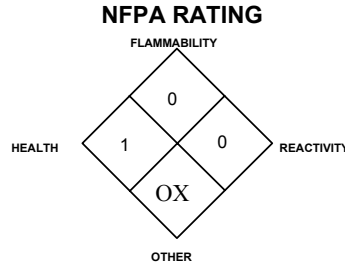




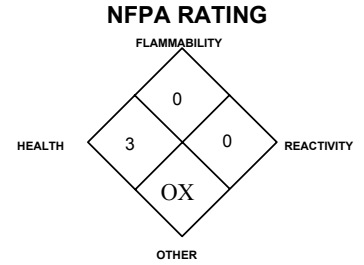
# MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

### NITROUS OXIDE GAS



### NITROUS OXIDE REFRIGERATED LIQUID



## PART I *What is the material and what do I need to know in an emergency?*

### 1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

**NITROUS OXIDE - N<sub>2</sub>O**  
**NITROUS OXIDE - N<sub>2</sub>O**  
**(Refrigerated Liquid)**

PRODUCT USE:

Document Number: 001042  
For use in anesthesia and general analytical/synthetic chemical applications.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 N. Radnor-Chester Road  
Suite 100  
Radnor, PA 19087-5283

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

1-800-949-7937

International: 423-479-0293 (Call Collect)

DATE OF PREPARATION:

May 20, 1996

REVISION DATE:

January 2, 2002

### 2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Nitrous Oxide	10024-97-2	> 99.0%	50, A4 (Not Classifiable as a Human Carcinogen)	NE	NE	NE	NE	NIOSH REL: 25 ppm DFG MAK: 100 ppm
Maximum Impurities		< 1.0%	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit


See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.



### 3. HAZARD IDENTIFICATION

**EMERGENCY OVERVIEW:** Nitrous Oxide is a colorless, nonflammable gas or a colorless, refrigerated liquid. The gas and liquid have a sweet odor. The refrigerated liquid will rapidly boil to the gas at standard temperatures and pressures. At high concentrations, Nitrous Oxide is an anesthetic and overexposure will produce symptoms of drowsiness, weakness, and loss of coordination. At higher concentrations, the gas will act as an asphyxiant by displacing oxygen. The liquefied gas can cause frostbite to any contaminated tissue. Nitrous oxide is not flammable, but at elevated temperatures or if involved in a fire, the gas can act as an oxidizer to initiate and sustain the combustion of flammable materials. Adequate fire protection must be provided.

#### NITROUS OXIDE GAS

HAZARDOUS MATERIAL INFORMATION SYSTEM			
<b>HEALTH</b>	(BLUE)	2	
<b>FLAMMABILITY</b>	(RED)	0	
<b>REACTIVITY</b>	(YELLOW)	0	
<b>PROTECTIVE EQUIPMENT</b>			<b>B</b>
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

#### NITROUS OXIDE: REFRIGERATED LIQUID

HAZARDOUS MATERIAL INFORMATION SYSTEM			
<b>HEALTH</b>	(BLUE)	3	
<b>FLAMMABILITY</b>	(RED)	0	
<b>REACTIVITY</b>	(YELLOW)	0	
<b>PROTECTIVE EQUIPMENT</b>			<b>X</b>
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

**See Section 16 for Definition of Ratings**

**SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:** The most significant route of overexposure for this gas is by inhalation. The following paragraphs describe symptoms of exposure by route of exposure.

**INHALATION:** High concentrations of this gas can cause an oxygen-deficient environment. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. The skin of a victim of overexposure may have a blue color. Under some circumstances of overexposure, death may occur. The effects associated with various levels of oxygen are as follows:

**CONCENTRATION                      SYMPTOMS OF EXPOSURE**

12-16% Oxygen: Breathing and pulse rate increased, muscular coordination slightly disturbed.

10-14% Oxygen: Emotional upset, abnormal fatigue, disturbed respiration.

6-10% Oxygen:                      Nausea and vomiting, collapse or loss of consciousness.

Below 6%:                              Convulsive movements, possible respiratory collapse, and death.

When Nitrous Oxide is inhaled in high concentrations, the gas acts as a central nervous system depressant. Symptoms of such overexposure include excitation, euphoria, dizziness, drowsiness, and narcosis. Inhalation of small amounts of this gas often produces a type of hysteria; therefore, a common name for Nitrous Oxide is "Laughing Gas".

Prolonged or repeated overexposures to Nitrous Oxide have produced injury to the nervous system. Symptoms of such overexposure include numbness, tingling of the hands and legs, loss of feeling in the fingers, and muscular weakness. Other effects of inhalation exposure include potential reproductive effects. Exposure to Nitrous Oxide may be associated with an increase in spontaneous abortions in humans. Prolonged exposures to Nitrous Oxide have resulted in bone marrow damage and adverse effects on the blood.

### 3. HAZARD IDENTIFICATION (Continued)

**OTHER POTENTIAL HEALTH EFFECTS:** Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after contact with liquid can quickly subside.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:** An Explanation in **Lay Terms**. Overexposure to Nitrous Oxide may cause the following health effects:

**ACUTE:** The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres and effects on the central nervous system. Symptoms of oxygen deficiency or central nervous system depression include respiratory difficulty, ringing in ears, headaches, dizziness, indigestion, and nausea. At high concentrations, unconsciousness or death may occur. Contact with liquid or rapidly expanding gases may cause frostbite.

**CHRONIC:** Prolonged or repeated overexposures to Nitrous Oxide has produced injury to the nervous system. Symptoms of such overexposure include numbness, tingling of the hands and legs, loss of feeling in the fingers, and muscular weakness. Exposure to Nitrous Oxide may be associated with an increase in spontaneous abortions in humans. Single, prolonged exposures to Nitrous Oxide have resulted in bone marrow damage and adverse effects on the blood. Refer to Section 11 (Toxicological Information) of this MSDS for additional information.

**TARGET ORGANS:** Respiratory system, central nervous system, blood system, reproductive system.

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## PART II *What should I do if a hazardous situation occurs?*

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### 4. FIRST-AID MEASURES

**RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO NITROUS OXIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Personal Protective Equipment should be worn.**

Remove victim(s) to fresh air, as quickly as possible. Trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Only trained personnel should administer supplemental oxygen.

In case of frostbite, place the frostbitten part in warm water. DO NOT USE HOT WATER. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area in the armpit. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

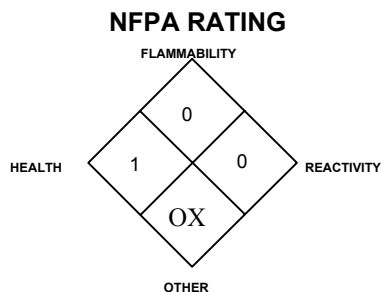
**MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing respiratory conditions, central nervous system disorders, blood and immune system disorders, and pregnancies may be aggravated or adversely effected by overexposure to Nitrous Oxide.

**RECOMMENDATIONS TO PHYSICIANS:** Provide oxygen, treat symptoms, and reduce overexposure.

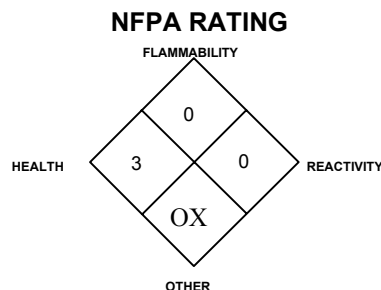
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### 5. FIRE-FIGHTING MEASURES

#### NITROUS OXIDE GAS



#### NITROUS OXIDE REFRIGERATED LIQUID



**See Section 16 for Definition of Ratings**

**FLASH POINT:** Not applicable.

**AUTOIGNITION TEMPERATURE:** Not applicable.

**FLAMMABLE LIMITS (in air by volume, %):**

Lower (LEL): Not applicable.

Upper (UEL): Not applicable.

## 5. FIRE-FIGHTING MEASURES (Continued)

**FIRE EXTINGUISHING MATERIALS:** Non-flammable gas. Use extinguishing media appropriate for surrounding fire. In the event of fire, cool containers of Nitrous Oxide with water to prevent failure. Use a water spray or fog to reduce or direct vapors.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Nitrous Oxide does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire. Additionally, at temperatures above 200°C (392°F) or when involved in a fire, Nitrous Oxide is an oxidizer. Nitrous Oxide can increase the likelihood of ignition and sustain the combustion of combustible materials. At elevated temperatures, Nitrous Oxide will decompose to nitrogen and oxygen.

**RESPONSE TO FIRE INVOLVING REFRIGERATED LIQUID:** Refrigerated liquids can be particularly dangerous during fires because of their potential to rapidly freeze water. Careless use of water may cause heavy icing. Furthermore, relatively warm water greatly increases the evaporation rate of Nitrous Oxide. If large concentrations of Nitrous Oxide gas are present, the water vapor in the surrounding air will condense, creating a dense fog that may make it difficult to find fire exits or equipment. Liquid Nitrous Oxide, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release.

**Explosion Sensitivity to Mechanical Impact:** Not Sensitive.

**Explosion Sensitivity to Static Discharge:** Not Sensitive.

**SPECIAL FIRE-FIGHTING PROCEDURES:** Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. If cylinders are exposed to heat, the cylinder may rupture or burst, and release the contents. It may be prudent to remove potentially heat-exposed cylinders from the area surrounding a fire, if it is safe for firefighters to do so. Otherwise, cool containers with hose stream and protect personnel. Withdraw immediately in case of rising sounds from venting safety device or any discoloration of cylinders due to the fire.

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## 6. ACCIDENTAL RELEASE MEASURES

**SPILL AND LEAK RESPONSE:** Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area and protect people.

Minimum Personal Protective Equipment should be **Level B: protective clothing, mechanically-resistant gloves and Self-Contained Breathing Apparatus.**

Locate and seal the source of the leaking gas. Allow the gas to dissipate. Monitor the surrounding area for oxygen levels and the level of Nitrous Oxide. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Reading should also indicate that Nitrous Oxide is below levels listed in Section 2 (Composition and information on Ingredients) before non-emergency personnel are permitted to re-enter the area. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

**RESPONSE TO LIQUID RELEASE:** Clear the affected area and allow the liquid to evaporate and the gas to dissipate. After the gas is formed, follow the instructions provided in the previous paragraph. If the area must be entered by emergency personnel, SCBA, Kevlar gloves, and appropriate foot and leg protection must be worn.

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## PART III *How can I prevent hazardous situations from occurring?*

### 7. HANDLING and STORAGE

**WORK PRACTICES AND HYGIENE PRACTICES:** As with all chemicals, avoid getting Nitrous Oxide IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of dizziness, fatigue, or other overexposure symptoms (See Section 3, Hazard Identification); exposures to fatal concentrations of Nitrous Oxide could occur without any significant warning symptoms.

**STORAGE AND HANDLING PRACTICES:** This is a liquefied, oxidizing gas, stored under pressure. Use piping and equipment adequately designed to withstand pressures to be encountered. Store and use with adequate ventilation at all times. Store away from flammable materials. Cylinders should be stored in dry, well-ventilated areas away from sources of heat. Compressed gases can present significant safety hazards. Store containers away from heavily trafficked areas and emergency exits. Post "No Smoking or Open Flames" signs in storage or use areas.

**SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS:** Protect cylinders against physical damage. Store in cool, dry, well-ventilated, fireproof area, away from flammable materials and corrosive atmospheres. Store away from heat and ignition sources and out of direct sunlight. Do not store near elevators, corridors or loading docks. Do not allow area where cylinders are stored to exceed 52°C (125°F). Use only storage containers and equipment (pipes, valves, fittings to relieve pressure, etc.) designed for the storage of Liquid Nitrous Oxide.

## 7. HANDLING and STORAGE (Continued)

Do not store containers where they can come into contact with moisture. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. The following rules are applicable to cylinder use:

**Before Use:** Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in-place until cylinder is ready for use.

**During Use:** Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

**After Use:** Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

**NOTE:** Use only DOT or ASME code containers. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

**PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT:** Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (e.g., nitrogen) before attempting repairs.

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## 8. EXPOSURE CONTROLS - PERSONAL PROTECTION

**VENTILATION AND ENGINEERING CONTROLS:** Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents Nitrous Oxide dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the level of oxygen or Nitrous Oxide.

**RESPIRATORY PROTECTION:** Maintain oxygen levels above 19.5% in the workplace and below the exposure limits listed in Section 2 (Composition and Information on Ingredients). Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Nitrous Oxide. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), applicable State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

**EYE PROTECTION:** Splash goggles, face-shields or safety glasses. Face-shields must be worn when using liquid Nitrous Oxide.

**HAND PROTECTION:** Wear mechanically-resistant gloves when handling cylinders of Nitrous Oxide. Use low-temperature protective gloves (e.g. Kevlar) when in situations in which splashes of liquid Nitrous Oxide may occur.

**BODY PROTECTION:** Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product, as well provide sufficient insulation from extreme cold.

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## 9. PHYSICAL and CHEMICAL PROPERTIES

**VAPOR DENSITY:** 1.947kg/m<sup>3</sup> (0.115 lb/ft<sup>3</sup>)

**SPECIFIC GRAVITY (air = 1):** 1.530

**SOLUBILITY IN WATER:** Soluble.

**VAPOR PRESSURE (psia):** 759.7

**EXPANSION RATIO:** Not applicable.

**COEFFICIENT WATER/OIL DISTRIBUTION:** 0.665

**EVAPORATION RATE (nBuAc = 1):** Not applicable.

**FREEZING POINT:** -90.8°C (-131.5°F)

**BOILING POINT(°F @ 1 atm):** -88.5°C (-127.4°F)

**pH:** Not applicable.

**ODOR THRESHOLD:** Not determined.

**SPECIFIC VOLUME (ft<sup>3</sup>/lb):** 8.7

**APPEARANCE AND COLOR:** Nitrous Oxide is a colorless gas or a colorless liquid. Both the liquid and gas have a sweet odor.

**HOW TO DETECT THIS SUBSTANCE (warning properties):** There are no unusual warning properties associated with a release of Nitrous Oxide. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

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## 10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Nitrous Oxide decomposes explosively at high temperatures, producing nitrogen and oxygen.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Nitrous Oxide is incompatible with flammable materials, oils, grease, alkali metals, aluminum, boron, tin oxide, lithium hydride tungsten carbide. Nitrous oxide forms explosive mixtures with phosphine, ammonia, carbon monoxide, hydrogen sulfide, hydrogen, and acetylene. This reaction will occur at lower temperatures in the presence of catalytic surfaces (e.g., silver, platinum, cobalt, copper oxides, or nickel oxides). Mixtures of Nitrous Oxide and silane are stable, but such mixtures will detonate explosively when exposed to the atmosphere or elevated temperatures. Flashback into the cylinder resulting in catastrophic failure of the cylinder containing such mixtures can occur. Nitrous Oxide/Fuel gas mixtures are subject to all of the restrictions and precautions governing Fuel/Oxidizer mixtures.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

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## **PART IV** *Is there any other useful information about this material?*

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### 11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Nitrous Oxide.

TCLo (Inhalation-Human) 24 mg/kg/2hours: Behavioral: general anesthetic; Cardiac: pulse rate; Nutritional and Gross Metabolic: body temperature decrease	TCLo (Inhalation-Rat) 20 pph/8 hours: male 28 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct	TDL0 (Subcutaneous-Rat) 3 gm/kg: female 8 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Effects on Embryo or Fetus: other effects to embryo; Specific Developmental Abnormalities: musculoskeletal system
TCLo (Inhalation-Mouse) 50 ppm/6 hours/13 weeks-intermittent: Liver: changes in liver weight; Blood: changes in leukocyte (WBC) count	TCLo (Inhalation-Rat) 1 pph/8 hours: female 1-21 day(s) after conception: Reproductive: Effects on Embryo or Fetus: extra-embryonic structures (e.g., placenta, umbilical cord), fetal death	TCLo (Inhalation-Hamster) 90 pph/24 hours: female 10 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)
TCLo (Inhalation-Rat) 5 pph/4 hours: female 6-15 day(s) after conception: Reproductive: Effects on Newborn: behavioral	TCLo (Inhalation-Rat) 50 pph/4 hours: female 14 day(s) after conception: Reproductive: Effects on Newborn: biochemical and metabolic	TCLo (Inhalation-Hamster) 95 pph/24 hours: female 7 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
TCLo (Inhalation-Rat) 50 pph/24 hours: female 8-11 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System, cardiovascular (circulatory) system, urogenital system	TCLo (Inhalation-Rat) 3 gm/kg: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system	TCLo (Inhalation-Hamster) 95 pph/24 hours: female 7 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
TCLo (Inhalation-Rat) 50 ppm/6 hours: male 30 day(s) pre-mating: Reproductive: Effects on Newborn: live birth index (measured after birth), growth statistics (e.g.%, reduced weight gain)	TCLo (Inhalation-Mouse) 75 pph/6 hours: female 14 day(s) after conception: Reproductive: Effects on Embryo or Fetus: cytological changes (including somatic cell genetic material)	Sex Chromosome Loss and Nondisjunction (Inhalation-Drosophila melanogaster) 99 pph/6 minutes-continuous
	TCLo (Inhalation-Mouse) 5000 ppm/4 hours: female 14 day(s) after conception: Reproductive: Effects on Newborn: behavioral	DNA (Inhalation-Human) 50 pph/24 hours DNA (Inhalation-Rat) 75,000 ppm/24 hours Mutation Test Systems-not otherwise specified (Inhalation-Rat) 50 pph/24 hours

SUSPECTED CANCER AGENT: Nitrous Oxide is listed, as follows:

**NITROUS OXIDE:** ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen)

Nitrous Oxide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC; therefore it is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Nitrous Oxide is not an irritant. Contact with rapidly expanding gases can cause frostbite and damage to exposed skin and eyes.

SENSITIZATION OF PRODUCT: Nitrous Oxide is not a skin or respiratory sensitizer.

## 11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Epidemiological studies suggest fetotoxic effects and higher rates of spontaneous abortions in personnel who have been over-exposed to Nitrous Oxide. Although a definite causal relationship between Nitrous Oxide exposures and reproductive problems has not been established, exposure to the gas should be minimized. Listed below is additional information concerning the effects of Nitrous Oxide on the human reproductive system.

Mutagenicity: Nitrous Oxide is not expected to cause mutagenic effects in humans.

Embryotoxicity: Nitrous Oxide is reported to cause embryotoxic effects in laboratory animals.

Teratogenicity: Nitrous Oxide may cause teratogenic effects in humans. Exposure to Nitrous Oxide has caused embryo and fetal toxicity effects in laboratory animals. Such effects include reduced fetal weight, delayed ossification, and an increased incidence of visceral and skeletal variations.

Reproductive Toxicity: Nitrous Oxide may cause adverse reproductive effects in humans.

A *mutagen* is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An *embryotoxin* is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) have not been determined for Nitrous Oxide.

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## 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to oxygen deficient environments, effects on the central nervous system, and potential reproductive problems. Symptoms of exposure would be similar for those described for humans. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of Nitrous Oxide on aquatic life. This gas is soluble in water.

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## 13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas. Do not dispose of locally.

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## 14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

**For Nitrous Oxide Gas:**

<u>PROPER SHIPPING NAME:</u>	Nitrous oxide
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.2 (Non-Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1070
<u>PACKING GROUP:</u>	Not Applicable
<u>DOT LABEL(S) REQUIRED:</u>	Non-Flammable Gas, Oxidizer
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):</u>	122

**For Nitrous Oxide, Refrigerated Liquid:**

<u>PROPER SHIPPING NAME:</u>	Nitrous oxide, refrigerated liquid
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	2.2 (Non-Flammable Gas)
<u>UN IDENTIFICATION NUMBER:</u>	UN 2201
<u>PACKING GROUP:</u>	Not applicable.
<u>DOT LABEL(S) REQUIRED:</u>	Non-Flammable Gas, Oxidizer
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000):</u>	122

MARINE POLLUTANT: Nitrous Oxide is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

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## 15. REGULATORY INFORMATION

**SARA REPORTING REQUIREMENTS:** Nitrous Oxide is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

**U.S. SARA THRESHOLD PLANNING QUANTITY:** There are no specific Threshold Planning Quantities for this compound. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

**U.S. SARA HAZARD CATEGORIES (SECTION 311/312, 40 CFR 370-21):** ACUTE: Yes; CHRONIC: Yes; FIRE: No; REACTIVE: No; SUDDEN RELEASE: Yes

**U.S. CERCLA REPORTABLE QUANTITY (RQ):** Not applicable.

**CANADIAN DSL/NDSL INVENTORY STATUS:** Nitrous Oxide is on the DSL Inventory.

**U.S. TSCA INVENTORY STATUS:** Nitrous Oxide is on the TSCA Inventory.

**OTHER U.S. FEDERAL REGULATIONS:** Nitrous Oxide is covered under the following specific State regulations:

**Alaska - Designated Toxic and Hazardous Substances:** No.

**California - Permissible Exposure Limits for Chemical Contaminants:** Nitrous Oxide.

**Florida - Substance List:** No.

**Illinois - Toxic Substance List:** Nitrous Oxide.

**Kansas - Section 302/313 List:** No.

**Massachusetts - Substance List:** No.

**Michigan - Critical Materials Register:** No.

**Minnesota - List of Hazardous Substances:** Nitrous Oxide.

**Missouri - Employer Information/Toxic Substance List:** No.

**New Jersey - Right to Know Hazardous Substance List:** Nitrous Oxide.

**North Dakota - List of Hazardous Chemicals, Reportable Quantities:** No.

**Pennsylvania - Hazardous Substance List:** No.

**Rhode Island - Hazardous Substance List:** No.

**Texas - Hazardous Substance List:** No.

**West Virginia - Hazardous Substance List:** No.

**Wisconsin - Toxic and Hazardous Substances:** No.

**CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65):** Nitrous Oxide is not on the California Proposition 65 lists.

**LABELING (for Compressed Gas):**

**WARNING:**

HIGH PRESSURE OXIDIZING LIQUID AND GAS.  
VIGOROUSLY ACCELERATES COMBUSTION.  
CAN CAUSE RAPID SUFFOCATION.  
CAN CAUSE ANESTHETIC EFFECTS.  
MAY CAUSE FROSTBITE.  
Avoid breathing gas.  
Store and use with adequate ventilation.  
Keep oil and grease away.  
Use only with equipment cleaned for nitrous oxide service and rated for cylinder pressure.  
Do not get liquid in eyes, on skin, or clothing.  
Cylinder temperature should not exceed 125 °F (52 °C).  
Open valve slowly.  
Close valve after each use and when empty.  
Use in accordance with the Material Safety Data Sheet.

**NOTE:**

Suck-back into cylinder may cause rupture.  
Always use a back flow preventative device in the piping.

**FIRST-AID:**

**IF INHALED**, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.  
**IN CASE OF FROSTBITE**, obtain immediate medical attention.  
DO NOT REMOVE THIS PRODUCT LABEL.

**LABELING (for Liquid):**

**WARNING:**

ALWAYS KEEP CONTAINER IN UPRIGHT POSITION.  
COLD, OXIDIZING LIQUID AND GAS UNDER PRESSURE.  
VIGOROUSLY ACCELERATES COMBUSTION.  
CAN CAUSE RAPID SUFFOCATION.  
CAN CAUSE ANESTHETIC EFFECTS.  
MAY CAUSE FROSTBITE.  
Avoid breathing gas.  
Store and use with adequate ventilation.  
Keep oil and grease away.  
Use only with equipment cleaned for nitrous oxide service.  
Do not get liquid in eyes, on skin, or clothing.  
For liquid withdrawal, wear face shield and gloves.  
Do not drop. Use hand truck for container movement.  
Avoid spills. Do not walk on or roll equipment over spills.

**NOTE:**

Close valve after each use and when empty.  
Use in accordance with the Material Safety Data Sheet.  
Suck-back into cylinder may cause rupture.  
Always use a back flow preventative device in piping.

**FIRST AID:**

**IF INHALED**, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.  
**IN CASE OF FROSTBITE**, obtain immediate medical attention.  
DO NOT REMOVE THIS PRODUCT LABEL.

**ADDITIONAL CANADIAN REGULATIONS:**

CANADIAN DSL/NDSL INVENTORY STATUS: Nitrous Oxide is on the DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

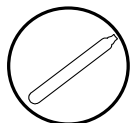
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITY SUBSTANCES LISTS: This compound is not on the CEPA Priority Substances Lists.

CANADIAN WHMIS SYMBOLS:

**Class A:** Compressed Gases

**Class C:** Oxidizing Materials

**Class D2A:** Materials Causing Other Toxic Effects



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## 16. OTHER INFORMATION

**PREPARED BY:**

**Airgas - SAFECOR**

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

## DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

**CAS #:** This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

### EXPOSURE LIMITS IN AIR:

**ACGIH** - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

**OSHA** - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

**IDLH** - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

### HAZARD RATINGS:

**HAZARDOUS MATERIALS IDENTIFICATION SYSTEM:** Health Hazard: **0** (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]. Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

**NATIONAL FIRE PROTECTION ASSOCIATION:** Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury).

**NATIONAL FIRE PROTECTION ASSOCIATION (Continued):** Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

### FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

### TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD<sub>50</sub>** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC<sub>50</sub>** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m<sup>3</sup>** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program, **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

### REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**); the Canadian Domestic/Non-Domestic Substances List (**DSL/NDL**); the U.S. Toxic Substance Control Act (**TSCA**); Marine Pollutant status according to the **DOT**; the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**); and various state regulations.