICES:** Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately.

**STORAGE AND HANDLING PRACTICES:** Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING!** Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment is rated for proper service pressure.

**SPECIFIC USE(S):** This product is for use in various industries. Follow all industry standards for use.

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of components and oxygen.

**EXPOSURE LIMITS:**

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELs		NIOSH	OTHER
		TWA ppm	STEL ppm	TWA ppm	STEL ppm	TWA ppm	STEL ppm	IDLH ppm	
n-Hexane	110-54-3	50 (skin)	NE	500 50 (Vacated 19890 PEL)	NE	50	NE	1100 (10% of LEL)	DFG MAKs: TWA = 50 PEAK = 8•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: C Carcinogen: EPA-II
n-Pentane	109-66-0	600	NE	1000 600 (Vacated 19890 PEL)	750 (Vacated 19890 PEL)	120	610 (ceiling) 15 min.	1500 (10% of LEL)	DFG MAKs: TWA = 1000 PEAK = 2•MAK 15 min. average value, 1-hr interval, 4-per shift DFG MAK Pregnancy Risk Classification: C
Oxygen	7782-44-7	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%.							
Nitrogen	7727-37-9	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.							

NE = Not Established.

The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132) and equivalent standards of Canada (including CSA Standard Z94.4-02 and CSA Standard Z94.3-07.. Please reference applicable regulations and standards for relevant details.

**RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Maintain component levels below 50% of the TLVs of components (see previous page) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection when component levels exceed 50% of the TLV, oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of components and Oxygen. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), equivalent U.S. State standards and Canadian CSA Standard Z94.4-02, the. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following are NIOSH Respiratory Protective Equipment Guidelines for the components of this gas mixture, Hexane and Pentane:

**n-HEXANE**

CONCENTRATION

Up to 500 ppm:

Up to 1100 ppm:

RESPIRATORY PROTECTION

Any Supplied-Air Respirator (SAR).

Any SAR operated in a continuous-flow mode, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions: Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister or any appropriate escape-type, SCBA.

**n-PENTANE**

CONCENTRATION

Up to 1200 ppm:

Up to 1500 ppm:

RESPIRATORY PROTECTION

Any Supplied-Air Respirator (SAR).

Any SAR operated in a continuous-flow mode, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.

Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.

Escape: Any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

**EYE PROTECTION:** Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or the Canadian CSA Standard Z94.3-07.

**HAND PROTECTION:** Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. Use triple gloves for spill response. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

**BODY PROTECTION:** No special protection is needed under normal circumstances of use. If necessary, refer to appropriate Standards of Canada. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136 and the Canadian CSA Standard Z195-02, *Protective Footwear*.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for the Nitrogen component of this gas mixture.

**GAS DENSITY @ 0°C and 1 atm:** .072 lbs/ ft<sup>3</sup> (1.153 kg/m<sup>3</sup>)

**FREEZING/MELTING POINT @ 10 psig:** -345.8°F (-210°C)

**SPECIFIC GRAVITY (air = 1) @ 21.1°C:** 0.906

**SOLUBILITY IN WATER vol/vol @ 0°C and 1 atm:** 0.023

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**VAPOR PRESSURE @ 21.1°C (psig):** Not applicable.

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

**BOILING POINT:** -320.4°F (-195.8°C)

**pH:** Not applicable.

**MOLECULAR WEIGHT:** 28.01

**EXPANSION RATIO:** Not applicable.

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 13.8

The following information is for this gas mixture.

**ODOR THRESHOLD:** For Hexane: Reported values vary widely and are not reliable; range of referenced values: 65-248 ppm.

**APPEARANCE, ODOR and COLOR:** This is a colorless gas mixture that may be odorless or have a gasoline-like odor when the n-Hexane component is at high concentration.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** The odor cannot be relied upon as a method of identifying release of this gas mixture as the reported odor thresholds of n-Hexane are unreliable and are above the TLV; odorant may be added by supplier.. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

**STABILITY:** Normally stable in gaseous state.

**DECOMPOSITION PRODUCTS:** *Combustion:* Carbon oxides. *Hydrolysis:* None.

**MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE:** Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Due to the presence of n-Pentane and n-Hexane, this gas mixture may be incompatible with strong oxidizers and halogens. n-Hexane is also incompatible with chlorine dioxide, fluorine, nitrogen dioxide, potassium chlorate, chlorine and chlorosulfuric acid.

**HAZARDOUS POLYMERIZATION:** Will not occur.

**CONDITIONS TO AVOID:** Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

**SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of over-exposure to this gas mixture is via inhalation.

**INHALATION:** Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. Due to the presence of n-Hexane, exposure in confined space or other instance of concentrated exposure, may lead to depression of the central nervous system and adverse effects on the peripheral nervous system. In studies with human volunteers, inhalation of 5000 ppm n-Hexane for 10 minutes resulted in dizziness and giddiness. Exposure to 2000 ppm for 10 minutes caused no symptoms. Occupational exposure to 1000-25000 ppm for 30-60 minutes was reported to cause dizziness. The chief health hazard associated with this gas mixture is when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. 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 over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

Another significant health hazard associated with this gas mixture is when this gas mixture contains less than 19.5% Oxygen and is released in a small, poorly-ventilated area (i.e. an enclosed or confined space). Under this circumstance, an oxygen-deficient environment may occur. 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 over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

**CONCENTRATION OF OXYGEN**

12-16% Oxygen:

10-14% Oxygen:

6-10% Oxygen:

Below 6%:

**OBSERVED EFFECT**

Breathing and pulse rate increased, muscular coordination slightly disturbed.

Emotional upset, abnormal fatigue, disturbed respiration.

Nausea, vomiting, collapse, or loss of consciousness.

Convulsive movements, possible respiratory collapse, and death.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD		(BLUE)	1
FLAMMABILITY HAZARD		(RED)	0
PHYSICAL HAZARD		(YELLOW)	0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
See Section 8			
For Routine Industrial Use and Handling Applications			

**WARNING:** Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

**CONTACT WITH SKIN or EYES:** Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite. Due to the presence of n-Hexane in this gas mixture, there is a risk of nerve damage of the extremities, such as the hands and feet (peripheral neuropathy) after prolonged or repeated contact.

**SKIN ABSORPTION:** The n-Hexane component can be absorbed through intact skin. Due to the small volume of gas in this cylinder, this route of exposure is not expected to be significant.

**IRRITANCY OF PRODUCT:** Prolonged contact with this gas mixture may cause irritation to the skin.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.** Over-exposure to this gas mixture may cause the following health effects:

**ACUTE:** Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. If inhalation occurs, adverse effects on the central nervous system may occur. Inhalation of high concentrations of the mixture, as may occur in a confined space, may result in an oxygen-deficient atmosphere and asphyxiation. A sudden release of pressure from the cylinder may cause frostbite to exposed tissues.

**CHRONIC:** Chronic low-level exposure to the skin may cause dermatitis. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. Due to the presence of the n-Hexane in this gas mixture, chronic exposure may result in damage to the nerves of the extremities.

**TARGET ORGANS:** ACUTE: Respiratory system, central nervous system. CHRONIC: Skin, heart, nervous system, peripheral nervous system.

**TOXICITY DATA:** Data are available for the Oxygen component, but since these data are from hyperbaric exposure to oxygen, which is an unlikely exposure to this gas mixture, the data are not presented in this MSDS. No data are applicable to the main component, Nitrogen, as it is a simple asphyxiant. The following are toxicological data for the n-Hexane component, which is above 1% concentration.

**HEXANE:**

TCLo (Inhalation-Human) 190 ppm/8 weeks: Peripheral Nerve and Sensation: structural change in nerve or sheath

TCLo (Inhalation-Human) 5400 mg/m<sup>3</sup>/10 minutes: Behavioral: headache; Lungs, Thorax, or Respiration: respiratory obstruction; Gastrointestinal: nausea or vomiting

**HEXANE (continued):**

TCLo (Inhalation-Human) 190 mg/m<sup>3</sup>/6 years-intermittent: Peripheral Nerve and Sensation: paresthesia

Standard Draize Test (Eye-Rabbit) 10 mg: Mild

LC<sub>50</sub> (Inhalation-Rat) 48,000 ppm/4 hours

LC<sub>50</sub> (Inhalation-Rat) 627,000 mg/m<sup>3</sup>/3 minutes

LC<sub>50</sub> (Inhalation-Mouse) 150,000 mg/m<sup>3</sup>/2 hours

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

**HEXANE (continued):**  
LC<sub>50</sub> (Inhalation-Mammal-Species Unspecified) 126 gm/m<sup>3</sup>: Behavioral: excitement  
Sense Organs and Special Senses (Eye): conjunctive irritation  
LD<sub>50</sub> (Oral-Rat) 15,840 mg/kg  
LD<sub>50</sub> (Oral-Rat) 29,700 mg/kg: Behavioral: somnolence (general depressed activity); Gastrointestinal: changes in structure or function of salivary glands, hypermotility, diarrhea  
LDLo (Intraperitoneal-Rat) 9100 mg/kg  
LDLo (Intravenous-Mouse) 831 mg/kg: Behavioral: altered sleep time (including change in righting reflex)  
LDLo (Intravenous-Rabbit) 132 mg/kg  
TDLo (Oral-Rat) 20,000 mg/kg: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), prostate, seminal vesicle, Cowper's gland, accessory glands  
TDLo (Oral-Rat) 40 gm/kg/4 weeks-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TDLo (Oral-Rat) 100,000 mg/kg/5 days-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TDLo (Oral-Mouse) 238 gm/kg: female 6-15 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TDLo (Intraperitoneal-Rat) 18,900 mg/kg/35 days-intermittent: Peripheral Nerve and Sensation: recording from afferent nerve, recording from peripheral motor nerve; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TDLo (Intraperitoneal-Rat) 4788 mg/kg/7 days-intermittent: Liver: other changes; Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol); Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: multiple enzyme effects  
TDLo (Intraperitoneal-Chicken) 18 gm/kg/90 days-intermittent: Peripheral Nerve and Sensation: structural change in nerve or sheath; Behavioral: ataxia; Related to Chronic Data: death  
TDLo (Subcutaneous-Rat) 7.5 mL/kg/12 weeks-intermittent: Liver: hepatitis (hepatocellular necrosis), zonal; Blood: microcytosis with or without anemia; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: multiple enzyme effects  
LCLo (Inhalation-Mouse) 120 gm/m<sup>3</sup>: Behavioral: general anesthetic; Lungs, Thorax, or Respiration: respiratory depression; Cardiac: other changes  
TCLo (Inhalation-Rat) 5000 ppm/24 hours: Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), testes, epididymis, sperm duct  
TCLo (Inhalation-Rat) 5000 ppm/24 hours: Peripheral Nerve and Sensation: flaccid paralysis without anesthesia (usually neuromuscular blockage); Reproductive: Paternal Effects: spermatogenesis (incl. genetic material, sperm morphology, motility, and count), testes, epididymis, sperm duct  
TCLo (Inhalation-Rat) 2000 ppm/12 hours/24 weeks-intermittent: Spinal Cord: other degenerative changes; Peripheral Nerve and Sensation: recording from peripheral motor nerve; Biochemical: Metabolism (Intermediary): other proteins  
TCLo (Inhalation-Rat) 1000 ppm/24 hours/11 weeks-continuous: Brain and Coverings: recordings from specific areas of CNS; Behavioral: muscle weakness; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 1 pph/6 hours/13 weeks-intermittent: Brain and Coverings: changes in brain weight; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 476 ppm/6 hours/4 weeks-intermittent: Lungs, Thorax, or Respiration: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases, dehydrogenases  
TCLo (Inhalation-Rat) 3000 ppm/6 hours/2 years-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 500 ppm/24 hours/9 weeks-continuous: Peripheral Nerve and Sensation: spastic paralysis with or without sensory change; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 1200 ppm/12 hours/16 weeks-intermittent: Peripheral Nerve and Sensation: recording from peripheral motor nerve; Nutritional and Gross Metabolic: weight loss or decreased weight gain; Biochemical: Metabolism (Intermediary): other proteins  
TCLo (Inhalation-Rat) 10,000 ppm/13 weeks-intermittent: Liver: changes in liver weight; Kidney/Ureter/Bladder: changes in kidney weight; Related to Chronic Data: changes in testicular weight

**CARCINOGENIC POTENTIAL OF COMPONENTS:** The components of this product are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows:

**Hexane:** EPA II (Inadequate Information for Assess Carcinogenic Potential)  
The remaining components of this gas mixture are not found on the following lists: U.S. EPA, U.S. NTP, U.S. OSHA, U.S. NIOSH, GERMAN MAK, IARC, or ACGIH; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

**IRRITANCY OF PRODUCT:** Contact with rapidly expanding gases can be irritating to exposed skin and eyes.

**SENSITIZATION TO THE PRODUCT:** Chronic exposure to Pentane and Hexane may result in sensitization of the heart to epinephrine (based on animal data).

**REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of the components this gas mixture on the human reproductive system.

**Mutagenicity:** The components of this gas mixture are not reported to cause mutagenic effects in humans.  
**Embryotoxicity:** The components of this gas mixture are not reported to cause embryotoxic effects in humans.  
**Teratogenicity:** The components of this gas mixture are not reported to cause teratogenic effects in humans.  
**Reproductive Toxicity:** The components of this gas mixture are not reported to cause reproductive effects in humans.

*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.*

**BIOLOGICAL EXPOSURE INDICES (BEIs):** Currently, the following Biological Exposure Indices (BEIs) have been determined for the n-Hexane component of this gas mixture.

CHEMICAL: DETERMINANT	SAMPLING TIME	BEI
Hexane • 2,5-Hexanedione in urine	• End of shift at end of workweek	• 0.4 mg/L

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

**MOBILITY:** Hexane may volatilize from dry soil surfaces based upon its vapor pressure. If released to soil, the Pentane component is expected to have high mobility based upon an estimated Koc of 80. Volatilization from moist soil surfaces is expected to be an important fate process based upon a Henry's Law constant of 1.25 atm-cu m/mole. Pentane may volatilize from dry soil surfaces based upon its vapor pressure.

**PERSISTENCE AND BIODEGRADABILITY:** Persistence: Nitrogen is a natural element and presents no hazard of persistence. The Hexane and Pentane components will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals. The half-life of each of these materials is as follows: Hexane = 3 days; Pentane = 4 days. Biodegradation: Nitrogen does not biodegrade.

**HEXANE (continued):**  
TCLo (Inhalation-Rat) 1700 mg/m<sup>3</sup>/6 hours/4 weeks-intermittent: Lungs, Thorax, or Respiration: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: phosphatases, Metabolism (Intermediary): lipids including transport  
TCLo (Inhalation-Rat) 5000 ppm/14 days-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 6500 ppm/13 weeks-intermittent: Kidney/Ureter/Bladder: changes in kidney weight  
TCLo (Inhalation-Rat) 1200 ppm/16 weeks-intermittent: Peripheral Nerve and Sensation: structural change in nerve or sheath; Behavioral: changes in motor activity (specific assay); Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 5000 ppm/6 weeks-intermittent: Peripheral Nerve and Sensation: flaccid paralysis without anesthesia (usually neuromuscular blockage); Reproductive: Paternal Effects: testes, epididymis, sperm duct; Nutritional and Gross Metabolic: weight loss or decreased weight gain  
TCLo (Inhalation-Rat) 1000 ppm/4 hours/59 weeks-intermittent: Tumorigenic: carcinogenic by RTECS criteria; Reproductive: Tumorigenic effects: testicular tumors  
TCLo (Inhalation-Rat) 10,000 ppm/7 hours: female 15 day(s) pre-mating 1-18 day(s) after conception: Reproductive: Effects on Newborn: behavioral  
TCLo (Inhalation-Rat) 1000 ppm/6 hours: female 8-16 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain)  
TCLo (Inhalation-Rat) 5000 ppm/20 hours: female 6-19 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TCLo (Inhalation-Rat) 1000 ppm: female 6-19 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TCLo (Inhalation-Rat) 5000 ppm: female 6-19 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system, urogenital system  
TCLo (Inhalation-Rat) 1000 ppm: female 6-19 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TCLo (Inhalation-Rat) 5000 ppm: female 6-19 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus); Specific Developmental Abnormalities: musculoskeletal system  
TCLo (Inhalation-Mouse) 10,000 ppm/6 hours/13 weeks-intermittent: Sense Organs and Special Senses (Olfaction): effect, not otherwise specified; Behavioral: changes in motor activity (specific assay); Blood: changes in other cell count (unspecified)  
TCLo (Inhalation-Mouse) 1000 ppm/13 weeks-intermittent: Behavioral: changes in motor activity (specific assay)  
TCLo (Inhalation-Mouse) 10,000 ppm/13 weeks-intermittent: Behavioral: changes in motor activity (specific assay); Liver: changes in liver weight; Kidney/Ureter/Bladder: changes in kidney weight  
TCLo (Inhalation-Mouse) 9018 ppm/6 hours/2 years-intermittent: Tumorigenic: neoplastic by RTECS criteria; Liver: tumors  
TCLo (Inhalation-Mouse) 5000 ppm: female 6-17 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TCLo (Inhalation-Mouse) 200 ppm: female 6-17 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)  
TCLo (Inhalation-Mouse) 200 ppm: female 6-17 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)  
TCLo (Inhalation-Guinea Pig) 150,000 mg/m<sup>3</sup>/1 hour/30 days-intermittent: Brain and Coverings: changes in surface EEG  
Sex Chromosome Loss and Non-Disjunction (Yeast-Saccharomyces cerevisiae) 132 mmol/L  
Cytogenetic Analysis (Hamster Fibroblast) 500 mg/L  
Cytogenetic Analysis (Subcutaneous-Rat) 7.5 mL/kg/12 weeks-intermittent

12. ECOLOGICAL INFORMATION (Continued)

**PERSISTENCE AND BIODEGRADABILITY (continued):** Screening studies suggest that the Hexane and Pentane components will undergo biodegradation in soil and water surfaces, but volatilization is expected to be the predominant fate process in the environment.

**POTENTIAL TO BIOACCUMULATE:** The Nitrogen component of this gas mixture will not bioaccumulate. An estimated BCF of 200 was calculated for the Hexane component, using a log Kow of 3.90 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is high. An estimated BCF of 80 was calculated for the Pentane component, using a log Kow of 3.39 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is moderate.

**ECOTOXICITY:** This gas mixture has not been tested for aquatic or animal toxicity. All release to terrestrial, atmospheric and aquatic environments should be avoided. The following aquatic toxicity data is available for the n-Hexane component.

**n-HEXANE:**  
EC<sub>0</sub> (*Microcystis pyrifera*) 96 hours = 10 mg/L  
EC<sub>50</sub> (*Daphnia magna*) 48 hours = 2.1 mg/L  
LC<sub>0</sub> (Coho salmon young) 96 hours = 100 mg/L

**n-HEXANE (continued):**  
LC<sub>50</sub> (*Daphnia magna*) 24 hours = > 50 mg/L  
LC<sub>50</sub> (*Chaetogammarus marinus*) 96 hours = 0.4 mg/L  
LC<sub>50</sub> (*Mysidopsis bahia*) 96 hours = 0.4 mg/L  
LC<sub>50</sub> (goldfish) 24 hours = 4 mg/L

**OZONE-DEPLETION POTENTIAL:** Components are not Class I or Class II ozone depleting chemicals (40 CFR Part 82).

**ENVIRONMENTAL EXPOSURE CONTROLS:** Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

13. DISPOSAL CONSIDERATIONS

**PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL:** Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

**U.S. DEPARTMENT OF TRANSPORTATION 49 CFR 172.101:** This material is classified as Dangerous Goods, per regulations of the DOT.

**PROPER SHIPPING NAME:**  
**HAZARD CLASS NUMBER and DESCRIPTION:**  
**UN IDENTIFICATION NUMBER:**  
**PACKING GROUP:**  
**DOT LABEL(S) REQUIRED:**  
**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2008):**  
**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).  
**SPECIAL SHIPPING INFORMATION:** Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.  
**Note:** DOT 39 Cylinders ship in a strong outer carton (outer package). Pertinent shipping information goes on the outside of the outer package. DOT 39 Cylinders do not have transportation information on the cylinder itself.

Compressed gases, n.o.s. (Nitrogen, Oxygen)  
2.2 (Non-Flammable Gas)  
UN 1956  
Not applicable.  
Class 2.2 (Non-Flammable Gas)  
126

**TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS:** This gas is classified as Dangerous Goods, per regulations of Transport Canada.

**PROPER SHIPPING NAME:**  
**HAZARD CLASS NUMBER and DESCRIPTION:**  
**UN IDENTIFICATION NUMBER:**  
**PACKING GROUP:**  
**HAZARD LABEL:**  
**SPECIAL PROVISIONS:**  
**EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX:**  
**ERAP INDEX:**  
**PASSENGER CARRYING SHIP INDEX:**  
**PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX:**  
**NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2008):**  
**NOTE:** Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

Compressed gases, n.o.s. (Nitrogen, Oxygen)  
2.2 (Non-Flammable Gas)  
UN 1956  
Not Applicable  
Class 2.2 (Non-Flammable Gas)  
None  
0.12  
None  
None  
75  
126

**INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):** This gas mixture is classified as Dangerous Goods, per the International Air Transport Association.

**UN IDENTIFICATION NUMBER:**  
**PROPER SHIPPING NAME:**  
**HAZARD CLASS NUMBER and DESCRIPTION:**  
**HAZARD LABEL(S) REQUIRED:**  
**PACKING GROUP:**  
**EXCEPTED QUANTITIES:**  
**PASSENGER & CARGO AIRCRAFT LIMITED QUANTITY PACKING INSTRUCTION:**  
**PASSENGER & CARGO AIRCRAFT LIMITED QUANTITY MAXIMUM NET QUANTITY/PKG:**  
**PASSENGER & CARGO AIRCRAFT PACKING INSTRUCTION:**  
**PASSENGER & CARGO AIRCRAFT MAXIMUM NET QUANTITY/PKG:**  
**CARGO AIRCRAFT ONLY PACKING INSTRUCTION:**  
**CARGO AIRCRAFT ONLY MAXIMUM NET QUANTITY/PKG:**  
**SPECIAL PROVISIONS:**  
**ERG CODE:**

UN 1956  
Compressed gases, n.o.s. (Nitrogen, Oxygen)  
2.2 (Non-Flammable Gas)  
Class 2.2 (Non-Flammable Gas)  
None  
E2  
None  
None  
75 kg  
200  
150 kg  
None  
2L

15. REGULATORY INFORMATION

**ADDITIONAL U.S. REGULATIONS:**

**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:

COMPOUND	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Hexane	No	No	Yes

**U.S. SARA 302 EXTREMELY HAZARDOUS THRESHOLD PLANNING QUANTITY (TPQ):** Not Applicable  
**U.S. SARA 304 EXTREMELY HAZARDOUS REPORTABLE QUANTITY (RQ):** Hexane = 5000 lb (2270 kg)  
**U.S. CERCLA REPORTABLE QUANTITY (RQ):** Not Applicable  
**U.S. TSCA INVENTORY STATUS:** The components of this gas mixture are listed on the TSCA Inventory.  
**U.S. EPA CLEAN WATER ACT SECTIONS 301, 307, AND 311:** Not Applicable

## 15. REGULATORY INFORMATION (Continued)

### ADDITIONAL U.S. REGULATIONS (continued):

**U.S. CLEAN AIR ACT SECTION 112(r)- Table 3 to §68.130:** Pentane is listed under this regulation in Table 3 as a Regulated Substances (Flammable Substances), in quantities of 10,000 lb (4,540 kg) or greater. Hexane is listed as a Hazardous Air Pollutant (HAP) generally known or suspected to cause serious health problems under the Clean Air Act.

**U.S. EPA LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION- Table 1 to §68.130:** Not Applicable

**U.S. EPA REGULATED SUBSTANCES, PER 40 CFR, PART 68, OF THE RISK MANAGEMENT FOR CHEMICAL RELEASES CLEAN AIR ACT SECTION 112(r)- Table 3 to §68.130:** Not Applicable

**U.S. OSHA HIGHLY HAZARDOUS CHEMICALS (HHCS):** Not Applicable

### OTHER U.S. FEDERAL REGULATIONS:

- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** No component of this gas mixture is on the California Proposition 65 lists.

### ADDITIONAL CANADIAN REGULATIONS:

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

**CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS:** The components of this gas mixture are on the CEPA Priorities Substances Lists as follows:

**n-Hexane:** This is a National Pollutant Release Inventory (NPRI) substance. Information about this substance must be reported to the Minister of the Environment in accordance with subsection 46(1) of the Canadian Environmental Protection Act, 1999. This substance is listed under PART 5, ISOMER GROUPS.

**GREENHOUSE GASES KYOTO PROTOCOL:** Not applicable.

**CANADIAN WHMIS REGULATIONS:** This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2B, as per the Controlled Product Regulations.

### CANADIAN WHMIS SYMBOLS:



## 16. OTHER INFORMATION

### INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Non-flammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. Calgaz will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

**MIXTURES:** When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 421 Walney Road, 5<sup>th</sup> Floor, Chantilly, VA 20151. Telephone: (703) 788-2700, Fax: (703) 961-1831.

*P-1 "Safe Handling of Compressed Gases in Containers"*

*AV-1 "Safe Handling and Storage of Compressed Gases"*  
*"Handbook of Compressed Gases"*

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Fax on Demand: 1-800-231-1366



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of Calgas' knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.