iSi Components Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Nitrous oxide (compressed)	**Trade Name:** Nitrous Oxide
Chemical Name: Nitrogen Oxide	**Synonyms:** Dinitrogen monoxide, nitrogen (I) oxide, factitious air, hyponitrous acid anhydride, laughing gas
Formula: N_2O	**Chemical Family:** Oxide
Telephone: **Emergencies:** 1-800-424-9300 * **Routine:** 1-973-227-2426	**Company Name:** ***iSi North America, Inc.*** 175 Route 46 West Fairfield, NJ. 07004

** Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact iSi Components or call the number above.*

2. Composition/Information on Ingredients

For custom mixtures of this product, request an MSDS for each component. See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCEN-TRATION	OSHA PEL	ACGIH TLV-TWA (1999)
Nitrogen Oxide	10024-97-2	>99%*	None currently established	50 ppm

** The symbol > means "greater than"; the symbol <, "less than."*

3. Hazards Identification

EMERGENCY OVERVIEW

WARNING! High-pressure, oxidizing liquid and gas.
Vigorously accelerates combustion.
Can cause rapid suffocation.
Can cause anesthetic effects.
May cause dizziness and drowsiness.
May cause nervous system and blood cell damage.
Reproductive hazard.
May cause frostbite.
Self-contained breathing apparatus may be required by rescue workers.
Odor: Slightly sweet.

THRESHOLD LIMIT VALUE: TLV-TWA, 50 ppm (ACGIH, 1999). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

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 for further information.)

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: 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.

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

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

FLASH POINT (test method)**:**	Not applicable	
AUTOIGNITION TEMPERATURE:	Not applicable	
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** Not applicable	**UPPER:** Not applicable

EXTINGUISHING MEDIA: Nitrous oxide cannot catch fire. Use media appropriate for surrounding fire.

SPECIAL FIRE FIGHTING PROCEDURES: 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.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Oxidizing agent; may accelerate 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. *Recommended storage temperature: -30 degrees C to +65 degrees C.*

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: WARNING! High-pressure, oxidizing liquid and gas. 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.

WASTE DISPOSAL METHOD: 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 STORAGE: Store and use with adequate ventilation, away from oil, grease, and other hydrocarbons. Separate nitrous oxide cylinders from flammables by at 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. Firmly secure cylinders upright to keep them from falling or being knocked over.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage, refer to section 16.

8. Exposure Controls/Personal Protection

VENTILATION/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

RESPIRATORY PROTECTION: Use an air-supplied respirator in a continuous-flow mode for concentrations up to 10 times the applicable permissible exposure limit. A self-contained breathing apparatus in a positive-pressure demand mode is required for higher concentrations. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear clean work gloves free of any oil and grease when handling cylinders.

EYE PROTECTION: Select in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling; protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	44.0128
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	1.5297
GAS DENSITY at 70°F (21.1°C) and 1 atm**:**	0.1146 lb/ft^3 (1.947 kg/m^3)
VAPOR PRESSURE at 70°F (21.1°C)**:**	735 psig (5070 kPa)
SOLUBILITY IN WATER, vol/vol at 68°F (20°C) and 1 atm**:**	0.68
PERCENT VOLATILES BY VOLUME:	100
BOILING POINT at 1 atm**:**	-127.4°F (-88.5°C)
MELTING POINT at 1 atm**:**	-131.5°F (-90.8°C)

APPEARANCE, ODOR, AND STATE: Colorless gas with a slightly sweet odor and taste.

10. Stability and Reactivity

STABILITY: ☐ **Unstable** ☒ **Stable**

INCOMPATIBILITY (materials to avoid): 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.

HAZARDOUS POLYMERIZATION: ☐ **May Occur** ☒ **Will Not Occur**

CONDITIONS TO AVOID: None known.

11. Toxicological Information

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

No adverse ecological effects expected. Nitrous oxide does not contain any Class I or Class II ozone-depleting chemicals. Nitrous oxide is not listed as a marine pollutant by DOT.

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	**IDENTIFICATION NUMBER:** UN 1070	**PRODUCT RQ:** None
SHIPPING LABEL(s):	NONFLAMMABLE GAS, OXIDIZER	
PLACARD (when required):	NONFLAMMABLE GAS, OXIDIZER	

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)].

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 (40 CFR Part 355):

Threshold Planning Quantity (TPQ): None
Extremely Hazardous Substances (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	**PRESSURE:** Yes
DELAYED: 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 does not require 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.

WARNING: Medical grades of nitrous oxide are used as an anesthetic. Medical nitrous oxide is subject to strict federal regulation and is for use only under the control of a licensed physician or clinician, familiar with the product and its hazards. Care should be taken in transportation, handling, and storage of nitrous oxide to prevent unauthorized use.

SPECIAL PRECAUTIONS: ***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 CO_2 equipment for N_2O equipment unless the CO_2 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.***

Recommended Equipment: In semiconductor process gas and other suitable applications, iSi Components 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	= 2	HEALTH	= 2
FLAMMABILITY	= 0	FLAMMABILITY	= 0
REACTIVITY	= 0	REACTIVITY	= 0
SPECIAL	= OX (OXidizer)		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

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

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply.