Emergency Contact: Chemtrec (800) 424-9300
Or Norco (208) 336-1643

1125 West Amity Road
Boise, ID 83705
(208) 336-1643

Nitrogen Dioxide 0.0002% to 0.005% in Nitrogen

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Nitrogen Dioxide 0.0002% to 0.005% (2 to 500 PPM) in Nitrogen
CAS Number: N/A
Chemical Family: Gas Mixture
Chemical Formula: NO_2 in N_2
Synonyms: Calibration Gas Mixture, Cal Gas, NOx Gas Mix
MSDS Identification Code/Number: NLB 2240
Prepared By: Quality Dept.

Revision Date: 08/18/10
Last Review Date: 10/23/13

Composition, Information on Ingredients

Exposure Limits[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Nitrogen Dioxide Formula: NO_2 CAS: 10102-44-0 RTECS#: QW9800000	0.0002% to 0.005%	5 ppm Ceiling	3 ppm TWA 5ppm STEL	LC50: 115 ppm Inhalation/rat 1 Hr.
Nitrogen Formula: N_2 CAS: 7727-37-9 RTECS#: QW9700000	99.005% to 99.9999%	None Established	Simple Asphyxiant	Not Available

[1] Refer to individual state or provincial regulations, as applicable, for limits that may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993).
[3] As stated in the ACGIH 2007 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

IDLH: 20 PPM

Hazards Identification

Emergency Overview:

This product is a colorless gas with a slight acrid odor. At higher concentrations nitrogen dioxide has a reddish brown color. Nitrogen dioxide is extremely toxic by inhalation, and symptoms of over-exposure may not become apparent for up to 72 hours. Over-exposures to this gas may result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. If high concentrations of nitrogen dioxide (>100 ppm) are inhaled, delayed pulmonary damage and breathing difficulty may occur. Nitrogen acts as a simple asphyxiant by displacing oxygen necessary to support life. Contents under pressure. Use and store below 125^{O} F, (52^{O} C).

Hazards Identification Cont.

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
Yes	No	Yes	Yes	No

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	Reproductive Hazard	Mutagen
Yes	Yes	Yes
Synergistic Effects None reported		

Carcinogenicity: NTP: No IARC: No OSHA: No

Eye Effects:
May cause irritation. Contact with rapidly expanding gas near the point of release may cause frostbite.

Skin Effects:
May irritate the skin upon contact. Contact with rapidly expanding gas near the point of release may cause frostbite with redness, skin color change to gray or white, and blistering.

Ingestion Effects:
Ingestion is unlikely. Gas at room temperature.

Inhalation Effects:
Inhalation of nitrogen dioxide in low concentrations produces an irritating effect on the mucous membranes of the eyes, nose, throat, and lungs. Acute exposure through inhalation may result in dryness and irritation of the nose and throat, choking, coughing, and bronchospasm. Severe overexposure may cause death through systemic, delayed pulmonary edema. Exposure to high concentrations may also cause unconsciousness, and under some circumstances, death. Medical care after overexposure is essential as symptoms will rapidly worsen, possibly leading to death.

Nitrogen acts as a simple asphyxiant. Accumulation of high concentrations can displace oxygen content in the air necessary to support life.

Medical Conditions Aggravated by Exposure:
Pre-existing respiratory, dental, skin and eye conditions may be aggravated by overexposure to this gas mixture.

NFPA Hazard Codes		**HMIS Hazard Codes**		**Ratings System**
Health:	1	Health:	1	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight hazard
Instability:	0	Physical Hazard:	3	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Hazard Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19_2009, *CGA Recommended Hazard ratings for Compressed Gases, 3rd Edition.*

First Aid Measures

Eye:
PERSONS WITH POTENTIAL EXPOSURE TO NITROGEN DIOXIDE SHOULD NOT WEAR CONTACT LENSES. Flush eyes with large amounts of water for at least 15 minutes, holding eyelids open to ensure adequate rinsing. If irritation persists, seek immediate medical attention.

First Aid Measures Continued

Skin:
Remove contaminated clothing and flush affected area with large quantities of water. If irritation persists or symptoms occur, seek medical attention. If frostbite has occurred, seek medical attention immediately; do NOT rub the affected areas or flush them with water. In order to prevent further tissue damage, do NOT attempt to remove frozen clothing from frostbitten areas.

Ingestion:
Not anticipated; product is a gas.

Inhalation:
PROMPT REMOVAL FROM THE CONTAMINATED AREA AND IMMEDIATE MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS.

Delayed onset of life-threatening symptoms is likely to occur. **Victim(s) must be taken for medical attention.**

Victims should be carried (not assisted) to an uncontaminated area and inhale fresh air supplemented with oxygen. Quick removal from the contaminated area is most important. Keep patient warm, quiet and under competent medical observation until the danger of delayed pulmonary edema has passed (at least 72 hours). Any physical exertion during this period should be discouraged as it may increase the severity of the pulmonary edema or chemical pneumonitis. Bed rest is indicated. Unconscious persons should be moved to an uncontaminated area, given artificial resuscitation and supplemental oxygen. Once respiration has been restored, they should be treated as above.

Fire Fighting Measures

Conditions of Flammability: Not flammable		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL (%): Not Applicable	UEL (%): Not Applicable	
Hazardous combustion products: Nitrogen compounds		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

Fire and Explosion Hazards:
Nonflammable. Cylinders may rupture violently from pressure when involved in a fire situation.

Extinguishing Media:
Use media suitable for surrounding combustible or flammable materials. Nitrogen dioxide can slowly react with water to form a corrosive solution of nitric acid. Nitric acid is corrosive to skin and metal.

Fire Fighting Instructions:
Stop the flow of gas if it can be done without risk. Use water spray to cool surrounding containers. Continue to cool surrounding containers until well after flames are extinguished. Firefighters should wear a full-face piece, NIOSH/MSHA-approved self-contained breathing apparatus (SCBA) operated in positive pressure mode and full turnout gear.

Accidental Release Measures

Isolate hazard area, evacuate personnel and deny entry to unauthorized/unprotected individuals. Extinguish all ignition sources and ventilate closed spaces and low areas. Personnel entering area should wear appropriate protective equipment, including respiratory protection suitable for unknown concentrations. Personnel should not re-enter an area until nitrogen dioxide has sufficiently dispersed and adequate oxygen re-established. If a leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest Norco/NorLab location.

Handling and Storage

Electrical classification:
Non-hazardous

Use only in well-ventilated areas. Valve protection caps must remain in place on refillable cylinders unless cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure reducing regulator when connecting cylinder to lower pressure piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in cool, dry, well-ventilated area of non-combustible construction away from heavy traffic areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125^{O} F (52^{0}C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Use a "first in-first out" inventory system to prevent full cylinders being stored for excessive periods of time.

For additional recommendations, consult Compressed gas Association Pamphlet P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid form in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

Exposure Controls, Personal Protection

Engineering Controls:
Use a laboratory hood with forced ventilation for handling small quantities. Use local exhaust to prevent accumulation above the exposure limit.

Eye/Face Protection:
Chemical safety goggles with full faceshield.

Skin Protection:
Protective gloves as appropriate for the job (rubber or Teflon for pure nitrogen dioxide).

Respiratory Protection:
A NIOSH/MSHA-approved full-facepiece SCBA operated in positive mode and/or any supplied air respirator with a full-facepiece and operated in a positive pressure mode in combination with an auxiliary self contained breathing apparatus operated in positive pressure mode should be used for high or unknown concentrations. Respirators should be stored in an area not likely to be contaminated.

Other/General Protection:
Safety shoes, safety showers and an emergency eyewash station should be available.

Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not applicable	
Vapor density (Air = 1)	: 0.906	
Evaporation point	: Not applicable	
Boiling point	: -320.4	^{O}F
	: -195.8	^{O}C
Freezing point	: -345.9	^{O}F
	: -209.9	^{O}C
pH	: Not applicable	
Specific gravity	: Not available	
Oil/water partition coefficient	: Not available	
Solubility (H_2O) vol/vol @0^{O} C ($32^{O}F$) and 1 atm.	: 0.023	
Odor threshold	: 0.1 to 0.4 ppm for nitrogen dioxide	
Odor and appearance	: Colorless to red-brown non-flammable gas with an acidic odor.	

Stability and Reactivity

Stability:
Stable under normal conditions.

Incompatible Materials:
Nitrogen dioxide is not compatible with strong bases, strong oxidizers, alkali metals, alkali earth metals and powdered metals.

Hazardous Decomposition Products:
None

Hazardous Polymerization:
Will not occur.

Toxicological Information

Nitrogen dioxide is highly toxic and hazardous because of its ability to cause delayed chemical pneumonitis and pulmonary edema. Chronic or repeated exposure may cause permanent decrements in pulmonary function (silo filler's disease). The absence of marked acute irritation of nitrogen dioxide limits its warning properties.

LC_{50} (Rat), Inhalation of 115 PPM for 1 hour.

Experimental data indicate this compound may produce teratogenic, reproductive or mutagenic effects.

Ecological Information

Environmental Fate:
This gas mixture will be dissipated rapidly in well-ventilated areas. Complex reactions of nitrogen dioxide occur in the atmosphere which contribute to air pollution.

Nitrogen dioxide hydrolyzes to nitric acid when in contact with water.

This product does not contain any class 1 or class 2 ozone depleting substances.

Disposal Considerations

Do not attempt to dispose of waste or unused quantities in returnable cylinders. Return in the shipping container, *properly labeled, with any valve outlet plugs or caps secure and valve protection cap in place* to NorLab for proper disposal. Non-refillable containers should be vented in a well-ventilated area then disposed of in compliance with local regulations, or returned to NorLab.

Transportation Information

Parameter	United States DOT	Canada TDG
Proper Shipping Name:	Compressed gas, n.o.s., (nitrogen dioxide, nitrogen)	Compressed gas, n.o.s.
Hazard Class:	2.2	2.2
Identification Number:	UN 1956	UN 1956
Shipping Label:	Non Flammable Gas	Non Flammable Gas

Regulatory Information

SARA Title III Notifications and Information:
Releases of
Releases of nitrogen dioxide in quantities equal to or greater than the reportable quantity (RQ) of 10 pounds are subject to reporting to the National Response Center under CERCLA, Section 304 SARA Title III.

Nitrogen dioxide is listed under Section 302 as an extremely hazardous Substance (EHS). The presence of nitrogen dioxide in quantities in excess of the threshold planning quantity (TPQ) of 100 pounds requires certain emergency planning activities to be conducted.

SARA Title III – Hazard Classes:
Acute Health Hazard
Sudden Release of Pressure Hazard

California Proposition 65: This product does not contain ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

Other Information

Compressed gas cylinders must not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

Disclaimer of expressed and implied warranties:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

NorLAB
A DIVISION OF NORCO, INC.

Emergency Contact: Chemtrec (800) 424-9300
Or Norco (208) 336-1643

1125 West Amity Road
Boise, ID 83705
(208) 336-1643

Carbon Monoxide in Nitrogen 0.0001% to 20.0%

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Carbon Monoxide in Nitrogen 0.0001% to 20.0%
Chemical Name: Carbon Monoxide in Nitrogen
Chemical Family: Gas Mixture
CAS Number: N/A
Common Names/Synonyms: N/A
MSDS Identification Code/Number: 2070
Prepared by: Quality Dept.

Revision Date: 05-01-03
Last Review Date: 03/04/13

Composition, Information on Ingredients

Exposure Limits[1]

Ingredient	% Volume	PEL-OSHA [2]	TLV-ACGIH [3]	LD_{50} or LC_{50} Route/Species
Nitrogen Formula: N_2 CAS Number: 7727-37-9 RTECS #: QW9700000	80.0 to 99.9999	None Established	Simple Asphyxiant	Not Available
Carbon Monoxide Formula: CO CAS Number: 630-08-0 RTECS#: FG3500000	0.0001 to 20.0	50 PPM TWA 25 PPM Canada	25 PPM TWA	LC 50 3760 PPM RAT Time Adj.

[1] Refer to individual state or provincial regulations, as applicable, for limits which may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993)
[3] As stated in the ACGIH 2007 Threshold Limit Values for Chemical Substances and Physical Agents

Hazard Identification

Emergency Overview:
Non-flammable, colorless, odorless gas. Nitrogen acts as a simple asphyxiant, displacing atmospheric oxygen and may cause asphyxiation if released in a confined area. Carbon monoxide acts as a chemical asphyxiant, binding to the blood hemoglobin, greatly reducing the red blood cell's ability to transport oxygen to body tissues. Effects may include headaches, dizziness, convulsions, loss of consciousness and death. Contents under pressure. Use and store below 125^0 F (52^0 C).

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	No	Yes	No

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	No	No
Teratogen	Reproductive Hazard	Mutagen
Yes	Yes	Yes
Synergistic Effects None reported		

Hazards Identification Continued

Carcinogenicity: NTP: No IARC: No OSHA: No

Eye Effects:
Contact with rapidly expanding gas near the point of release may cause frostbite.

Skin Effects:
Contact with rapidly expanding gas near the point of release may cause frostbite with redness, skin color change to gray or white, and blistering.

Ingestion Effects:
None known. Ingestion is unlikely.

Inhalation Effects:
Depending on the concentration of the carbon monoxide present, this product may act as a simple asphyxiant or a chemical asphyxiant.

Inhaled carbon monoxide binds with blood hemoglobin to form carboxyhemoglobin. Carboxyhemoglobin can not take part in normal oxygen transport, greatly reducing the blood's ability to transport oxygen. Depending on levels and duration of exposure, symptoms may include headache, dizziness, heart palpitations, weakness, confusion, nausea, and even convulsions, eventual unconsciousness and death.

Some experimental evidence indicates teratogenic and reproductive effects.

Medical Conditions Aggravated by Exposure:
Recovery from carbon monoxide may be adversely affected by obesity, alcoholism, and chronic heart disease.

NFPA Hazard Codes		**HMIS Hazard Codes**		**Ratings System**
Health:	1	Health:	1	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight Hazard
Instability:	0	Physical Hazard:	3	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Hazard Data from: *CGA P-19-2004, CGA Recommended Hazard Ratings for Compressed Gases, Second edition*

First Aid Measures

Eyes:
Never introduce ointment or oil into the eyes without medical advice! Remove victim from the source of contamination. Flush eyes with water for 15 minutes. If pain is present, refer the victim to an ophthalmologist for treatment and follow up. If the victim cannot tolerate light, protect the eyes with a light bandage. If frostbite is suspected, flush with cool water for 15 minutes and obtain immediate medical attention.

Skin:
None required for gas. For frostbite, immerse skin in lukewarm water. DO NOT USE HOT WATER. Obtain medical attention.

Ingestion:
None required.

Inhalation:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE TO THIS PRODUCT. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious persons should be assisted to an uncontaminated area and be treated with supplemental oxygen. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area and be given artificial respiration and oxygen at the same time. Administration of 100% oxygen by tight fitting face mask reduces the biological half-life of CO.

First Aid Measures Continued

FOR SEVERELY POISNED PATIENTS, HYPERBARIC OXYGEN THERAPY SHOULD BE CONSIDERED. The administering of the oxygen at an elevated pressure (up to 2 to 2.5 atmospheres) has shown to be beneficial as has treatment in a hyperbaric chamber. The physician should be informed that the patient has inhaled toxic quantities of carbon monoxide.

Fire Fighting Measures

Conditions of Flammability: Nonflammable		
Flash point: Not Available	Method: Not Available	Autoignition Temperature: Not Available
LEL(%): 12.5 (CO)	UEL(%) 74.0 (CO)	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: Not Available		

Fire and Explosion Hazards:
Non-flammable. Concentrations of carbon monoxide less than or equal to 20% in nitrogen are considered non-flammable (CGA P-23, 1995).

Extinguishing Media:
None required. Use media appropriate for surrounding materials.

Fire Fighting Instructions:
Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear. If possible, stop the flow of gas supply. Use water spray to cool adjacent cylinders and areas.

Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If leak is in user's equipment, be certain to purge piping with inert gas prior to attempting repairs. If leak is in container or valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest Norco/NorLab location.

Handling and Storage

Carbon monoxide can be handled in all commonly used metals up to approximately 500 psig (3450 kPa). Above that pressure it forms toxic and corrosive carbonyl compounds with some metals. Carbon steels, aluminum alloys, copper and copper alloys, low carbon stainless steels and nickel-based alloys such as Hastelloy A, B & C are recommended for higher pressure applications.

Use only in well-ventilated areas. Valve protection caps must remain in place unless the cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (< 3000 psig) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into the cylinder.

Protect cylinders from physical damage. Store in a cool, dry, well-ventilated area of non-combustible construction away from heavy traffic areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed $125^{O}F$ ($52^{O}C$). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time.

For additional recommendations, consult Compressed Gas Association's Pamphlet P-1.

Exposure Controls, Personal Protection

Engineering Controls:
Hood with forced ventilation. Use local exhaust to prevent accumulation above the exposure limit. Use mechanical ventilation in accordance with electrical codes.

Exposure Controls, Personal Protection Continued

Eye/Face Protection:
Safety goggles or glasses as appropriate for the job.

Skin Protection:
Protective gloves made of any suitable material.

Respiratory Protection:
Positive pressure air line with mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

Other/General Protection:
Safety shoes.

Physical and Chemical Properties

Parameter	Value	Units
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not Available	
Vapor density (Air = 1)	: Not Available	
Evaporation Point	: Not Available	
Boiling point	: Not Available	
	: Not Available	
Freezing point	: Not Available	
	: Not Available	
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H_2O)	: Very slight	
Odor threshold	: Not Applicable	
Odor and appearance	: Odorless, colorless gas	

Stability and Reactivity

Stability:
Stable.

Incompatible Materials:
None known.

Hazardous Decomposition Products:
Carbon dioxide.

Hazardous Polymerization:
Will not occur.

Toxicological Information

Inhalation:
LC50: 3670 ppm inhalation/rat (Time Adj.).

Reproductive:
Inhalation of 150 ppm carbon monoxide for 24 hours by pregnant rats produced cardiovascular and behavioral defects in offspring. Toxic effects to fertility were observed in female rats exposed to 1 mg/m^3 for 24 hours. Similar effects observed in other mammalian species.

Toxicological Information Continued

Mutagenic:
Genetic changes observed in mammalian cell assay systems at exposures of 1500 to 2500 ppm for 10 minutes.

Other:
Degenerative changes were observed in the brain of rats chronically exposed to 30 mg/m^3 carbon monoxide.

Ecological Information

Product does not contain Class I or Class II ozone depleting substances. Not expected to bioconcentrate

Disposal Considerations

Do not attempt to dispose of waste or unused quantities in returnable cylinders. Return in the shipping container, *properly labeled, with any valve outlet plugs or caps secure and valve protection cap in place* to NorLab for proper disposal. Non-refillable containers should be vented in a well-ventilated area then disposed of in compliance with local regulations, or returned to NorLab.

Transport Information

Parameter	United States DOT	Canada TDG
Proper Shipping name:	Compressed gases, n.o.s., (Carbon Monoxide, Nitrogen)	Compressed gases, n.o.s.,
Hazard Class:	2.2	2.2
Identification Number:	UN 1956	UN 1956
Shipping Label:	Non-flammable Gas	Non-flammable Gas

Regulatory Information

SARA Title III Notification and Information:

SARA Title III – Section 313 Supplier Notification:
This product does not contain toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and CFR 372.

SARA Title III – Hazard Classes:
Acute Health hazard
Fire Hazard
Sudden Release of Pressure Hazard

California Proposition 65: This product contains carbon monoxide, which the State of California has listed as having developmental toxicity.

Other Information

Compressed gas cylinders shall not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

Disclaimer of Expressed and Implied Warranties:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).

Emergency Contact: Chemtrec (800) 424-9300
Or Norco (208) 336-1643

1125 West Amity Road
Boise, ID 83705
(208) 336-1643

Pentane 0.0001% to 1.5%, Oxygen 2% to 23%, in Nitrogen

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Pentane 0.0001% to 1.5%, Oxygen 2% to 23% in Nitrogen
CAS Number: N/A
Chemical Family: Gas Mixture
Chemical Formula: C_5H_{12}, O_2, in N_2
Synonyms: Pentane, Oxygen in Nitrogen Mixture, Pentane LEL Mix
MSDS Identification Code/Number: NL2320
Prepared By: Quality Dept.

Revision Date: 08/18/11
Last Review Date: 08/18/11

Composition, Information on Ingredients

Exposure Limits[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Pentane Formula: C_5H_{12} CAS Number: 109-66-0 RTECS#: RZ9450000	0.0001% to 1.5%	TWA 1000 PPM	TWA 600 PPM	LC_{50} Rat, Inhalation 4 hours 12.33%
Oxygen Formula: O_2 CAS Number: 7782-44-7 RTECS# RS206000	2.0% to 23.0%	None Established	Non Established	Not Available
Nitrogen Formula: N_2 CAS Number: 7727-37-9 RTECS#: QW9700000	76.5% to 98%	Simple Asphyxiant	Simple Asphyxiant	Not Available

[1]Refer to individual state or provincial regulations, as applicable, for limits that may be more stringent than those listed here.
[2] As stated in 29 CFR 1910, Subpart Z (revised July 1, 1993).
[3] As stated in the ACGIH 2007 Threshold Limit Values for Chemical Substances and Physical Agents.

OSHA Regulatory Status: This material is classified as hazardous under OSHA regulations.

IDLH: Pentane 1500 PPM (10% LEL)

Hazards Identification

Emergency Overview:
Colorless, non-flammable gas with a mild gasoline type odor. High concentrations may have a narcotic effect. Repeated or prolonged skin contact may cause irritation or dermatitis. Use only with adequate ventilation. Contents under pressure. Use and store below $125^{O}F$ ($52^{0}C$).

Route of Entry:

Skin Contact	Skin Absorption	Eye Contact	Inhalation	Ingestion
No	No	Yes	Yes	No

Hazards Identification Continued

Health Effects:

Exposure Limits	Irritant	Sensitization
Yes	Yes	No
Teratogen	Reproductive Hazard	Mutagen
No	No	No
Synergistic Effects None reported.		

Carcinogenicity: NTP: No IARC: No OSHA: No

Eye Effects:
May cause minor irritation. Contact with rapidly expanding gas near the point of release may cause frostbite.

Skin Effects:
Pentane is a primary skin irritant and fat solvent. Prolonged or repeated contact may tend to dry and defat skin causing irritation and dermatitis. Contact with rapidly expanding gas near the point of release may cause frostbite with redness, skin color change to gray or white, and blistering.

Ingestion Effects:
Ingestion is unlikely. Product is a gas at room temperature.

Inhalation Effects:
High concentrations of vapors may have a narcotic effect. Symptoms may include dizziness, headache and nausea.

Medical Conditions Aggravated by Exposure:
None Known

NFPA Hazard Codes		HMIS Hazard Codes		Ratings System
Health:	1	Health:	1	0 = No Hazard
Flammability:	0	Flammability:	0	1 = Slight hazard
Instability:	0	Physical Hazard:	3	2 = Moderate Hazard
				3 = Serious Hazard
				4 = Severe Hazard

Hazard ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, *CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.*

First Aid Measures

Eye:
Flush eyes with water for 15 minutes. If irritation persists, seek medical attention. If frostbite is suspected, flush eyes with cool water for 15 minutes and obtain immediate medical attention.

Skin:
Rinse skin thoroughly with water. If irritation persists, seek medical attention. For frostbite, immerse skin in lukewarm water. DO NOT USE HOT WATER. Obtain medical attention.

Ingestion:
None required. Product is a gas at normal temperatures and conditions.

Inhalation:
PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Victims should be assisted to an uncontaminated area and inhale fresh air. Quick removal from the contaminated area is most important. Unconscious persons should be moved to an uncontaminated area, and if breathing has stopped, administer artificial resuscitation and supplemental oxygen. Further treatment should be symptomatic and supportive.

Fire Fighting Measures

Conditions of Flammability: Not flammable		
Flash point: None	Method: Not Applicable	Autoignition Temperature: None
LEL (%): None	UEL (%): None	
Hazardous combustion products: None		
Sensitivity to mechanical shock: None		
Sensitivity to static discharge: None		

Fire and Explosion Hazards:
Nonflammable Contains pentane in concentrations below the LEL of 1.5%. Cylinders may vent rapidly or rupture violently from pressure when involved in a fire situation. Product may contain sufficient oxygen to support combustion.

Extinguishing Media:
Use as appropriate for surrounding materials.

Fire Fighting Instructions:
If possible, stop the flow of gas supply. Use water spray to cool adjacent cylinders and areas. Fire fighters should wear a full-facepiece NIOSH/MSHA approved self-contained breathing apparatus (SCBA) operated in positive pressure mode and full turnout gear.

Accidental Release Measures

Evacuate all personnel from affected area. Use appropriate protective equipment. If a leak is in user's equipment, be certain to purge piping with an inert gas prior to attempting repairs. If leak is in container or container valve, contact the appropriate emergency telephone number listed in Section 1 or call your closest Norco/NorLab location.

Handling and Storage

Gas mixture is non-corrosive and may be used with any common structural material.

Use only in well-ventilated areas. Valve protection caps must remain in place unless the cylinder is secured with valve outlet piped to use point. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinder movement. Use a pressure regulator when connecting cylinder to lower pressure (<3000 PSIG) piping or systems. Do not heat cylinder by any means to increase the discharge rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous backflow into the cylinder.

Protect cylinders from physical damage. Store in a cool, dry, well ventilated area of non-combustible construction away from heavy traffic areas and emergency exits. Do not allow the temperature where cylinders are stored to exceed 125^{O}F (52^{0}C). Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. Full and empty cylinders should be segregated. Use a "first in – first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" sign in the storage or use area.

For additional recommendations, consult Compressed Gas Association Pamphlets P-1.

Never carry a compressed gas cylinder or a container of a gas in cryogenic liquid from in an enclosed space such as a car trunk, van or station wagon. A leak can result in a fire, explosion, asphyxiation or a toxic exposure.

Exposure Controls, Personal Protection

Engineering Controls:
Local exhaust used in combination with general ventilation as necessary to maintain air contaminants at or below acceptable exposure guidelines

Eye/Face Protection:
Safety goggles or glasses as appropriate for the job.

Skin Protection:
Protective gloves of nitrile rubber or polyvinyl alcohol.

Exposure Controls, Personal Protection Continued

Respiratory Protection:
Positive pressure air line with full-face mask and escape bottle or self-contained breathing apparatus should be available for emergency use.

Other/General Protection:
Safety shoes

Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: Not Available	
Vapor density (Air = 1)	: ~ 1	
Evaporation point	: Not Available	
Boiling point	: Not Available	^{O}F
	: Not Available	^{O}C
Freezing point	: Not Available	^{O}F
	: Not Available	^{O}C
pH	: Not Available	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H_2O)	: Slightly Soluble	(as pentane)
Odor threshold	: 300 – 500 PPM	(as pentane)
Odor and appearance	: Colorless gas with a slight gasoline type odor.	

Stability and Reactivity

Stability:
Stable

Incompatible Materials:
None

Hazardous Polymerization:
Does not occur

Toxicological Information

Inhalation:
Ten minute exposures to pentane concentrations of 5,000 PPM (0.5%) produced slight dizziness within a few minutes.

Skin and Eye:
Pentane is a mucous membrane irritant in animals. Ten-minute exposure in humans to 5,000 PPM (0.5%) pentane did not produce noticeable eye, nose or respiratory tract irritation. Undiluted pentane applied to human skin for 1 hour and 5 hours cause immediate irritation (hyperemia, erythema, pigmentation and swelling) with blisters after 5 hours. Mild symptoms continued for up to 96 hours after exposure, but no permanent scarring was observed.

Chronic:
Exposures to pentane alone in animals has not caused neurologic damage. It is possible that pentane in solvent mixtures may potentiate hexacarbon neuropathy in humans.

Ecological Information

Product does not contain Class I or Class II ozone depleting substances. Not toxic. Will not bioconcentrate.

Disposal Considerations

Do not attempt to dispose of waste or unused quantities in returnable cylinders. Return in the shipping container, *properly labeled, with any valve outlet plugs or caps secure and valve protection cap in place* to NorLab for proper disposal. Non-refillable containers should be vented in a well-ventilated area then disposed of in compliance with local regulations, or returned to NorLab.

Transportation Information

Parameter	United States DOT	Canada TDG
Proper Shipping Name:	Compressed Gas, N.O.S. (Pentane, Nitrogen)	Compressed Gas N.O.S.
Hazard Class:	2.2	2.2
Identification Number:	UN1956	UN1956
Shipping Label:	Non-flammable Gas	Non-flammable Gas

Regulatory Information

SARA Title III Notifications and Information:
Pentane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA Title III – Hazard Classes:
Pentane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

SARA Title III- Section 313 Supplier Notification:
Pentane is listed under the accident prevention provisions of section 112(r) of the Clean Air Act (CAA) with a threshold quantity (TQ) of 10,000 pounds.

California Proposition 65:
This product does not contain ingredient(s) known to the State of California to cause cancer or reproductive toxicity.

Other Information

Compressed gas cylinders must not be refilled without the express written permission of the owner. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transportation regulations.

Disclaimer of expressed and implied warranties:
Although reasonable care has been taken in the preparation of this document, we extend no warranties and make no representations as to the accuracy or completeness of the information contained herein, and assume no responsibility regarding the suitability of this information for the user's intended purposes or for the consequences of its use. Each individual should make a determination as to the suitability of the information for their particular purpose(s).