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

Nitric Oxide 0.0001% to 1.0% in Nitrogen

MATERIAL SAFETY DATA SHEET

Identification

Product Name: Nitric Oxide 0.0001% to 1.0% (1 PPM to 1.0%) in Nitrogen
Revision Date: 07/31/03
CAS Number: N/A
Last Review Date: 02/21/07
Chemical Family: Gas Mixture
Chemical Formula: NO in N_2
Synonyms: Calibration Gas Mixture, Cal Gas, NOx Gas Mix, Nitric Oxide Protocol Mix
MSDS Identification Code/Number: 2140
Prepared By: Quality Dept.

Composition, Information on Ingredients

Exposure Limits[1]:

INGREDIENT	% VOLUME	PEL-OSHA[2]	TLV-ACGIH[3]	LD_{50} or LC_{50} Route/Species
Nitric Oxide Formula: NO CAS: 10102-43-9 RTECS#: QX0525000	0.0001% to 1.0%	25 ppm	25 ppm TWA	LC50: 115 ppm Inhalation/rat (1 hr. as NO_2, CGA P-20, 2003)
Nitrogen Formula: N_2 CAS: 7727-37-9 RTECS#: QW9700000	99.0% 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 2006 Threshold Limit Values for Chemical Substances and Physical Agents.

IDLH (Nitric Oxide): 100 ppm

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

Hazards Identification

Emergency Overview:

Colorless non-flammable gas. May cause skin, eye, and respiratory irritation. This product contains nitric oxide which is toxic at relatively low concentrations. Symptoms are dependent upon concentration of nitric oxide and duration of exposure and may be delayed. If respiratory, skin or eye irritation occurs when working with this product, inhalation exposure may have already occurred. Nitric oxide can cause chemical pneumonitis, retention of body fluid and swelling in the lungs (edema) or cyanosis. Prompt medical attention is mandatory in all cases of overexposure. 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
No	No	No
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 cause skin irritation. 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:
The toxicity of this gas mixture depends upon the amount of nitric oxide present. Generally the only symptoms occurring at the time of exposure are slight cough, fatigue, and nausea. Very concentrated fumes may cause coughing, choking, nausea, headache, abdominal pain and tightness, and burning in the chest. Severe symptoms may be delayed (possibly for several hours) and include cyanosis, increased difficulty in breathing (from hypoxia), irregular respiration, lassitude and eventual death due to pulmonary edema in untreated cases.

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

Chronic Effects:
Repeated exposure to nitric oxide may cause a permanent decrease in pulmonary function (Silo Filler's Disease) or chronic irritation of the respiratory tract with cough, headache, loss of appetite, dyspepsia, tooth corrosion and gradual loss of strength.

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
Reactivity:	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-19-2004, *CGA Recommended Hazard Ratings for Compressed Gases, 2nd Edition.*

First Aid Measures

Eye:
PERSONS WITH POTENTIAL EXPOSURE TO NITRIC OXIDE SHOULD NOT WEAR CONTACT LENSES. Flush eyes with large amounts of water for at least 15 minutes, holding eyelids open to ensure adequate rinsing. Seek immediate medical attention as soon as possible.

Skin:
Remove contaminated clothing and flush affected area with large quantities of water. For frostbite immerse skin in lukewarm water. DO NOT USE HOT WATER. If irritation persists or frostbite occurs, seek medical attention.

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 vent rapidly or rupture violently from pressure when involved in a fire situation. Nitric oxide may vigorously accelerate combustion. Nitric oxide will support or initiate combustion/explosion of organic matter and other oxidizable material.

Extinguishing Media:
Use media suitable for surrounding combustible or flammable materials. Nitric oxide 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 nitric oxide 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 1or 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. 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.

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 Available	
Vapor density (Air = 1)	: Not Available	
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) vol/vol @0^{O} C ($32^{O}F$) and 1 atm.	: Very slight	
Odor threshold	: Not Applicable	
Odor and appearance	: Colorless gas	

Stability and Reactivity

Stability:
Stable under normal conditions.

Incompatible Materials:
Oxidizing agents, halides, hydrocarbons, and oxygen. Reacts vigorously with fluorine, fluorine oxides and chlorine in the presence of moisture.

Hazardous Decomposition Products:
Nitric oxide oxidizes in air to from nitrogen dioxide, which is extremely reactive and a strong oxidizer. Nitric oxide reacts with moisture and oxygen to form nitrous and nitric acids.

Hazardous Polymerization:
Will not occur.

Toxicological Information

Nitric oxide 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 nitric oxide limits its warning properties.

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

There is unspecified mutagenic data for nitric oxide (SAX/RTECS).

Ecological Information

Environmental Fate:
This gas mixture will be dissipated rapidly in well-ventilated areas. Nitric oxide is involved in a series of atmospheric chemical reactions which lead to the formation of photochemical smog.

Nitric oxide hydrolyzes to nitric acid when in contact with water.

Product does not contain Class I or Class II 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., (nitric oxide, 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 nitric oxide in quantities equal to or greater than the reportable quantity (RQ) of 100 pounds are subject to reporting to the National Response Center under CERCLA, Section 304 SARA Title III.

Nitric oxide is listed under Section 302 as an extremely hazardous Substance (EHS). The presence of nitric oxide 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
Chronic Health Hazard
Sudden Release of Pressure Hazard

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 40 CFR 372:

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).