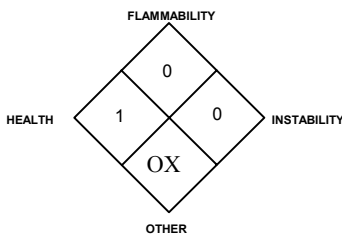




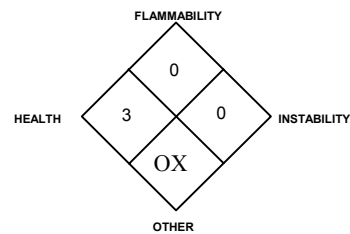
NITROUS OXIDE GAS

NITROUS OXIDE REFRIGERATED LIQUID

NFPA RATING



NFPA RATING



MATERIAL SAFETY DATA SHEET

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

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

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

NITROUS OXIDE - N₂O
NITROUS OXIDE - N₂O (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

BUSINESS PHONE:

Radnor, PA 19087-5283

EMERGENCY PHONE:

1-610-687-5253

1-800-949-7937

International: 423-479-0293

DATE OF PREPARATION:

May 20, 1996

REVISION DATE:

February 10, 2004

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	PEL ppm	STEL ppm		
Nitrous Oxide	10024-97-2	> 99.0%	50	NE	NE	NE	NE	NIOSH REL: TWA = 25 DFG MAKs: TWA = 100 PEAK = 2•MAK 15 min., average value, 1-hr interval DFG MAK Pregnancy Risk Classification: D Carcinogen: TLV-A4
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.



See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.



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 presents a reproductive hazard which can cause embryotoxic, fetotoxic and teratogenic effects, based on human information. 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 IDENTIFICATION SYSTEM			
HEALTH HAZARD	(BLUE)		2
FLAMMABILITY HAZARD	(RED)		0
PHYSICAL HAZARD	(YELLOW)		0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For Routine Industrial Use and Handling Applications			

NITROUS OXIDE: REFRIGERATED LIQUID

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH HAZARD	(BLUE)		3
FLAMMABILITY HAZARD	(RED)		0
PHYSICAL HAZARD	(YELLOW)		0
PROTECTIVE EQUIPMENT			
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For Routine Industrial Use and Handling 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: Exposure to concentrations of Nitrous Oxide of 100,000 ppm (10%) and higher can affect behavior and the ability to carry out mental tasks. This effect has also been demonstrated in volunteers exposed to a very low concentration (50 ppm for 3-4 hours). However, this finding, at such low exposure levels, has not been confirmed in subsequent studies. Reversible effects, such as delayed response to stimuli, have been consistently observed in volunteers briefly exposed to concentrations of 100,000 ppm (10%) or higher. Performing moderate to heavy work during exposure has not affected results. At levels of 330,000 ppm (33%), volunteers have shown reduced sensitivity to pain. Levels of 400,000-700,000 ppm (40-70%) have caused reversible blood system (hematological) changes, including depression of bone marrow activity. Levels of 500,000-700,000 ppm (50-70%) have produced a feeling of numbness (anesthesia). At concentrations greater than 800,000 ppm (80%), a feeling of drunkenness (stupor) may result. 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".

In cases of substance abuse, inhalation of nitrous oxide has caused unconsciousness. Vomiting and subsequent aspiration of vomit into the lungs has caused death. On rare occasions, medical use of Nitrous Oxide as an anesthetic, without adequate accompanying oxygen, has led to prolonged unconsciousness with visual impairment, including loss of vision, in patients.

3. HAZARD IDENTIFICATION (Continued)

INHALATION (continued): Repeated exposure to high concentrations of Nitrous Oxide can damage the peripheral nervous system. A condition called polyneuropathy has been observed. While this condition may improve over time, it is not completely reversible. Initial signs and symptoms of polyneuropathy include numbness, a burning or prickling sensation on the skin (paresthesia), poor muscle coordination (ataxia) and clumsiness. If exposure continues, weakness, disturbances in walking (gait), impotence and signs of degeneration of the spinal cord can occur. One small study of dentists who used Nitrous Oxide occupationally did not report harmful effects. However, another larger study of dentists and dental assistants heavily exposed to Nitrous Oxide (concentrations not provided) over several years reported an increased incidence of peripheral nervous system effects, including numbness, tingling, and weakness. In 15 cases of Nitrous Oxide-induced polyneuropathy, two cases were dentists overexposed during routine clinical use in poorly ventilated dental clinics and 13 were cases of substance-abuse in which dentists self-administered 300,000 to 800,000 ppm (30-80%) Nitrous Oxide, 30 to 60 minutes/day, 2-7 days/week, for periods ranging from 3 months to several years.

In addition, 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.

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 or rapidly expanding gas can quickly subside. Other effects of inhalation exposure include potential reproductive effects. Exposure to Nitrous Oxide may be associated with an increase in spontaneous abortions in humans.

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. Effects of long-term (chronic) overexposure to Nitrous Oxide are similar to those seen with vitamin B12 deficiency in the diet. Nitrous Oxide is thought to inactivate vitamin B12, which impairs functioning of an enzyme system which makes methionine. Methionine is used by the body to produce many molecules including thymine, a building block of DNA. Case reports of substance-abuse suggest nitrous oxide may have addictive properties. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. Refer to Section 11 (Toxicological Information) of this MSDS for additional information.

TARGET ORGANS: ACUTE: Respiratory system. CHRONIC: Respiratory system, central nervous system, blood system, reproductive system, heart.

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

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. 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).

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.

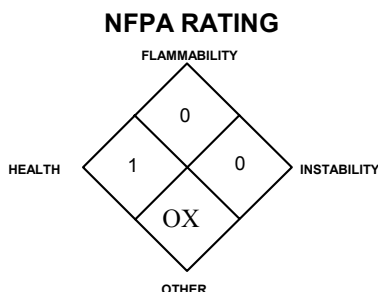
4. FIRST-AID MEASURES (Continued)

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.

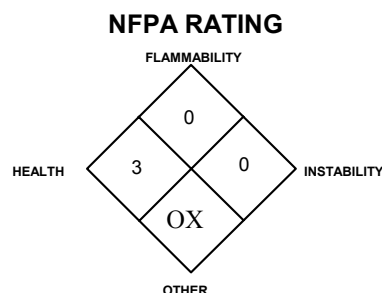
RECOMMENDATIONS TO PHYSICIANS: Provide oxygen, treat symptoms, and reduce overexposure. Cryogenic dermal injuries should be treated by water bath re-warming at 40 to 42°C until vasodilatory flush has returned. Elevation of the limb and standard frostbite management with late surgical debridement should be utilized. Ocular exposure requires irrigation and slit-lamp evaluation for injury.

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.

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.

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.

6. ACCIDENTAL RELEASE MEASURES (Continued)

SPILL AND LEAK RESPONSE (continued): 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.

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.

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.

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. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. 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. If necessary, refer to U.S. OSHA 29 CFR 1910.133, or Canadian Standards.

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. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

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. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR.

9. PHYSICAL and CHEMICAL PROPERTIES

VAPOR DENSITY: 1.947kg/m³ (0.115 lb/ft³)

SPECIFIC GRAVITY (air = 1): 1.530

SOLUBILITY IN WATER: Soluble.

VAPOR PRESSURE (psig): 745

EXPANSION RATIO: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: 0.665

APPEARANCE, ODOR 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.

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 (ft³/lb): 8.7

10. STABILITY and REACTIVITY

STABILITY: Stable under conditions of normal temperature and pressure. At elevated temperatures (above 649°C) Nitrous Oxide decomposes into nitrogen and oxygen. This decomposition may become explosive at high temperatures. Decomposition will occur at lower temperatures in the presence of catalytic surfaces such as silver, platinum, cobalt, copper oxides or nickel oxides.

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, wood, alkali metals, aluminum, boron, tin oxide, lithium hydride, tungsten and 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. Nitrous Oxide and phenyllithium forms unstable lithium phenylazoxide. Contact with plastic tubes (e.g. polyvinyl chloride, silicone rubber or red rubber) such as surgical tubes have been ignited by surgical lasers or electrocautery in atmospheres enriched by Nitrous Oxide. Amorphous boron, gaseous sodium, tin(ii)oxide or tungsten carbide will ignite when heated in nitrous oxide. Nitrous Oxide can be corrosive to aluminum, nickel, and nickel-copper and nickel-chromium-iron alloys at high concentrations in water.

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.

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

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-Mouse) 50 ppm/6 hours/13
weeks-intermittent: Liver: changes in liver
weight; Blood: changes in leukocyte (WBC)
count

TCLo (Inhalation-Rat) 5 pph/4 hours: female
6-15 day(s) after conception: Reproductive:
Effects on Newborn: behavioral

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) 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-Rat) 20 pph/8 hours: male
28 day(s) pre-mating: Reproductive:
Paternal Effects: testes, epididymis, sperm
duct

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-Rat) 50 pph/4 hours: female
14 day(s) after conception: Reproductive:
Effects on Newborn: biochemical and
metabolic

TCLo (Inhalation-Rat) 3 gm/kg: female 8
day(s) after conception: Reproductive:
Specific Developmental Abnormalities:
cardiovascular (circulatory) system

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)

TCLo (Inhalation-Mouse) 5000 ppm/4 hours:
female 14 day(s) after conception:
Reproductive; Effects on Newborn:
behavioral

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

TDLo (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-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)	Sex Chromosome Loss and Nondisjunction (Inhalation-Drosophila melanogaster) 99 pph/6 minutes-continuous 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
	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)	

GENERAL TOXICOLOGICAL INFORMATION: Harmful effects have been observed in blood formation and immune system functions and the neurological system (peripheral nervous system effects) following exposures to high concentrations. Blood Formation and Immune System Functions: Rats exposed to high concentrations (greater than 10,000 ppm (1%)) have shown impaired formation and development of blood cells (hematopoiesis). At very high concentrations (greater than 400,000 ppm (40%)), effects are observed within the first few days of exposure. In some studies, the effects have been shown to be reversible once exposure stops. Prolonged exposure has caused cell division in the bone marrow to completely stop. In one study, mice were exposed to 50, 500 or 5000 ppm for 2 or 13 weeks. No effects were observed after two weeks. At 13 weeks, decreased liver weights and a decreased number of white blood cells were seen at all concentrations. Bone marrow activity was depressed at the middle and high concentrations, and the number of plaque-forming cells, an indicator of depressed immune response, was decreased at 5000 ppm.

Neurological Effects: Monkeys inhaling 150,000 ppm (15%) developed poor muscle coordination within a few days. If administration continued for more than 2 weeks, irreversible degeneration of nerve tissue in the spinal cord occurred. In rats, exposure to 700,000 ppm (70%) for 6 months did not cause neurological effects. Primates appear more sensitive than rodents to the nervous system effects of nitrous oxide.

SUSPECTED CANCER AGENT: Nitrous Oxide is listed by agencies tracking the carcinogenic potential of chemical compounds, 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 human skin or respiratory sensitizer.

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: Results from studies investigating mutagenicity in the blood cells of health care workers exposed to volatile anesthetics are conflicting. The available studies have not investigated the effect in people exposed to Nitrous Oxide alone. Mutagenicity in blood cells were reported in health care workers exposed to the anesthetic halothane, in combination with Nitrous Oxide. The urine of these workers was not mutagenic in a bacterial test. The specific role of Nitrous Oxide in producing these results cannot be determined. Negative results have been obtained for Nitrous Oxide in bacteria and cultured mammalian cells.

Embryotoxicity: Nitrous Oxide is reported to cause embryotoxic effects in laboratory animals. Several human population studies among health care workers indicate that repeated exposure to volatile anesthetics, including Nitrous Oxide, is associated with an increased incidence of spontaneous abortion and, to a lesser extent, developmental effects in children. These observations of effects in humans are consistent with results from animal studies, despite limitations with information derived from human population studies (for example, potential reporting biases, possible confounding factors, and/or inadequate exposure data). In a study which examined nitrous oxide specifically, more spontaneous abortions were observed in female dental assistants. Also, more developmental effects were observed in the children of female dental assistants. The rates of spontaneous abortion and developmental effects in children were also significantly elevated in female hospital workers exposed to volatile anesthetics, primarily Nitrous Oxide, compared to unexposed workers. Spontaneous abortions in female dental assistants were increased in women who worked with Nitrous Oxide for 3 hours/week or more in dental facilities not using scavenging equipment. In other studies, pregnancy outcome has not been affected by exposure to Nitrous Oxide as part of surgical procedures. Veterinary workers exposed to low nitrous oxide levels (estimated to be in the range of 25 ppm) did not have more spontaneous abortions or developmental effects in their children.

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.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):

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.

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.

13. DISPOSAL CONSIDERATIONS

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

14. TRANSPORTATION INFORMATION

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

For Nitrous Oxide Gas:

PROPER SHIPPING NAME: Nitrous oxide
HAZARD CLASS NUMBER and DESCRIPTION: Class 2.2 (Non-Flammable Gas); Class 5.1 (Oxidizer)
UN IDENTIFICATION NUMBER: UN 1070
PACKING GROUP: Not Applicable
DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas), Class 5.1 (Oxidizer)
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 122

For Nitrous Oxide, Refrigerated Liquid:

PROPER SHIPPING NAME: Nitrous oxide, refrigerated liquid
HAZARD CLASS NUMBER and DESCRIPTION: Class 2.2 (Non-Flammable Gas), Class 5.1 (Oxidizer)
UN IDENTIFICATION NUMBER: UN 2201
PACKING GROUP: Not Applicable.
DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas), Class 5.1 (Oxidizer)
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 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 gas is considered as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

For Nitrous Oxide Gas:

PROPER SHIPPING NAME: Nitrous oxide
HAZARD CLASS NUMBER and DESCRIPTION: Class 2.2 (Non-Flammable Gas); Class 5.1 (Oxidizer)
UN IDENTIFICATION NUMBER: UN 1070
PACKING GROUP: Not Applicable
HAZARD LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas), Class 5.1 (Oxidizer)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX: 0
ERAP INDEX: 3000
PASSENGER CARRYING SHIP INDEX: 450
PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX: 75
MARINE POLLUTANT: Nitrous Oxide is not a Marine Pollutant.

14. TRANSPORTATION INFORMATION (Continued)

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS (continued):

For Liquefied Nitrous Oxide:

<u>PROPER SHIPPING NAME:</u>	Nitrous oxide, refrigerated liquid
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	Class 2.2 (Non-Flammable Gas); Class 5.1 (Oxidizer)
<u>UN IDENTIFICATION NUMBER:</u>	UN 2201
<u>PACKING GROUP:</u>	Not Applicable
<u>HAZARD LABEL(S) REQUIRED:</u>	Class 2.2 (Non-Flammable Gas), Class 5.1 (Oxidizer)
<u>SPECIAL PROVISIONS:</u>	None
<u>EXPLOSIVE LIMIT & LIMITED QUANTITY INDEX:</u>	0
<u>ERAP INDEX:</u>	3000
<u>PASSENGER CARRYING SHIP INDEX:</u>	0
<u>PASSENGER CARRYING ROAD OR RAIL VEHICLE INDEX:</u>	Forbidden
<u>MARINE POLLUTANT:</u>	Nitrous Oxide is not a Marine Pollutant.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. 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.

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

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

CGA LABELING (for Compressed Gas):

WARNING:

HIGH PRESSURE OXIDIZING LIQUID AND GAS.
VIGOROUSLY ACCELERATES COMBUSTION.
CAN CAUSE RAPID SUFFOCATION.
CAN CAUSE ANESTHETIC EFFECTS.
CAN CAUSE REPRODUCTIVE 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.

15. REGULATORY INFORMATION (Continued)

ADDITIONAL U.S. REGULATIONS (continued):

CGA 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.
CAN CAUSE REPRODUCTIVE 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.

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

OTHER CANADIAN REGULATIONS: Not applicable.

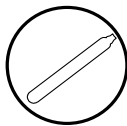
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITY SUBSTANCES LISTS: This compound is not on the CEPA Priority Substances Lists.

CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gases

Class C: Oxidizing Materials

Class D2A: Materials Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
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619/670-0609

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 that uniquely identifies each constituent.

EXPOSURE LIMITS IN AIR:

CEILING LEVEL: The concentration that shall not be exceeded during any part of the working exposure.

LOQ: Limit of Quantitation.

MAK: Federal Republic of Germany Maximum Concentration Values in the workplace.

NE: Not Established. When no exposure guidelines are established, an entry of NE is made for reference.

EXPOSURE LIMITS IN AIR (continued):

NIC: Notice of Intended Change.

NIOSH CEILING: The exposure that shall not be exceeded during any part of the workday. If instantaneous monitoring is not feasible, the ceiling shall be assumed as a 15-minute TWA exposure (unless otherwise specified) that shall not be exceeded at any time during a workday.

NIOSH RELs: NIOSH's Recommended Exposure Limits.

DEFINITIONS OF TERMS (Continued)

EXPOSURE LIMITS IN AIR (continued):

PEL-Permissible Exposure Limit: OSHA's Permissible Exposure Limits. 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 that was vacated by Court Order.

SKIN: Used when there is a danger of cutaneous absorption.

STEL-Short Term Exposure Limit: Short Term Exposure Limit, usually a 15-minute time-weighted average (TWA) exposure that should not be exceeded at any time during a workday, even if the 8-hr TWA is within the TLV-TWA, PEL-TWA or REL-TWA.

TLV-Threshold Limit Value: An airborne concentration of a substance that 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.

TWA-Time Weighted Average: Time Weighted Average exposure concentration for a conventional 8-hr (TLV, PEL) or up to a 10-hr (REL) workday and a 40-hr workweek.

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.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS: This rating system was developed by the National Paint and Coating Association and has been adopted by industry to identify the degree of chemical hazards.

HEALTH HAZARD:

0 (Minimal Hazard): No significant health risk, irritation of skin or eyes not anticipated. *Skin Irritation:* Essentially non-irritating. PII or Draize = "0". *Eye Irritation:* Essentially non-irritating, or minimal effects which clear in < 24 hours [e.g. mechanical irritation]. Draize = "0". *Oral Toxicity LD₅₀ Rat:* < 5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* < 2000 mg/kg. *Inhalation Toxicity 4-hrs LC₅₀ Rat:* < 20 mg/L.; **1 (Slight Hazard):** Minor reversible injury may occur; slightly or mildly irritating. *Skin Irritation:* Slightly or mildly irritating. *Eye Irritation:* Slightly or mildly irritating. *Oral Toxicity LD₅₀ Rat:* > 500-5000 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 1000-2000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 2-20 mg/L.; **2 (Moderate Hazard):** Temporary or transitory injury may occur. *Skin Irritation:* Moderately irritating; primary irritant; sensitizer. PII or Draize > 0, < 5. *Eye Irritation:* Moderately to severely irritating and/or corrosive; reversible corneal opacity; corneal involvement or irritation clearing in 8-21 days. Draize > 0, ≤ 25. *Oral Toxicity LD₅₀ Rat:* > 50-500 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 200-1000 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.5-2 mg/L.; **3 (Serious Hazard):** Major injury likely unless prompt action is taken and medical treatment is given; high level of toxicity; corrosive. *Skin Irritation:* Severely irritating and/or corrosive; may destroy dermal tissue, cause skin burns, dermal necrosis. PII or Draize > 5-8 with destruction of tissue. *Eye Irritation:* Corrosive, irreversible destruction of ocular tissue; corneal involvement or irritation persisting for more than 21 days. Draize > 80 with effects irreversible in 21 days. *Oral Toxicity LD₅₀ Rat:* > 1-50 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* > 20-200 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* > 0.05-0.5 mg/L.; **4 (Severe Hazard):** Life-threatening; major or permanent damage may result from single or repeated exposure. *Skin Irritation:* Not appropriate. Do not rate as a "4", based on skin irritation alone. *Eye Irritation:* Not appropriate. Do not rate as a "4", based on eye irritation alone. *Oral Toxicity LD₅₀ Rat:* ≤ 1 mg/kg. *Dermal Toxicity LD₅₀Rat or Rabbit:* ≤ 20 mg/kg. *Inhalation Toxicity LC₅₀ 4-hrs Rat:* ≤ 0.05 mg/L.

FLAMMABILITY HAZARD:

0 (Minimal Hazard-Materials) that will not burn in air when exposure to a temperature of 815.5°C [1500°F] for a period of 5 minutes.);

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued):

1 (Slight Hazard-Materials) that must be pre-heated before ignition can occur. Material require considerable pre-heating, under all ambient temperature conditions before ignition and combustion can occur, Including: Materials that will burn in air when exposed to a temperature of 815.5°C (1500°F) for a period of 5 minutes or less; Liquids, solids and semisolids having a flash point at or above 93.3°C [200°F] (e.g. OSHA Class IIIB, or; Most ordinary combustible materials [e.g. wood, paper, etc.]; **2 (Moderate Hazard-Materials)** that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not, under normal conditions, form hazardous atmospheres in air, but under high ambient temperatures or moderate heating may release vapor in sufficient quantities to produce hazardous atmospheres in air, Including: Liquids having a flash-point at or above 37.8°C [100°F] Solid materials in the form of course dusts that may burn rapidly but that generally do not form explosive atmospheres; Solid materials in a fibrous or shredded form that may burn rapidly and create flash fire hazards (e.g. cotton, sisal, hemp; Solids and semisolids that readily give off flammable vapors.); **3 (Serious Hazard- Liquids and solids)** that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures, or, unaffected by ambient temperature, are readily ignited under almost all conditions, including: Liquids having a flash point below 22.8°C [73°F] and having a boiling point at or above 38°C [100°F] and below 37.8°C [100°F] [e.g. OSHA Class IB and IC]; Materials that on account of their physical form or environmental conditions can form explosive mixtures with air and are readily dispersed in air [e.g., dusts of combustible solids, mists or droplets of flammable liquids]; Materials that burn extremely rapidly, usually by reason of self-contained oxygen [e.g. dry nitrocellulose and many organic peroxides]; **4 (Severe Hazard-Materials)** that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air, and which will burn readily, including: Flammable gases; Flammable cryogenic materials; Any liquid or gaseous material that is liquid while under pressure and has a flash point below 22.8°C [73°F] and a boiling point below 37.8°C [100°F] [e.g. OSHA Class IA; Material that ignite spontaneously when exposed to air at a temperature of 54.4°C [130°F] or below [e.g. pyrophoric].

PHYSICAL HAZARD:

0 (Water Reactivity): Materials that do not react with water. *Organic Peroxides:* Materials that are normally stable, even under fire conditions and will not react with water. *Explosives:* Substances that are Non-Explosive. *Unstable Compressed Gases:* No Rating. *Pyrophorics:* No Rating. *Oxidizers:* No "0" rating allowed. *Unstable Reactives:* Substances that will not polymerize, decompose, condense or self-react.; **1 (Water Reactivity):** Materials that change or decompose upon exposure to moisture. *Organic Peroxides:* Materials that are normally stable, but can become unstable at high temperatures and pressures. These materials may react with water, but will not release energy. *Explosives:* Division 1.5 & 1.6 substances that are very insensitive explosives or that do not have a mass explosion hazard. *Compressed Gases:* Pressure below OSHA definition. *Pyrophorics:* No Rating. *Oxidizers:* Packaging Group III; *Solids:* any material that in either concentration tested, exhibits a mean burning time less than or equal to the mean burning time of a 3:7 potassium bromate/cellulose mixture and the criteria for Packing Group I and II are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise time of a 1:1 nitric acid (65%)/cellulose mixture and the criteria for Packing Group I and II are not met. *Unstable Reactives:* Substances that may decompose, condense or self-react, but only under conditions of high temperature and/or pressure and have little or no potential to cause significant heat generation or explosive hazard. Substances that readily undergo hazardous polymerization in the absence of inhibitors.);

DEFINITIONS OF TERMS (Continued)

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM

HAZARD RATINGS (continued):

PHYSICAL HAZARD (continued):

2 (Water Reactivity): Materials that may react violently with water. *Organic Peroxides:* Materials that, in themselves, are normally unstable and will readily undergo violent chemical change, but will not detonate. These materials may also react violently with water. *Explosives:* Division 1.4 – Explosive substances where the explosive effect are largely confined to the package and no projection of fragments of appreciable size or range are expected. An external fire must not cause virtually instantaneous explosion of almost the entire contents of the package. *Compressed Gases:* Pressurized and meet OSHA definition but < 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group II *Solids:* any material that, either in concentration tested, exhibits a mean burning time of less than or equal to the mean burning time of a 2:3 potassium bromate/cellulose mixture and the criteria for Packing Group I are not met. *Liquids:* any material that exhibits a mean pressure rise time less than or equal to the pressure rise of a 1:1 aqueous sodium chlorate solution (40%/cellulose mixture and the criteria for Packing Group I are not met. *Unstable Reactives:* Substances that may polymerize, decompose, condense, or self-react at ambient temperature and/or pressure, but have a low potential for significant heat generation or explosion. Substances that readily form peroxides upon exposure to air or oxygen at room temperature); **3 (Water Reactivity):** Materials that may form explosive reactions with water. *Organic Peroxides:* Materials that are capable of detonation or explosive reaction, but require a strong initiating source, or must be heated under confinement before initiation; or materials that react explosively with water. *Explosives:* Division 1.2 – Explosive substances that have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but do not have a mass explosion hazard. *Compressed Gases:* Pressure ≥ 514.7 psi absolute at 21.1°C (70°F) [500 psig]. *Pyrophorics:* No Rating. *Oxidizers:* Packing Group I *Solids:* any material that, in either concentration tested, exhibits a mean burning time less than the mean burning time of a 3:2 potassium bromate/cellulose mixture. *Liquids:* Any material that spontaneously ignites when mixed with cellulose in a 1:1 ratio, or which exhibits a mean pressure rise time less than the pressure rise time of a 1:1 perchloric acid (50%/cellulose mixture. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a moderate potential to cause significant heat generation or explosion.); **4 (Water Reactivity):** Materials that react explosively with water without requiring heat or confinement. *Organic Peroxides:* Materials that are readily capable of detonation or explosive decomposition at normal temperature and pressures. *Explosives:* Division 1.1 & 1.2-explosive substances that have a mass explosion hazard or have a projection hazard. A mass explosion is one that affects almost the entire load instantaneously. *Compressed Gases:* No Rating. *Pyrophorics:* Add to the definition of Flammability “4”. *Oxidizers:* No “4” rating. *Unstable Reactives:* Substances that may polymerize, decompose, condense or self-react at ambient temperature and/or pressure and have a high potential to cause significant heat generation or explosion.)

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS:

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 could cause death or major residual injury).

FLAMMABILITY HAZARD: 0 Materials that will not burn under typical fire conditions, including intrinsically noncombustible materials such as concrete, stone, and sand. **1** Materials that must be preheated before ignition can occur. Materials in this degree require considerable preheating, under all ambient temperature conditions, before ignition and combustion can occur

NATIONAL FIRE PROTECTION ASSOCIATION HAZARD RATINGS (continued):

FLAMMABILITY HAZARD (continued): 2 Materials that must be moderately heated or exposed to relatively high ambient temperatures before ignition can occur. Materials in this degree would not under normal conditions form hazardous atmospheres with air, but under high ambient temperatures or under moderate heating could release vapor in sufficient quantities to produce hazardous atmospheres with air. **3** Liquids and solids that can be ignited under almost all ambient temperature conditions. Materials in this degree produce hazardous atmospheres with air under almost all ambient temperatures or, though unaffected by ambient temperatures, are readily ignited under almost all conditions. **4** Materials that will rapidly or completely vaporize at atmospheric pressure and normal ambient temperature or that are readily dispersed in air and will burn readily.

INSTABILITY HAZARD: 0 Materials that in themselves are normally stable, even under fire conditions. **1** Materials that in themselves are normally stable, but that can become unstable at elevated temperatures and pressures. **2** Materials that readily undergo violent chemical change at elevated temperatures and pressures. **3** Materials that in themselves are capable of detonation or explosive decomposition or explosive reaction, but that require a strong initiating source or that must be heated under confinement before initiation. **4** Materials that in themselves are readily capable of detonation or explosive decomposition or explosive reaction at normal temperatures and pressures.

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:

Human and Animal Toxicology: 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: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - 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/m³** 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. Other measures of toxicity include **TDL_o**, the lowest dose to cause a symptom and **TCL_o** 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. **Cancer Information:** 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 Information:** **BEI** - ACGIH 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. **BCF** = Bioconcentration Factor, which is used to determine if a substance will concentrate in lifeforms which consume contaminated plant or animal matter. **TL_m** = median threshold limit; Coefficient of Oil/Water Distribution is represented by **log K_{ow}** or **log K_{oc}** and is used to assess a substance's behavior in the environment.

DEFINITIONS OF TERMS (Continued)

REGULATORY INFORMATION:

U.S. and CANADA:

This section explains the impact of various laws and regulations on the material. **ACGIH**: American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **EPA** is the U.S. Environmental Protection Agency. **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**). **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/NDSL**); 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. This section also includes information on the precautionary warnings which appear on the material's package label. **OSHA** - U.S. Occupational Safety and Health Administration.