Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Nitrous oxide, refrigerated liquid (MSDS No. P-6226-B)	**Trade Names:** Medipure® Liquid Nitrous Oxide
Chemical Name: Nitrous Oxide	**Synonyms:** Nitrous oxide (cryogenic liquid)
Chemical Family: Oxide	**Product Grades:** 2.5 AA, 5.5 Semiconductor Process Gas, USP-Source Material, USP-Medical Drug

Telephone: **Emergencies:** 1-800-645-4633* **Company Name:** Praxair, Inc.
CHEMTREC: 1-800-424-9300* 39 Old Ridgebury Road
Routine: 1-800-PRAXAIR Danbury, CT 06810-5113

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).*

2. Hazards Identification

EMERGENCY OVERVIEW

WARNING! Cold, oxidizing liquid and gas under pressure.
Vigorously accelerates combustion.
Can cause rapid suffocation.
Can cause anesthetic effects.
May cause nervous system and blood cell damage.
Reproductive hazard.
May cause frostbite.
May cause dizziness and drowsiness.
Self-contained breathing apparatus and protective clothing may be required by rescue workers.
Under ambient conditions, this colorless gas has a slightly sweet odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. May cause excitation, dizziness, drowsiness, poor coordination, and narcosis. Exposure to concentrations of 50% or greater will produce clinical anesthesia. High concentrations may cause asphyxia and death from lack of oxygen.

Skin Contact. No harm expected from gas. Liquid may cause frostbite.

Swallowing. An unlikely route of exposure. This product is a gas at normal temperature and pressure, but frostbite of the lips and mouth may result from contact with the liquid.

A vertical line in the left margin indicates revised or new material.

Eye Contact. No harm expected from gas. Liquid may cause frostbite.

Effects of Repeated (Chronic) Overexposure. Metabolic injury to the nervous system has resulted from frequent exposure to anesthetic concentrations of nitrous oxide. Complaints include numbness, tingling of hands and legs, loss of feeling in fingers, poor balance, and muscular weakness.

Other Effects of Overexposure. Nitrous oxide is an asphyxiant. Lack of oxygen can kill.

Medical Conditions Aggravated by Overexposure. Pregnant women should avoid exposure to nitrous oxide.

CARCINOGENICITY: Nitrous oxide is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Nitrous Oxide	10024-97-2	>99%*

**The symbol > means "greater than."*

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: For exposure to liquid, immediately warm frostbite area with warm water not to exceed 105°F (41°C). In case of massive exposure, remove contaminated clothing while showering with warm water. Call a physician.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: For exposure to liquid, immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

***NOTES TO PHYSICIAN*:** *Nitrous oxide may cause vitamin B-12 deficiency. This chemically induced deficiency may result in megaloblastic anemia and damage to the nervous system. When administered for anesthetic purposes, nitrous oxide may suppress immunological function, reducing resistance to infection and to other immuno-dependent disease processes.*

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Oxidizing agent; may accelerate combustion. This product cannot catch fire.

SUITABLE EXTINGUISHING MEDIA: Use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION: Not applicable.

PROTECTION OF FIREFIGHTERS: WARNING! Cold, oxidizing liquid and gas under pressure. Evacuate all personnel from danger area. Immediately spray containers with water

from maximum distance until cool, taking care not to direct spray onto vents on top of container. Do not discharge sprays into liquid product. Liquid nitrous oxide will freeze water rapidly. When containers have cooled, move them away from fire area if without risk. Self-contained breathing apparatus may be required by rescue workers. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Vapors form from this product and may travel or be moved by air currents to locations distant from the product handling point. Contact with combustible materials such as oil, grease, and other hydrocarbon products, especially in the presence of ignition sources such as pilot lights, other flames, smoking, sparks, heaters, electrical equipment, and static discharges may cause fire or explosion. Heat of fire can build pressure in closed container and cause it to rupture. No part of a container should be subjected to a temperature higher than 125°F (52°C). Liquid nitrous oxide containers are equipped with pressure relief devices. Venting vapors may obscure visibility. Liquid causes severe frostbite, a burn-like injury.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

WARNING! Cold, oxidizing liquid and gas under pressure.

Personal Precautions. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Nitrous oxide is an asphyxiant. Lack of oxygen can kill. Vapors can spread from spill. Contact with flammable materials may cause fire or explosion. Test for sufficient oxygen, especially in confined areas, before allowing reentry. Use self-contained breathing apparatus where needed. Shut off leak if without risk. Ventilate area of leak or move container to a well-ventilated area.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: ***Gas can cause rapid suffocation due to oxygen deficiency.*** Protect containers from damage. Use a suitable hand truck to move containers. Cryogenic containers must be handled and stored in an upright position. Do not drop or tip containers, or roll them on their sides. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using nitrous oxide, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation, away from oil, grease, and other hydrocarbons. Do not store in a confined space. Cryogenic containers are equipped with a pressure relief device and a pressure controlling valve. Under normal conditions, these containers will periodically vent product. Separate nitrous oxide containers from flammables by at least 20 ft (6.1 m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hour. Store only where temperature will not exceed 125°F (52°C).

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2008)
Nitrous Oxide	Not Established.	50 ppm*

*Praxair has established its own exposure level at 25 ppm.

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = Not available.

ENGINEERING CONTROLS:

Local Exhaust. Use a local exhaust system, if necessary, to control the concentration of nitrous oxide in the worker's breathing zone.

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure.

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear loose-fitting cryogenic gloves. Gloves must be free of oil and grease. Metatarsal shoes for container handling; protective clothing where needed. Cuffless trousers should be worn outside the shoes. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

Eye/Face Protection. Wear safety glasses and a full face shield. Select in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless liquid
ODOR:	Slightly sweet (Vapor)
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Cryogenic liquid
pH:	Not applicable.
MELTING POINT at 1 atm**:**	-131.48°F (-90.82°C)
BOILING POINT at 1 atm**:**	-127.26°F (-88.48°C)
FLASH POINT (test method)**:**	Not available.

EVAPORATION RATE (Butyl Acetate = 1)**:**	High
EXPANSION RATIO for liquid at boiling point to gas at 70°F (21.1°C):	Approx. 1 to 670
FLAMMABILITY:	Nonflammable
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** Not applicable. **UPPER:** Not applicable.
VAPOR PRESSURE at 68°F (20°C)**:**	759.7 psia (5238 kPa, abs)
LIQUID DENSITY at 77°F (25°C)**:**	46.3 lb/ft^3 (0.742 g/cm^3)
VAPOR DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1146 lb/ft^3 (.947 kg/m^3)
SPECIFIC GRAVITY (H_2O = 1) -127/60°F (-88.3/15.6°C)**:**	1.23
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	1.5297
SOLUBILITY IN WATER, vol/vol at 68°F (20°C) and 1 atm**:**	0.68
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	1202°F (650°C)
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	44.0128
MOLECULAR FORMULA:	N_2O

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: Flammable materials, hydrocarbons such as oils and grease, asphalt, ethers, alcohols, acids, and aldehydes. Alkali metals, boron, tungsten carbide, and powdered aluminum.

HAZARDOUS DECOMPOSITION PRODUCTS: Excess heat. Nitrous oxide decomposes explosively at 1,202°F (650°C) into two parts nitrogen to one part oxygen. In the presence of catalytic surfaces such as silver, platinum, cobalt, and copper or nickel oxides, this reaction occurs at lower temperatures.

POSSIBILITY OF HAZARDOUS REACTIONS: ☒ May Occur ☐ Will Not Occur

Nitrous oxide decomposes explosively at 1,202°F (650°C) into two parts nitrogen to one part oxygen. In the presence of catalytic surfaces such as silver, platinum, cobalt, and copper or nickel oxides, this reaction occurs at lower temperatures.

11. Toxicological Information

ACUTE DOSE EFFECTS: Not available.

STUDY RESULTS: Exposure to nitrous oxide has produced embryofetal toxicity in laboratory animals as evidenced by reduced fetal weight, delayed ossification, and increased incidence of visceral and skeletal variations. Exposure to nitrous oxide may be associated with an increased incidence of abortion in humans. Single prolonged exposure to high concentrations of nitrous oxide has resulted in bone marrow injury and adverse effects on the blood.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: Nitrous oxide does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Nitrous oxide, refrigerated liquid

HAZARD CLASS:	2.2	**PACKING GROUP/Zone:**	NA/NA*	**IDENTIFICATION NUMBER:**	UN2201	**PRODUCT RQ:**	None
SHIPPING LABEL(s):	NONFLAMMABLE GAS, OXIDIZER				
PLACARD (when required):	NONFLAMMABLE GAS, OXIDIZER				

** NA=Not applicable.*

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

MARINE POLLUTANTS: Nitrous oxide is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None
EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes
DELAYED: Yes
PRESSURE: Yes
REACTIVITY: No
FIRE: Yes

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Nitrous oxide is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Nitrous oxide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Nitrous oxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Nitrous oxide is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Nitrous oxide is listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

WARNING: Nitrous oxide is a chemical known to the State of California to cause developmental harm.
(California Health and Safety Code §25249.5 et seq.)

PENNSYLVANIA: Nitrous oxide is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Cold, oxidizing liquid and gas under pressure.*** Clean all gauges, valves, regulators, piping, and equipment as for oxygen service in accordance with CGA pamphlet G-4.1. Never substitute CO_2 equipment for N_2O equipment unless the CO_2 equipment has been disassembled and cleaned for oxygen service. Keep containers and their valves free of oil and grease. ***Use piping and equipment adequately designed to withstand pressures to be encountered.*** Avoid

materials incompatible with cryogenic use; some metals such as carbon steel may fracture easily at low temperature. ***Prevent reverse flow.*** Reverse flow into container may cause rupture. Use a check valve or other protective device in any line or piping from the container. Store and use with adequate ventilation. Close cylinder valve after each use; keep closed even when empty. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

Recommended Equipment: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

MIXTURES: When you mix two or more gases or liquefied gases, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 3
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 0	PHYSICAL HAZARD	= 2
SPECIAL	= OX		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-326 Gas Withdrawal CGA-624 Refrigerated Liquid Withdrawal
PIN-INDEXED YOKE:	Not applicable.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-712, but not generally applicable for Liquid Containers

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, http://www.cganet.com/Publication.asp.

AV-1	*Safe Handling and Storage of Compressed Gases*
AV-8	*Characteristics and Safe Handling of Cryogenic Liquid and Gaseous Oxygen*
G-4.1	*Cleaning Equipment for Oxygen Service*
G-8.1	*Standard for Nitrous Oxide Systems at Consumer Sites*
P-1	*Safe Handling of Compressed Gases in Containers*
SB-2	*Oxygen-Deficient Atmospheres*
SB-6	*Nitrous Oxide Security and Control*
V-1	*Compressed Gas Cylinder Valve Inlet and Outlet Connections*
—	*Handbook of Compressed Gases, Fourth Edition*

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current MSDSs for these products, contact your Praxair sales representative or local distributor or supplier, or download from www.praxair.com. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR; **Address:** Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14151-0044).

PRAXAIR®

Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113

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