NITRIC OXIDE
Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	NITRIC OXIDE
Product Code(s)	G-60, 1056
UN-Number	UN1660
Recommended Use	Compressed gas.
Synonyms	Mononitrogen Monoxide; Nitrogen Monoxide
Supplier Address*	Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC 575 Mountain Ave. Murray Hill, NJ 07974 Phone: 908-464-8100 www.lindeus.com Linde Gas Puerto Rico, Inc. Las Palmas Village Road No. 869, Street No. 7 Catano, Puerto Rico 00962 Phone: 787-641-7445 www.pr.lindegas.com Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecanada.com * May include subsidiaries or affiliate companies / divisions. For additional product information contact your local customer service.
Chemical Emergency Phone Number	Chemtrec: 1-800-424-9300 for US / 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Oxidizer
Fatal if inhaled
Accelerates combustion and increases risk of fire
The product causes burns of eyes, skin and mucous membranes
Contents under pressure
Keep at temperatures below 52°C / 125°F

Appearance Reddish-brown in air | Physical State Compressed gas. | Odor Acrid

OSHA Regulatory Status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential Health Effects

Principle Routes of Exposure	Eye contact. Skin contact. Inhalation.
Acute Toxicity	
Inhalation	Fatal if inhaled. Inhalation of corrosive fumes / gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate.
Eyes	Severely irritating to eyes. May cause burns.
Skin	Contact causes severe skin irritation and possible burns.
Skin Absorption Hazard	No known hazard in contact with skin.
Ingestion	Not an expected route of exposure. Ingestion causes burns of the upper digestive and respiratory tract.
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, tooth corrosion and gradual loss of strength
Aggravated Medical Conditions	Skin disorders. Pre-existing eye disorders. Respiratory disorders.
Environmental Hazard	See Section 12 for additional Ecological Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Nitric oxide	10102-43-9	>99	NO

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	Immediate medical attention is required. In case of contact with substance, immediately flush eyes with running water for at least 30 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing.
Skin Contact	Immediate medical attention is required. Wash off immediately with soap and plenty of water for at least 15 minutes while removing all contaminated clothing and shoes.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive. 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.
Ingestion	None under normal use. Call a POISON CENTER or doctor / physician if exposed or you feel unwell.
Notes to Physician	Treat symptomatically.
Protection of First-aiders	Use personal protective equipment. Avoid contact with skin, eyes and clothing.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Oxidizer. May vigorously accelerate combustion.
Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Hazardous Combustion Products	Nitric acid and nitrous acid.

Explosion Data

Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None
Specific Hazards Arising from the Chemical	Will ignite combustible materials (wood, paper, oil, debris, etc.). Nitric oxide hydrolizes to nitric acid in the presence of moisture. Continue to cool fire exposed cylinders until flames are extinguished. Cylinders may rupture under extreme heat. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA / NIOSH (approved or equivalent) and full protective gear. Additional chemical protective clothing may be required to protect from toxic decomposition products.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill / leak. Ensure adequate ventilation. Use personal protective equipment. Avoid contact with skin, eyes and clothing.
Environmental Precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas. Prevent product from entering drains.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Handling	Nitric oxide is non-corrosive 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 elminated stainless steel should be used. Use only in ventilated areas. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Never insert an object (e.g. wrench, screwdriver, pry bar,etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. "NO SMOKING" signs should be posted in storage and use areas.

Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.

Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.

Storage

Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregrated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nitric oxide 10102-43-9	TWA: 25 ppm	TWA: 25 ppm TWA: 30 mg / m^3	IDLH: 100 ppm TWA: 25 ppm TWA: 30 mg / m^3

Immediately Dangerous to Life or Health.

Other Exposure Guidelines

Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Engineering Measures

Showers. Eyewash stations. Ventilation systems. Exhaust gas should be vented to a gas treatment system.

Ventilation

Use ventilation adequate to keep exposures below recommended exposure limits.

Personal Protective Equipment

Eye / Face Protection

Tightly fitting safety goggles. Face-shield.

Skin and Body 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 manufacturer's specifications. (Teflon® is generally effective for exposures longer than 4 hours).

Respiratory Protection

General Use

If exposure limits are exceeded or irritation is experienced, NIOSH / MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Emergency Use

Use positive pressure air line respirator or self-contained breathing apparatus for exposure over exposure limits or emergency use. For exposures above IDLH, an additional escape bottle is required.

Hygiene Measures

Avoid contact with skin, eyes and clothing. When using, do not eat, drink or smoke. Wash hands before breaks and immediately after handling the product. Provide regular cleaning of equipment, work area and clothing. Keep away from food, drink and animal feeding stuffs.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Reddish-brown in air.	Odor	Acrid.
Odor Threshold	0.29-0.97 ppm	Physical State	Compressed gas
Flash Point	No information available.	Autoignition Temperature	No information available.
Decomposition Temperature	No information available.	Boiling Point / Boiling Range	-151.9 °C / -241.2 °F
Freezing Point	-163.6 °C / -262.5 °F	Molecular Weight	30.006
Water Solubility	7.4 (vol / vol @ 0°C and 1 atm)	Evaporation Rate	No information available
Vapor Pressure	Above critical temp.	Vapor Density	1.04 (air = 1)
Gas Density	@ 21.1°C (70°F) and 1 atm: 0.0777 lb / ft^3 (1.245 kg / m^3)	VOC Content (%)	Not applicable.
Specific Vol. @ 21.1°C & 1 atm	13 ft^3 / lb (0.81 m^3 / kg)	Flammability Limits in Air	
		Upper	Not applicable
		Lower	Not applicable

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions.
Incompatible Products	Strong oxidizing agents. Hydrocarbons. Halides. Uranium. Boron. Phosphorus trihydride (phosphine). chromium.
Conditions to Avoid	Heat, flames and sparks. Reacts vigorously with fluorine, fluorine oxides, and chlorine in the presence of moisture.
Hazardous Decomposition Products	Oxidizes in air to form nitrogen dioxide, which is extremely reactive and a strong oxidizer. Upon contact with moisture and oxygen, produces nitrous and nitric acid.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral:	No information available.
LD50 Dermal:	No information available.
LC50 Inhalation:	Per CGA P-20: 115 ppm / 1 hr (Rat) NO_2
Inhalation	Mice which inhaled a total of 320 ppm nitric oxide exhibited convulsions or effects on seizure threshold as well as cyanosis.
Repeated Dose Toxicity	No information available.

Chronic Toxicity

Chronic Toxicity	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.
Carcinogenicity	Contains no ingredient listed as a carcinogen.

Irritation	No information available.
Sensitization	No information available.
Reproductive Toxicity	No information available.
Developmental Toxicity	No information available.
Synergistic Materials	None known.
Target Organ Effects	Eyes. Respiratory system. Skin.

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	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 Linde for proper disposal.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Nitric oxide, compressed
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN1660
Description	UN1660,Nitric oxide, compressed,2.3,(5.1, 8)
Additional Description:	"Toxic-Inhalation Hazard Zone A". If net weight of product is greater than or equal to 10 lbs., the shipping description must also contain the letters "RQ".
Additional Marking Requirements:	"Inhalation Hazard". If net weight of product is greater than or equal to 10 lbs., the container must also be marked with the letters "RQ".
Emergency Response Guide Number	124

TDG

Proper Shipping Name	Nitric oxide, compressed
Hazard Class	2.3
Subsidiary Class	(5.1), (8)
UN-Number	UN1660
Description	UN1660,NITRIC OXIDE, COMPRESSED,2.3(5.1), (8)

MEX

Proper Shipping Name	Nitric oxide, compressed
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN1660
Description	UN1660 Nitric oxide, compressed,2.3

IATA

UN-Number	UN1660
Proper Shipping Name	Nitric oxide, compressed
Hazard Class	2.3
Subsidiary Class	5.1,8
ERG Code	2PX
Description	UN1660,Nitric oxide, compressed,2.3(5.1,8)
Maximum Quantity for Passenger	Forbidden
Maximum Quantity for Cargo Only	Forbidden
Limited Quantity	No information available.

IMDG / IMO

Proper Shipping Name	Nitric oxide, compressed
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN1660
EmS No.	F-C, S-W
Description	UN1660, Nitric oxide, compressed,2.3(5.1, 8)

ADR

Proper Shipping Name	Nitric oxide, compressed
Hazard Class	2.3
UN-Number	UN1660
Classification Code	1TOC
Description	UN1660 Nitric oxide, compressed,2.3,
ADR / RID-Labels	5.1, 8

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS / ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL / NDSL - Canadian Domestic Substances List / Non-Domestic Substances List
EINECS / ELINCS - European Inventory of Existing Commercial Chemical Substances / EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311 / 312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	No

Clean Water Act

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs

This material, as supplied, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

Chemical Name	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances	U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
Nitric oxide	10000 lbs		250 lb

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA / SARA

This material, as supplied, contains one or more substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	TPQ
Nitric oxide	10 lb	10 lb	100 lb TPQ

U.S. State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Nitric oxide	X	X	X		X

International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
Nitric oxide		Mexico: TWA 25 ppm Mexico: TWA 30 mg / m^3 Mexico: STEL 35 ppm Mexico: STEL 45 mg / m^3

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
A Compressed gases
C Oxidizing materials
D1A Very toxic materials
E Corrosive material

Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
Issuing Date	01-Jul-2010
Revision Date	27-Sep-2013
Revision Number	2
Revision Note	Not applicable.

NFPA	Health Hazard 4	Flammability 0	Stability 1	Physical and Chemical Hazards OX
HMIS	Health Hazard 3	Flammability 0	Physical Hazard 3	Personal Protection -

Note: 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.

End of Safety Data Sheet