

PRODUCT NAME: NITRIC OXIDE**1. Product and Company Identification**

**BOC Gases,
Division of
The BOC Group, Inc.
575 Mountain Avenue
Murray Hill, NJ 07974**

**TELEPHONE NUMBER: (908) 464-8100
24-HOUR EMERGENCY TELEPHONE NUMBER:
CHEMTREC (800) 424-9300**

**BOC Gases
Division of
BOC Canada Limited
5975 Falbourne Street, Unit 2
Mississauga, Ontario L5R 3W6**

**TELEPHONE NUMBER: (905) 501-1700
24-HOUR EMERGENCY TELEPHONE NUMBER:
(905) 501-0802
EMERGENCY RESPONSE PLAN NO: 2-0101**

**PRODUCT NAME: NITRIC OXIDE
CHEMICAL NAME: Nitric Oxide
COMMON NAMES/SYNONYMS: Nitrogen Monoxide
TDG (Canada) CLASSIFICATION: 2.3 (5.1, 8)
WHMIS CLASSIFICATION: A, C, D1A, E, D2B**

**PREPARED BY: Loss Control (908)464-8100/(905)501-1700
PREPARATION DATE: 6/1/95
REVIEW DATES: 06/28/04**

2. Composition, Information on Ingredients**EXPOSURE LIMITS¹:**

INGREDIENT	% VOLUME	PEL-OSHA²	TLV-ACGIH³	LD₅₀ or LC₅₀ Route/Species
Nitric Oxide FORMULA: NO CAS: 10102-43-9 RTECS #: QX0525000	98.0 to 99.995	25 ppm TWA	25 ppm TWA	LC ₅₀ : 115 ppm Inhalation/rat (1 H, as NO ₂ ; CGA P-20)

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 2004 Threshold Limit Values for Chemical Substances and Physical Agents.

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

3. Hazards Identification**EMERGENCY OVERVIEW**

Colorless to reddish brown gas with suffocating odor. Poison gas. Corrosive. Oxidizer. Nitric Oxide is severely irritating to eyes and respiratory system. Effects may be delayed for several hours following exposure. If irritation occurs when working with this product, inhalation exposure may have already occurred. Prompt medical attention is mandatory in all cases of overexposure. Inhalation may result in chemical pneumonitis, retention of body fluid and swelling in the lungs (edema) or cyanosis). Nonflammable but will accelerate combustion and increase the risk of fire and explosion in combustible or flammable materials. Contents under pressure. Use and store below 125 °F.

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ROUTE OF ENTRY:

Skin Contact Yes	Skin Absorption No	Eye Contact Yes	Inhalation Yes	Ingestion No
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HEALTH EFFECTS:

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

Carcinogenicity: -- NTP: No IARC: No OSHA: No

EYE EFFECTS: Severely irritating to the eyes. May cause corrosive burns.

SKIN EFFECTS: Severely irritating to dermal tissues. May cause corrosive burns

INGESTION EFFECTS: None. This product is a gas and cannot be ingested.

INHALATION EFFECTS: Usually 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.

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

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: May aggravate pre-existing eye, skin, and respiratory disorders.

POTENTIAL ENVIRONMENTAL EFFECTS: Ecotoxicity values were unavailable. Toxic effects are expected to be similar to those seen in humans and test animals.

4. First Aid Measures

EYES: Immediately flush eyes with lukewarm water for at least 30 minutes while obtaining immediate medical attention.

SKIN: Immediately flush skin with large quantities of lukewarm water. Get immediate medical attention.

INGESTION: Not required.

INHALATION: PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious victims should be CARRIED (not assisted) to an uncontaminated area and inhale fresh air with supplemental oxygen. Quick removal from the contaminated area is most important. Keep the 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, and given oxygen or artificial respiration as indicated. Once respiration has been restored they should be treated as above.

5. Fire Fighting Measures

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

FIRE AND EXPLOSION HAZARDS: Nitric oxide is nonflammable but will support and may vigorously accelerate combustion. Will support or initiate combustion/explosion of organic matter and other oxidizable material. Cylinder may vent rapidly or rupture violently from pressure when involved in a fire situation.

EXTINGUISHING MEDIA: Use media appropriate for surrounding materials. Nitric oxide hydrolyzes to nitric acid in the presence of moisture.

FIRE FIGHTING INSTRUCTIONS: Cut off the flow of gas which is supporting/accelerating fire if possible. Firefighters should wear respiratory protection (SCBA) and full turnout or Bunker gear with additional chemical protective clothing as necessary to prevent exposure. Continue to cool fire-exposed cylinders until well after flames are extinguished.

6. Accidental Release Measures

Immediately extinguish all ignition sources and evacuate all personnel from affected area. A leak near combustible or flammable materials may represent a severe fire or explosion hazard. Stop or control the leak or remove the cylinder to the outside if it can be done without risk. Ventilate enclosed spaces. Deny entry to persons not wearing appropriate protective equipment. Protective equipment is essential to prevent exposure (See Section 8). 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 container valve, contact a HAZMAT specialist and the appropriate emergency telephone number listed in Section 1 or call your closest BOC location.

7. Handling and Storage

Electrical Classification: Nonhazardous.

Nitric oxide is noncorrosive and may be used with most common structural materials. However, in the presence of moisture and oxygen, corrosive conditions will develop as a result of the formation of nitric and nitrous acids. Prior to use, systems to contain nitric oxide must first be purged with an inert gas. Where air contamination cannot be eliminated, stainless steel materials should be used.

Use only in well-ventilated areas. Valve protection caps must remain in place unless container 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 system. Do not insert any object (i.e.: screwdriver) into valve cap openings as this can damage the valve causing leakage.

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Protect cylinders from physical damage. Store in cool, dry, well-ventilated area away from heavily trafficked areas, emergency exits, flammables, and combustibles. Do not allow the temperature where cylinders are stored to exceed 125 °F (52 °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 being stored for excessive periods of time. Post "NO SMOKING OR OPEN FLAMES" signs in storage and use areas. There should be no sources of ignition in areas where nitric oxide is used or stored.

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

8. Exposure Controls, Personal Protection

ENGINEERING CONTROLS: Local exhaust ventilation used in combination with partially or totally enclosed processes as necessary to control air contaminants to at or below acceptable exposure guidelines.

EYE/FACE PROTECTION: Gas-tight safety goggles or full-face respirator.

SKIN PROTECTION: Appropriate protective and chemical-resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction, consult protective clothing manufacture's specific data. (Teflon® is generally effective for exposures longer than 4 hours).

RESPIRATORY PROTECTION: For emergency release and conditions with exposures above the applicable exposure limits use a positive pressure NIOSH approved air-supplying respirator systems (SCBA or airline/escape bottle) using a full-face mask and at a minimum Grade D air.

OTHER/GENERAL PROTECTION: Safety shoes, safety shower and emergency eyewash station

9. Physical and Chemical Properties

PARAMETER	VALUE	UNITS
Physical state (gas, liquid, solid)	: Gas	
Vapor pressure	: above critical temp.	
Vapor density at STP (Air = 1)	: 1.04	
Evaporation point	: Not Available	
Boiling point	: -241.2	°F
	: -151.9	°C
Freezing point	: -262.5	°F
	: -163.6	°C
PH	: Not Applicable	
Specific gravity	: Not Available	
Oil/water partition coefficient	: Not Available	
Solubility (H ₂ O)	: Negligible	
Odor threshold	: Not Applicable	
Odor and appearance	: Colorless gas, suffocating odor, reddish brown in air	

10. Stability and Reactivity

STABILITY: Stable

INCOMPATIBLE MATERIALS/CONDITIONS: Oxidizing agents, halides, hydrocarbons and oxygen. Reacts vigorously with fluorine, fluorine oxides and chlorine in the presence of moisture. Avoid heat, sparks, and flames.

HAZARDOUS DECOMPOSITION PRODUCTS: Oxidizes in air to form nitrogen dioxide, which is extremely reactive and a strong oxidizer. Upon contact with moisture and oxygen, it produces nitrous and nitric acids.

HAZARDOUS POLYMERIZATION: Will not occur.

11. Toxicological Information

INHALATION: Mice which inhaled a total of 320 ppm nitric oxide exhibited convulsions or effects on seizure threshold as well as cyanosis. The four hour inhalation LC₅₀ is 868 ppm (rat).

SKIN AND EYE: May cause skin and eye irritation and corrosion.

OTHER: Rat inhalation of nitric oxide (50 mg/m³; 40 ppm/6H/7W-I) produced changes in liver and lung weights as well as overall weight loss or decreased weight gain. Chronic or repeated exposures may cause permanent decrements in pulmonary function (Silo Filler's Disease). The absence of marked acute irritation of nitric oxide at toxic levels limits its warning properties.

12. Ecological Information

Product does not contain Class I or Class II ozone depleting substances. See Section 3 for ecotoxicity values. Bioconcentration information was unavailable. Nitric oxide 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. Nitric oxide is listed as an extremely hazardous substance (EHS) with a threshold planning quantity (TPQ) of 100 pounds. The CERCLA reportable quantity (RQ) for nitric oxide is 10 pounds.

13. Disposal Considerations

Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED, WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to BOC Gases or authorized distributor for proper disposal.

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14. Transport Information

PARAMETER	United States DOT	Canada TDG
PROPER SHIPPING NAME:	Nitric Oxide, Compressed	Nitric Oxide, Compressed
HAZARD CLASS:	2.3 (5.1, 8)	2.3 (5.1, 8)
IDENTIFICATION NUMBER:	UN 1660	UN 1660
SHIPPING LABEL:	POISON GAS, OXIDIZER, CORROSIVE	TOXIC GAS, OXIDIZER, CORROSIVE

Additional Marking Requirement: "Inhalation Hazard". If net weight of product \geq 10 pounds, the container must be also marked with the letters "RQ".

Additional Shipping Paper Description Requirement: "Poison-Inhalation Hazard, Zone A". If net weight of product \geq 10 pounds, the shipping papers must be also marked with the letters "RQ".

15. Regulatory Information

SARA TITLE III NOTIFICATIONS AND INFORMATION

SARA TITLE III - HAZARD CLASSES:

Acute Health Hazard
Chronic Health Hazard
Fire Hazard
Sudden Release of Pressure Hazard

SARA TITLE III - SECTION 313 SUPPLIER NOTIFICATION:

This product does not contain toxic chemicals subject to reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372.

U.S. TSCA/Canadian DSL: All ingredients are listed on the U.S. Toxic Substances Control Act (TSCA) inventory or exempt from listing and on the Canadian Domestic Substance List (DSL).

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

16. Other Information

NFPA HAZARD CODES

Health: 3
Flammability: 0
Instability: 0
OXIDIZER

HMIS HAZARD CODES

Health: 3
Flammability: 0
Physical Hazard: 3

RATINGS SYSTEM

0 = No Hazard
1 = Slight Hazard
2 = Moderate Hazard
3 = Serious Hazard
4 = Severe Hazard

Note: 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*.

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ACGIH	American Conference of Governmental Industrial Hygienists
DOT	Department of Transportation
IARC	International Agency for Research on Cancer
NTP	National Toxicology Program
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
WHMIS	Workplace Hazardous Materials Information System

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.

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