



**MATHESON
TRI•GAS**

ask. . .The Gas Professionals™

MATERIAL SAFETY DATA SHEET

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

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NITRIC OXIDE/NITROGEN GAS MIXTURE

CHEMICAL FAMILY: Inorganic Gas Mixture

PRODUCT USE: EPA Protocol Mixtures

MANUFACTURER

MATHESON TRI-GAS, INC.

959 ROUTE 46 EAST
PARSIPPANY, NJ 07054-0624
USA

Phone: 973/257-1100

EMERGENCY PHONE: **CHEMTREC DOMESTIC U.S.:** **1-800-424-9300**
 CHEMTREC INTERNATIONAL: **1-703-527-3887**
 CANUTEC (CANADA): **1-613-996-6666**

2. COMPOSITION and INFORMATION ON INGREDIENTS

(10,000 ppm = 1%)

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR							
			ACGIH-TLV		OSHA-STEL		NIOSH			OTHER
			TWA ppm	STEL ppm	TWA ppm	STEL ppm	TWA ppm	STEL ppm	IDLH ppm	
Nitric Oxide	10102-43-9	0.1-10,000 ppm	25	NE	25	NE	25	NE	100	NE
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Oxygen levels should be maintained above 19.5%.							

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1998 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.

NE = Not Established

See Section 16 for Definitions of Terms Used.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is colorless to reddish brown and has a bleach-like odor (due to the presence of Nitric Oxide). The Nitric Oxide component of this gas mixture is toxic at levels possible in this mixture. Over-exposures to this gas mixture may result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. Delayed pulmonary damage and breathing difficulty may occur. Additionally, releases of this product may produce oxygen-deficient atmospheres. Severe over-exposures can be fatal. This gas mixture is not flammable or reactive. Emergency responders must wear appropriate personal protective equipment for the situation to which they are responding.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this product is by inhalation.

INHALATION: The Nitric Oxide component of this gas mixture is toxic. Inhalation over-exposures to this gas mixture may result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. Delayed pulmonary damage and breathing difficulty may also occur. Severe inhalation over-exposures can be fatal. All of the symptoms described above may be aggravated by physical exertion.

As a result of severe over-exposures to this gas mixture, permanent lung injury may occur. Prolonged or repeated over-exposures to this gas mixture may cause impaired lung function, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell, dental erosion and gum disorders.

Note: symptoms can develop after over-exposure to concentrations of Nitrogen Dioxide in ranges which exist in this gas mixture. The onset of the symptoms of pulmonary edema can be delayed for hours or days after the exposure.

Additionally, if this gas mixture is released in poorly-ventilated areas (e.g., an enclosed or confined space), 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.

CONTACT WITH SKIN or EYES: The gas mixture may be irritating to the skin. Symptoms of skin over-exposure may include scratchiness, pain, and redness. If this gas mixture contaminates the eyes, severe injury and swelling of the eye tissue may occur. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite.

SKIN ABSORPTION: Skin absorption is a significant route of exposure for Nitric Oxide following prolonged low-level exposure.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Over-exposures may result in severe irritation and burns of eyes, skin, mucous membranes, and any other exposed tissue. If high concentrations of this gas mixture are inhaled, delayed pulmonary damage and breathing difficulty may occur. Severe inhalation over-exposures can be fatal, as a result of lung damage or asphyxiation.

CHRONIC: Prolonged or repeated over-exposures to this gas mixture may cause impaired lung function, bronchitis, coughing, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell, dental erosion and gum disorders. Refer to Section 11 (Toxicology Information) for additional data.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes. CHRONIC: Skin, respiratory system.

HMIS RATING: HEALTH = 3 FLAMMABILITY = 0 REACTIVITY = 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

4. FIRST-AID MEASURES

GENERAL INFORMATION: In cases of over exposure, delayed onset of life-threatening symptoms may occur. Remove to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. **Seek medical attention immediately.**

SKIN EXPOSURE: If this gas mixture has contaminated the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Seek immediate medical attention.

EYE EXPOSURE: If this gas enters the eyes, open exposed eyes while under gentle running water. Use sufficient force to open eyelids. "Roll" eyes. Minimum flushing is for 15 minutes.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions, skin conditions, or eye disorders may be aggravated by over-exposure to the components of this gas mixture.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

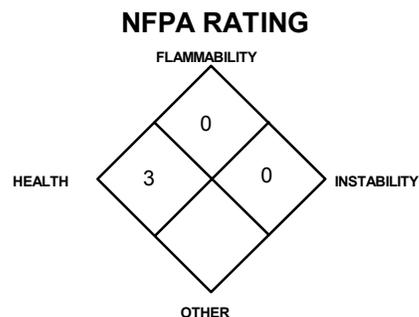
FIRE EXTINGUISHING MATERIALS: Use extinguishing materials appropriate for surrounding materials involved in the fire. Water spray should be used to cool fire-exposed containers.

UNUSUAL FIRE AND EXPLOSION HAZARD: The Nitric Oxide component of this gas mixture is toxic at relatively low concentrations and present a significant health hazard to firefighters in the concentrations present in this gas mixture. This component can slowly react with water to form a solution which is corrosive to skin and metal. Corrosive and toxic gases, vapors, and mists may spread from the point of release.

EXPLOSION SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Use a water spray or fog to reduce or direct vapors. Do not direct a water spray at the source of a release. Water spray should be used with care. Approach fire from an upwind direction, to prevent over-exposure to this gas mixture. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage.



**See Section 16 for
Definition of Ratings**

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used in the event of a significant release from a single cylinder. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666).

Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Monitor the surrounding area for the presence of Nitric Oxide, and oxygen. The level of must be below those listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES

Do not eat or drink while handling chemicals.

Be aware of all potential exposure symptoms; exposures to fatal concentrations of this product could occur without any significant warning symptoms.

All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release.

Workers who handle this gas mixture should wear protective clothing, as listed in Section 8 (Exposure Controls and Personal Protection).

Instant-acting showers should be available in the event of an emergency.

Eye-wash fountains or similar equipment should be available for eye irrigation.

If ventilation controls are not adequate to control exposure to this gas mixture, proper respiratory protection equipment should be provided and workers using such equipment should be carefully trained in its operation and limitations.

Precautions must always be taken to prevent suck-back of foreign materials into the cylinder by using a check-valve, or vacuum break, since suck-back may cause dangerous pressure changes within the cylinder.

STORAGE AND HANDLING PRACTICES: Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat or ignition. Do not allow area where cylinders are stored to exceed 52°C (125°F).

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

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

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not use oils or grease on gas-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating the cylinder valve. Never insert an object (e.g wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage the valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of an electric circuit.

Use: Close main cylinder valve. Replace valve protection cap. Close valve after each use and when empty. Mark empty cylinders "EMPTY".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Refer to current CGA Guidelines for information on protective practices during maintenance of contaminated equipment.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

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

RESPIRATORY PROTECTION: Maintain the level of Nitric Oxide below those listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. If necessary, use only respiratory protection authorized in the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards and Canadian CSA Standard Z94.4-93. 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).

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

RESPIRATORY PROTECTION (continued): The following are NIOSH respiratory protection recommendations for Nitric Oxide and Sulfur Dioxide for additional information on respiratory protective equipment.

NITRIC OXIDE CONCENTRATION

Up to 100 ppm:

RESPIRATORY PROTECTION

Any Supplied-Air Respirator (SAR) operated in a continuous-flow mode or any Chemical Cartridge Respirator with a full facepiece and cartridge(s), providing protection against Nitric Oxide. Only non-oxidizable sorbents are allowed (not charcoal), or any Powered, Air-Purifying Respirator (PAPR) with cartridge(s) providing protection against Nitric Oxide, or any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against Nitric Oxide, or any SAR, or any Self-Contained Breathing Apparatus (SCBA) 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 self-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 canister providing protection against Nitric Oxide. Only non-oxidizable sorbents are allowed (not charcoal), or any appropriate escape-type, SCBA.

SULFUR DIOXIDE CONCENTRATION

Up to 20 ppm:

RESPIRATORY PROTECTION

Any Chemical Cartridge Respirator with cartridge(s) providing protection against Sulfur Dioxide, or any Supplied-Air Respirator (SAR).

Up to 50 ppm:

Any SAR operated in a continuous-flow mode, or any Powered, Air-Purifying Respirator (PAPR) with cartridge(s) providing protection against the compound of concern.

Up to 100 ppm:

Any Chemical Cartridge Respirator with a full facepiece and cartridge(s) providing protection against the compound of concern, or any Air-Purifying, Full-Facepiece Respirator (gas mask) with a chin-style, front- or back-mounted canister providing protection against Sulfur Dioxide, or any PAPR with a tight-fitting facepiece and cartridge(s) providing protection against Sulfur Dioxide or any SAR that has a tight-fitting facepiece and is 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 canister providing protection against Sulfur Dioxide, or any appropriate escape-type, SCBA.

EYE PROTECTION: Splash goggles or safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or appropriate Canadian Standards.

HAND PROTECTION: Chemically resistant gloves should be worn when using this gas mixture. Wear mechanically-resistant gloves when handling cylinders containing this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138, or appropriate Standards of Canada.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to the task. 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, foot protection should be used, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture:

VAPOR DENSITY: 1.145 kg/m³ (0.0715 lb/ft³) **EVAPORATION RATE (nBuAc = 1):** Not applicable.
SPECIFIC GRAVITY (air = 1): 0.967 **FREEZING POINT:** -210°C (-345.8°F)
SOLUBILITY IN WATER: 1.49% (v/v) **BOILING POINT (@ 1 atmos.):** -195.8°C (-320.4°F)
EXPANSION RATIO: Not applicable. **SPECIFIC VOLUME (ft³/lb):** 13.8
ODOR THRESHOLD: 0.36 mg/m³ [Nitric Oxide]
VAPOR PRESSURE (psia): Not applicable.
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is pertinent to this product:

APPEARANCE, ODOR AND COLOR: This gas mixture is colorless to reddish brown and has a bleach-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): Although the odor of this gas mixture is irritating, it does not serve as a reliable warning property for releases of this gas mixture. 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. Area monitoring should be performed using appropriate equipment.

10. STABILITY and REACTIVITY

STABILITY: Stable at standard temperatures and pressures.

DECOMPOSITION PRODUCTS: Will react with water or moist air to form nitrogen dioxide, and other oxides of nitrogen and sulfur.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Nitric Oxide is not compatible with the following materials (especially in the presence of moisture): strong bases, strong oxidizers, powdered metals, and metal oxides. Nitrogen, the main component, is a relatively inert gas.

HAZARDOUS POLYMERIZATION: Will not occur.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following are human toxicity data, LC₅₀ inhalation-rat data, mutation data and select LCLo and TCLo data for the components of this gas mixture (which are present at a level greater than 1 mole%). Additional animal data are available for the components, but are not being presented in this MSDS.

NITRIC OXIDE:
LC₅₀ (Inhalation-Rat) 1068 mg/m³/4 hours

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

IRRITANCY OF PRODUCT: This product is severely irritating to contaminated tissue.

SENSITIZATION TO THE PRODUCT: The components of this product not known to be skin or respiratory sensitizers.

11. TOXICOLOGICAL INFORMATION (Continued)

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

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans. There are mutagenic data for Nitric Oxide, as follows:

NITRIC OXIDE:

Mutation in Microorganisms (Salmonella typhimurium) 30 ppm

Mutation in Mammalian Somatic Cells (Hamster-Fibroblast) 10 ppm

Embryotoxicity: This gas mixture has not been reported to cause embryotoxic effects in humans.

Teratogenicity: This gas mixture contains a component that can cause teratogenic effects in humans.

Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans.

Nitric Oxide, a component of this gas mixture, has been shown to cause and fetal toxicity in animal studies.

BIOLOGICAL EXPOSURE INDICES (BEIs): The following are Biological Exposure Indices (BEIs) currently available the Nitric Oxide component of this gas mixture (as a Methemoglobin Inducer).

CHEMICAL: DETERMINANT	SAMPLING TIME	BEI
Nitric Oxide (as Methemoglobin Inducer) • Methemoglobin in Blood	• During or End of Shift	• 1.5% of Hemoglobin

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas mixture will be dissipated rapidly in well-ventilated areas..

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to the corrosive nature of this product, animals exposed to this product may experience tissue damage, burns, and may be killed. Oxygen displacement may also be a factor in the toxicity of this product. Plants contaminated with this product may be adversely affected.

EFFECT OF CHEMICAL ON AQUATIC LIFE: The Nitric Oxide component of this gas mixture will hydrolyze and form nitric acid when in contact with water. In the unlikely event that a release of this product occurs near a river or other body of water, fish and other aquatic life may be harmed.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Matheson Tri-Gas. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

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

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Nitrogen, Nitric Oxide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

PACKING GROUP: Not Applicable

D.O.T HAZARD LABEL: Class 2.2 (Non-Flammable Gas)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as a 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 present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owner's consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

14. TRANSPORTATION INFORMATION (Continued)

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as dangerous goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gas, n.o.s. (Nitrogen, Nitric Oxide)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not Applicable
HAZARD LABEL: 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.125
ERAP INDEX: None
PASSENGER CARRYING SHIP INDEX: None
PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2004): 126

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).

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 present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owner's consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this product 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)
Nitric Oxide	YES	YES	NO

U.S. SARA THRESHOLD PLANNING QUANTITY: Nitric Oxide = 100 lb (45.4 kg)

U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21): ACUTE: Yes; CHRONIC: Yes; FIRE: No; REACTIVE: No; SUDDEN RELEASE: Yes

U.S. TSCA INVENTORY STATUS: Components of this product are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Nitric Oxide = 10 lb (4.54 kg)

OTHER U.S. FEDERAL REGULATIONS: Nitric Oxide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The threshold quantity for this gas is 10,000 lbs (4,540 kg).

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

LABELING: If cylinders of this gas mixture should be labeled for precautionary information per the guidelines of the CGA. Refer to the CGA for further information.

ADDITIONAL CANADIAN REGULATIONS:

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

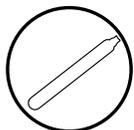
OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this product are not on the CEPA Priorities Substances Lists.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL CANADIAN REGULATIONS (continued):

CANADIAN WHMIS SYMBOLS: This gas mixture would be categorized as a Controlled Product, Hazard Classes: **A** (compressed gas), **D2A** (chronic toxic effects), and **D2B** (skin & eye irritation) as per the Controlled Product Regulations. The following symbols are required for WHMIS compliance for this gas mixture.



16. OTHER INFORMATION

CREATION DATE: April 5, 2000

REVISION DATE: June 20, 2005

REVISION HISTORY: Minor revision to Section 14, June 2005.

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 use 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 can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 421 Walney Road, 5th Floor, Chantilly, VA 20151. Telephone: (703) 788-2700, Fax: (703) 961-1831.

"Safe Handling of Compressed Gases in Containers" (P-1, 1999)

"Safe Handling and Storage of Compressed Gases" (AV-1, 1999)

"Handbook of Compressed Gases" (1992)

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
PO Box 3519, La Mesa, CA 91944-3519
800/441-3365

DEFINITIONS OF TERMS

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

CAS #: This is the Chemical Abstract Service Number that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

DFG MAK Pregnancy Risk Group Classification: **Group A:** A risk of damage to the developing embryo or fetus has been unequivocally demonstrated. Exposure of pregnant women can lead to damage of the developing organism, even when MAK and BAT (Biological Tolerance Value for Working Materials) values are observed. **Group B:** Currently available information indicates a risk of damage to the developing embryo or fetus must be considered to be probable. Damage to the developing organism cannot be excluded when pregnant women are exposed, even when MAK and BAT values are observed. **Group C:** There is no reason to fear a risk of damage to the developing embryo or fetus when MAK and BAT values are observed. **Group D:** Classification in one of the groups A-C is not yet possible because, although the data available may indicate a trend, they are not sufficient for final evaluation.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELs: NIOSH's Recommended Exposure Limits.

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA.

EXPOSURE LIMITS IN AIR (continued):

PEL-Permissible Exposure Limit (continued): The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

IDLH-Immediately Dangerous to Life and Health: This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat:* < 5000 mg/kg.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS (continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

HEALTH HAZARD (continued):

1 (continued): *Dermal Toxicity LD₅₀Rat or Rabbit:* < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat:* < 20 mg/L.; **1** (Slight Hazard: Minor reversible Injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat:* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 1000-2000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 2-20 mg/L); **2** (Moderate Hazard: Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, < 25. *Oral Toxicity LD₅₀ Rat:* > 50-500 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 200-1000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.5-2 mg/L.); **3** (Serious Hazard: Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat:* > 1-50 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 20-200 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.05-0.5 mg/L.); **4** (Severe Hazard: Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L).

FLAMMABILITY HAZARD:

0 (Minimal Hazard-Materials that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.); **1** (Slight Hazard-Materials that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]; **2** (Moderate Hazard-Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, including: Liquids having a flash-point at or above 37.8°C [100°F]; Solid materials in the form of coarse dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Liquids and semisolids that readily give off flammable vapors.); **3** (Serious Hazard- Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC];

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued):

3 (continued): Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]; **4** (Severe Hazard-Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignites spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric].

PHYSICAL HAZARD:

0 (*Water Reactivity:* Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Unstable Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react.); **1** (*Water Reactivity:* Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* *Oxidizers:* Packing Group II *Solids:* any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3** (*Water Reactivity:* Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group I *Solids:* any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. *Liquids:* Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%/cellulose mixture. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4** (*Water Reactivity:* Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability "4". *Oxidizers:* No "4" rating.

16. OTHER INFORMATION (Continued)

DEFINITIONS OF TERMS (continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

4 (continued): *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.).

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

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

FLAMMABILITY HAZARD: **0** Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur. **2** Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.

INSTABILITY HAZARD: **0** Materials that in themselves are normally stable, even under fire conditions. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

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

TOXICOLOGICAL INFORMATION:

Human and Animal Toxicology: Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **Cancer Information:** The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program,

RTECS - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. **Other Information:** **BEI** - ACGIH Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

ECOLOGICAL INFORMATION:

BCF = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter; **EC** is the Effect Concentration in water; **EC₅₀** is the Effect Concentration for 50% of the organisms exposed; **NOEC** is the No Observed Effect Concentration; **MATC** is the Maximum Acceptable Toxicant Concentration; **NOLC** is the No Observed Lethal Concentration; **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

REGULATORY INFORMATION:

U.S. and CANADA:

ACGIH: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration.