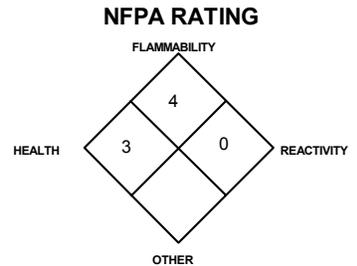




MATERIAL SAFETY DATA SHEET

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: **CARBON MONOXIDE - CO**
LIQUEFIED CARBON MONOXIDE- CO (Cryogenic)
 Document Number: 001014

PRODUCT USE: For general analytical/synthetic chemical uses.

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: CHEMTREC: 1-800-424-9300
 International: 703-527-3887 (Call Collect)

DATE OF PREPARATION: May 13, 1996
SECOND REVISION: December 12, 1997

2. COMPOSITION and INFORMATION ON INGREDIENTS

| CHEMICAL NAME | CAS # | mole % | EXPOSURE LIMITS IN AIR | | | | | |
|--------------------|----------|--------|--|-------------|-----------------------------------|--------------------------------|------|--|
| | | | ACGIH | | OSHA | | IDLH | OTHER |
| | | | TLV ppm | STEL ppm | PEL ppm | STEL ppm | | |
| Carbon Monoxide | 630-08-0 | > 99.0 | 25 | NE | 50 35 (Vacated 1989 PEL) | 200 C (Vacated 1989 PEL) | 1200 | NIOSH REL: 35 ppm (TWA); 200 ppm C DFG MAK: 30 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: Carbon Monoxide is a colorless, odorless, flammable, toxic gas or a colorless, odorless, cryogenic liquid. Carbon Monoxide is a chemical asphyxiant and may be fatal if inhaled. The liquefied gas can cause frostbite to any contaminated tissue. Carbon Monoxide is a reproductive toxin. Carbon Monoxide poses a serious fire hazard when it is accidentally released. Flame or high temperature impinging on a localized area of the cylinder of this product can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations.

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: Carbon monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs.

Since the affinity of carbon monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. The effects of exposure in humans can be summarized as follows:

CONCENTRATION

All exposure levels:

200 ppm:

400 ppm:

1,000 -2000 ppm:

200-2500 ppm:

>2500 ppm:

SYMPTOMS OF EXPOSURE

Lips and fingernails turn bright red. Slight symptoms (headache, discomfort) after several hours of exposure.

Headache and discomfort experienced within 2-3 hours of exposure.

Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger. Within 2 hours, there is mental confusion, headaches, and nausea.

Unconsciousness within 30 minutes.

Potential for collapse and death before warning symptoms are produced.

NOTES:

At high altitudes, individuals may be more susceptible to Carbon Monoxide overexposures. Development of symptoms may also occur more rapidly if individuals are doing physically demanding tasks. Individuals who have heart conditions may experience a more rapid onset of symptoms. During recovery, victims can experience headaches, vision problems, and memory loss.

OTHER POTENTIAL HEALTH EFFECTS: Contact with cryogenic 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 can quickly subside.

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

ACUTE: Symptoms of Carbon Monoxide poisoning include lips and fingernails turning bright red, respiratory difficulty, headaches, shortness of breath, blurred vision, memory loss, and nausea. At high concentrations, unconsciousness or death may occur. Contact with cryogenic liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite.

CHRONIC: Clinical studies indicate that there is a relationship between exposure to Carbon Monoxide in specific occupations (e.g., fire-fighters, foundry workers) had an increased incidence of cardiovascular problems. Carbon Monoxide is a reproductive toxin. Refer to Section 11 of this MSDS for further information.

TARGET ORGANS: Respiratory system, blood system, cardiovascular system, reproductive system.

| HAZARDOUS MATERIAL INFORMATION SYSTEM | | | |
|---|---------------|--|---------------|
| HEALTH | | (BLUE) | 3 |
| FLAMMABILITY | | (RED) | 4 |
| REACTIVITY | | (YELLOW) | 0 |
| PROTECTIVE EQUIPMENT | | | X |
| EYES | RESPIRATORY | HANDS | BODY |
|  | See Section 8 |  | See Section 8 |
| For routine industrial applications | | | |

See Section 16 for Definition of Ratings

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 CARBON MONOXIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

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). Physicians should refer to Section 11 (Toxicology Information) for additional data.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: 607°C (1125°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 12.5%

Upper (UEL): 74.2%

FIRE EXTINGUISHING MATERIALS: Extinguish fires of this gas by shutting-off the source of the gas. Use water spray to cool fire-exposed structures and equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Carbon Monoxide is a toxic gas and presents a severe health hazard to firefighters. An extreme explosion hazard exists in areas in which the gas has been released, but the material has not yet ignited. Carbon Monoxide decomposes to carbon and carbon dioxide between 400-700°C (752-1292°F).

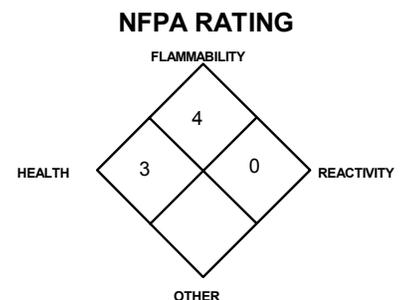
DANGER! Fires impinging (direct flame) on the outside surface of cryogenic liquid storage vessels of Carbon Monoxide can be very dangerous. Direct flame exposure on the cylinder wall can cause an explosion either by BLEVE (Boiling Liquid Expanding Vapor Explosion), or by exothermic decomposition. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the vessel. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

RESPONSE TO FIRE INVOLVING CRYOGEN: Cryogenic 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 Carbon Monoxide. If large concentrations of Carbon Monoxide 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 Carbon Monoxide, when exposed to the atmosphere, will produce a cloud of ice/fog in the air upon its release. A flammable mixture will exist within the vapor cloud, and it is advisable that personnel keep well outside the area of visible moisture.

Explosion Sensitivity to Mechanical Impact: Not Sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause this gas to ignite explosively, upon a release of this gas. Due to low electrical conductivity, this substance can generate electrostatic charges during handling operations.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment. The best fire-fighting technique may be simply to let the burning gas escape from the leak. Stop the leak before extinguishing fire. If the fire is extinguished before the leak is sealed, the still leaking gas could explosively re-ignite without warning and cause extensive damage, injury, or fatality. In this case, increase ventilation to prevent flammable or explosive mixture formation.



See Section 16 for Definition of Ratings

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. Adequate fire protection must be provided.

Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, mechanically-resistant gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas, which is approximately as heavy as air, to dissipate.

Monitor the surrounding area for combustible gas levels and oxygen. Colorimetric tubes can be used to detect the presence of Carbon Monoxide. Combustible gas concentration must be below 10% of the LEL (LEL = 12.5%) prior to entry of response personnel. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Colorimetric tube reading should indicate that Carbon Monoxide is not present in the atmosphere above background levels 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 CRYOGENIC 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.

THIS IS AN EXTREMELY FLAMMABLE, TOXIC GAS. Protection of all personnel and the area must be maintained.

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

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Carbon Monoxide IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of overexposure (see Section 3, Hazard Information); exposures to fatal concentrations of Carbon Monoxide could occur without any significant warning symptoms.

STORAGE AND HANDLING PRACTICES: Do not attempt to repair, adjust, or in any other way modify the cylinders containing Carbon Monoxide. If there is a malfunction, or another type of operational problem, contact nearest distributor immediately. 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 area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Isolate from oxidizers such as oxygen, chlorine, or fluorine. Do not store near alkalis, heavy metals, and metal oxides. Use a check valve or trap in the discharge line to prevent hazardous backflow. Post "No Smoking or Open Flame" signs in storage and use areas. 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 in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

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 in-place (where provided) 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 (where provided). Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. 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*. For cryogenic liquids, refer to CGA P-12, *Safe Handling of Cryogenic Liquids* and CGA-13, *The Safe Handling of Liquid Carbon Monoxide*, and 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 to ensure Carbon Monoxide levels are below those listed in Section 2 (Composition and Information on Ingredients). Local exhaust ventilation is preferred, because it prevents Carbon Monoxide dispersion into the work place by eliminating it at its source. If appropriate, install automatic monitoring equipment to detect the levels of Carbon Monoxide and oxygen. Carbon Monoxide detectors should be installed in or near areas where Carbon Monoxide is being used or stored.

RESPIRATORY PROTECTION: Maintain Carbon Monoxide levels are below those listed in Section 2 (Composition and Information on Ingredients) in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of Carbon Monoxide. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following are NIOSH recommendations for carbon monoxide concentrations in air:

| CONCENTRATION | RESPIRATORY EQUIPMENT |
|---|--|
| UP TO 350 ppm: | Supplied Air Respirator (SAR). |
| UP TO 875 ppm: | SAR operated in a continuous flow mode. |
| UP TO 1200 ppm: | Gas mask with canister to protect against carbon monoxide or full-facepiece Self-Contained Breathing Apparatus (SCBA) or full-facepiece SAR. |
| Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: | Positive pressure, full-facepiece SCBA or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA. |
| Escape: | Gas mask with canister to protect against carbon monoxide or escape-type SCBA. |
| NOTE: | NOTE: End of Service Life Indicator (ESLI) required for gas masks. The IDLH concentration for Carbon Monoxide is 1200 ppm. |

EYE PROTECTION: Splash goggles or safety glasses, for protection from rapidly expanding gases and splashes of liquid Carbon Monoxide.

HAND PROTECTION: Natural rubber and neoprene are attacked by Carbon Monoxide. Wear mechanically-resistant gloves when handling cylinders of Carbon Monoxide. Use low-temperature protective gloves (e.g., Kevlar) when working with containers of Liquid Carbon Monoxide.

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 as fire retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

| | |
|--|--|
| VAPOR DENSITY: 1.161 kg/m ³ (0.0725 lb/ft ³) | EVAPORATION RATE (nBuAc = 1): Not applicable. |
| SPECIFIC GRAVITY (air = 1): 0.967 | FREEZING POINT: -205°C (-337°F) |
| SOLUBILITY IN WATER @ 20°C (68°F): 30 mg/l | BOILING POINT @ 1 atm: -191.5°C (-312.7°F) |
| VAPOR PRESSURE (psia): Gas, ambient. | pH: Not applicable. |
| EXPANSION RATIO: 850 (cryogenic liquid) | SPECIFIC VOLUME (ft ³ /lb): 13.8 |
| COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable. | ODOR THRESHOLD: Not applicable |

APPEARANCE AND COLOR: Carbon Monoxide is a colorless, odorless gas. The liquid is colorless and odorless.

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no unusual warning properties associated with a release of Carbon Monoxide. 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.

10. STABILITY and REACTIVITY

STABILITY: Stable.

DECOMPOSITION PRODUCTS: Carbon Monoxide burns to form carbon and carbon dioxide between 400-700°C (752-1292°F).

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Strong oxidizers (e.g., chlorine, bromine, pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive with nickel and iron (especially at high temperatures and pressures). Natural rubber and neoprene are attacked by Carbon Monoxide.

Carbon Monoxide is also incompatible with the following substances: metal oxides, nickel, iron, chromium, alkali and alkaline earth metals, aluminum powder, iodine heptafluoride, sulfur, bromine, bromine trifluoride, bromine pentafluoride, chlorine dioxide, peroxodisulfuryl difluoride.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. If the cylinders are exposed to extremely high temperatures, these cylinders can rupture and rupture.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicity data are available for Carbon Monoxide:

| | | |
|---|---|--|
| TCLo (inhalation, mouse) = 65 ppm/24 hours (7-18 preg): reproductive effects | TCLo (inhalation, man) = 650 ppm/45 minutes: central nervous system and blood system effects. | LCLo (inhalation, rabbit) = 4000 ppm |
| TCLo (inhalation, mouse) = 8 pph/1 hour (female 8D post): teratogenic effects | LCLo (inhalation, human) = 5000 ppm/5 minutes | LC50 (inhalation, guinea pig) = 5718 ppm/4 hours |
| TCLo (inhalation, human) = 600 mg/m ³ /10 minutes | LCLo (inhalation, dog) = 4000 ppm/46 minutes | LCLo (inhalation, mammal) = 5000 ppm/5 minutes |
| LCLo (inhalation, man) = 4000 ppm/30 minutes | | LD50 (inhalation, wildbird) = 1334 ppm |

SUSPECTED CANCER AGENT: Carbon Monoxide is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Carbon Monoxide is not irritating; however, contact with rapidly expanding gases can be irritating to exposed skin and eyes.

SENSITIZATION OF PRODUCT: Carbon Monoxide is not a sensitizer after prolonged or repeated contact.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Carbon Monoxide on the human reproductive system.

Mutagenicity: Carbon Monoxide is not expected to cause mutagenic effects in humans. In one available animal study, Carbon Monoxide increased chromosomal damage in the blood of mice.

Embryotoxicity: Carbon Monoxide is not reported to cause human embryotoxic effects; see following paragraph.

Teratogenicity: Carbon Monoxide can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy have caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

Reproductive Toxicity: Carbon Monoxide is not expected to 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.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by overexposure to Carbon Monoxide. Carbon Monoxide can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris.

RECOMMENDATIONS TO PHYSICIANS: Provide oxygen. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) for Carbon Monoxide are as follows:

| CHEMICAL DETERMINANT | SAMPLING TIME | BEI |
|---|----------------------------------|----------------------------------|
| CARBON MONOXIDE • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air | • End of shift • End of shift | • 3.5% of hemoglobin • 20 ppm |

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Carbon Monoxide occurs naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are available for Carbon Monoxide:

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 °C, 2.3 ml at 20 °C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Carbon Monoxide can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas may also be harmful to plant life. Another adverse effect anticipated for plant-life is frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Carbon Monoxide is harmful to aquatic life in very low concentrations. The following aquatic toxicity data are available for Carbon Monoxide:

LD (sunfish) = 1.5 ppm/1-6 hours, fresh water.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

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

| | | |
|---|--|--|
| <u>PROPER SHIPPING NAME:</u> | Carbon Monoxide Gas: Carbon monoxide, compressed | Carbon Monoxide Liquid: Carbon monoxide, refrigerated liquid |
| <u>HAZARD CLASS NUMBER and DESCRIPTION:</u> | 2.3 (Poison Gas) | 2.3 (Poison Gas) |
| <u>UN IDENTIFICATION NUMBER:</u> | UN 1016 | NA 9202 |
| <u>PACKING GROUP:</u> | Not applicable. | Not applicable. |
| <u>DOT LABEL(S) REQUIRED:</u> | Poison Gas, Flammable Gas | Poison Gas, Flammable Gas |

SPECIAL PROVISION: Carbon Monoxide is poisonous by inhalation. Shipments must be properly described as inhalation hazards. ZONE D. Refer to 49 CFR 172.313.

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 119 (Gas); 168 (Liquid)

MARINE POLLUTANT: Carbon Monoxide 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.

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Carbon Monoxide 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: Not applicable.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): Not applicable.

CANADIAN DSL INVENTORY STATUS: Carbon Monoxide is listed on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Carbon Monoxide is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Depending on specific operations involving the use of Carbon Monoxide, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Carbon Monoxide is not listed in Appendix A of this regulation, however, any process that involves a flammable gas on-site, in one location, in quantities of 10,000 lb. (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Carbon Monoxide is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide.

California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide.

Florida - Substance List: Carbon Monoxide.

Illinois - Toxic Substance List: Carbon Monoxide.

Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Carbon Monoxide.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: Carbon Monoxide.

Missouri - Employer Information/Toxic Substance List: Carbon Monoxide.

New Jersey - Right to Know Hazardous Substance List: Carbon Monoxide.

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

Pennsylvania - Hazardous Substance List: Carbon Monoxide.

Rhode Island - Hazardous Substance List: Carbon Monoxide.

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): Carbon Monoxide is on the California Proposition 65 lists. WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm.

15. REGULATORY INFORMATION (Continued)

LABELING:

DANGER:

FLAMMABLE, ODORLESS, HIGH PRESSURE GAS.
ACTS ON BLOOD CAUSING DAMAGE TO CENTRAL NERVOUS SYSTEM.
CAN BE FATAL EVEN WITH ADEQUATE OXYGEN.
CAN FORM EXPLOSIVE MIXTURES WITH AIR.

Do not breathe gas.
Store and use with adequate ventilation.
Keep away from heat, flames, and sparks.
Use equipment rated for cylinder pressure.
Close valve after each use and when empty.
Use in accordance with the Material Safety Data Sheet.

FIRST-AID:

IF INHALED, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

DO NOT REMOVE THIS PRODUCT LABEL.

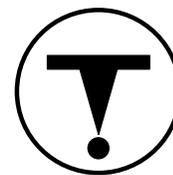
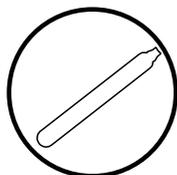
CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gases

Class B1: Flammable Gas

Class D1A: Toxic Material/Immediate and Serious Effects

Class D2B: Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

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: **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. 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 **TDL₀**, the lowest dose to cause a symptom and **TCL₀** 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/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.