Praxair Material Safety Data Sheet

Product: Nitrous Oxide	SDS No. P-4636-G March 2012

1. Chemical Product and Company Identification

Product Name: Nitrous Oxide (MSDS No. P-4636-G)	**Trade Names:** Nitrous Oxide, MediPure® Nitrous Oxide
Chemical Name: Nitrous Oxide	**Synonyms:** Dinitrogen monoxide, dinitrogen oxide, nitrogen (I) oxide, factitious air, hyponitrous acid anhydride, laughing gas, refrigerant gas R744a
Chemical Family: Oxide	**Product Grades:** Industrial; 2.5 atomic absorption, specialty gas; 5.5; USP

Emergency Telephone Numbers: *		**Company Name:** Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
Onsite emergencies:	1-800-645-4633	
CHEMTREC:	1-800-424-9300	

* 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 1-800-772-9247.

2. Hazard Identification

EMERGENCY OVERVIEW

WARNING! High-pressure, oxidizing liquid and gas.

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 may be required by rescue workers.

Under ambient conditions, nitrous oxide is a colorless gas with a slightly sweet odor and taste.

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

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

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.

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. (See section 11, Toxicological Information.)

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.

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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: Nitrous oxide cannot catch fire.

SUITABLE EXTINGUISHING MEDIA: Use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION: Not applicable. See section 10, Stability and Reactivity, for products of decomposition.

PROTECTION OF FIREFIGHTERS: WARNING! High-pressure, oxidizing liquid and gas. Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately spray cylinders with water from maximum distance until cool; then move them away from fire area if without risk. If cylinders are leaking, reduce vapors with water spray or fog; shut off leak if without risk. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.

Specific Physical and Chemical Hazards. Oxidizing agent; vigorously accelerates combustion. 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 cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Nitrous oxide cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.)

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! High-pressure, oxidizing liquid and gas.

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. (See section 5.) 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 cylinder to a well-ventilated area.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. 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: ***Protect cylinders from damage.*** Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. ***Open valve slowly.*** If valve is hard to open, discontinue use and contact your supplier. ***Never apply flame or localized heat directly to any part of the cylinder.*** High temperatures may damage the cylinder and could cause the pressure relief device to fail prematurely, venting the cylinder contents. For other precautions in using nitrous oxide, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Store only where temperature will not exceed 125°F (52°C). Post "No Smoking or Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g., NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure cylinders upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the cylinder is not in use. Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.**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 (2012)
Nitrous oxide	Not established.	50 ppm*

** Praxair, Inc., has established its own internal exposure limit at 25 ppm.*

IDLH = None assigned.

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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 clean work gloves free of any oil and grease when handling cylinders. Metatarsal shoes for cylinder handling; protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Eye/Face Protection. Select in accordance with OSHA 29 CFR 1910.133.

Respiratory Protection. Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas			
ODOR:	Slightly sweet			
ODOR THRESHOLD:	Not available.			
PHYSICAL STATE:	Gas at normal temperature and pressure			
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 applicable.			
EVAPORATION RATE (Butyl Acetate = 1)**:**	High			
FLAMMABILITY:	Nonflammable			
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:**	Not applicable.	**UPPER:**	Not applicable.
VAPOR PRESSURE at 70°F (21.1°C)**:**	759.7 psia (5238 kPa abs)			
LIQUID DENSITY at 77°F (25°C)**:**	46.3 lb/ft^3 (0.742 g/cm^3)			
GAS DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1146 lb/ft^3 (1.947 kg/m^3)			
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			

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9. Physical and Chemical Properties (cont.)

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: Contact with incompatible materials, heating to decomposition

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 1202°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 may decompose explosively at high temperatures. (See Hazardous Decomposition Products.)

11. Toxicological Information

ACUTE DOSE EFFECTS: Not available.

STUDY RESULTS: ***Reproductive toxicity.*** 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. ***Effects on blood and tissues.*** 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			
HAZARD CLASS: 2.2	**PACKING GROUP/Zone:** NA/NA	**IDENTIFICATION NUMBER:** UN1070	**PRODUCT RQ:** None
SHIPPING LABEL(s): NONFLAMMABLE GAS, OXIDIZER			
PLACARD (when required): NONFLAMMABLE GAS, OXIDIZER			

**NA = None Assigned.*

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(e)].

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

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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 not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

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: ***High-pressure, oxidizing liquid and gas.*** Clean all gauges, valves, regulators, piping, and equipment as for oxygen service in accordance with CGA pamphlet G-4.1. Never substitute carbon dioxide equipment for nitrous oxide equipment unless the carbon dioxide equipment has been disassembled and cleaned for oxygen service. Use piping and equipment adequately designed to withstand pressures to be encountered. Keep cylinders and their valves free of oil and grease. ***Prevent reverse flow.*** Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. ***Gas can cause rapid suffocation due to oxygen deficiency.*** 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.***

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.

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.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 2	HEALTH	= 1
FLAMMABILITY	= 0	FLAMMABILITY	= 0
INSTABILITY	= 0	PHYSICAL HAZARD	= 3
SPECIAL	= OX		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-326
PIN-INDEXED YOKE:	CGA-910 (medical use)
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-712

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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), www.cganet.com.

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*
P-2	*Characteristics and Safe Handling of Medical Gases*
SB-2	*Oxygen-Deficient Atmospheres*
SB-6	*Nitrous Oxide Security and Control*
V-1	*Compressed Gas Cylinder Valve Inlet and Outlet Connections*
V-7.1	*Standard Method Of Determining Cylinder Valve Outlet Connections For Medical Gases*
—	*Handbook of Compressed Gases*

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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. 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).

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