



MATERIAL SAFETY DATA SHEET

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

SECTION 1. PRODUCT IDENTIFICATION

PRODUCT NAME: 25 ppm - 10% CARBON MONOXIDE IN AIR
CHEMICAL NAME: Mixture of Carbon Monoxide (25 ppm - 10%) and Air (Balance)
FORMULA: Carbon Monoxide = CO; Air = Not applicable.
SYNONYMS: Not Applicable

MANUFACTURER: SPECTRA GASES, INC.
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SPECTRA GASES EMERGENCY CONTACT: 800-932-0624 8:30 am - 7:00 pm (EST)
24 HOUR EMERGENCY CONTACT, CHEMTREC: 800/424-9300, 202/484-7616
DATE OF PREPARATION: January 4, 1999
MSDS NUMBER: 1606b
PRODUCT USE: Environmental Calibration and Auditing Gas

SECTION 2. COMPOSITION and INFORMATION ON INGREDIENTS

COMPOSITION: Carbon Monoxide 25 ppm - 10%, Balance Air
CAS NUMBER: Carbon Monoxide: 630-08-0
 Air: 7727-37-9
EINECS NUMBER: Carbon Monoxide: 211-128-3
 Air: 231-783-9

EXPOSURE LIMITS:

	OSHA PELs:	ACGIH TLVs:	NIOSH RELs:
Carbon Monoxide:			
TWA =	50 ppm	TWA = 25 ppm	TWA = 35 ppm
TWA =	35 ppm (vacated 1989 PEL)		Ceiling = 200 ppm
Ceiling =	200 ppm (vacated 1989 PEL)		IDLH = 1200 ppm
Air:			
There are no exposure limits for Air.			

SECTION 3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, odorless, non-flammable gas mixture. This gas mixture can produce significant, adverse health effects at relatively low concentrations, due to the presence of Carbon Monoxide. Overexposure to Carbon Monoxide, a chemical asphyxiant, can cause nausea, dizziness, headaches, and collapse. Emergency Responders must protect themselves from inhalation exposures.

ROUTES OF ENTRY, SYMPTOMS OF ACUTE EXPOSURE: WARNING - If rescue personnel need to enter an area suspected of having a toxic level of Carbon Monoxide, they should be equipped with Self-Contained Breathing Apparatus (SCBA), and, if available, a full-body chemically resistant suit. Acute overexposure to this gas mixture may cause the following health effects:

EYE CONTACT: Release of a high-pressure gas may result in airborne objects.

INGESTION: Ingestion of this gas mixture is not a likely route of industrial exposure.

INHALATION: This gas mixture can produce significant, adverse health effects at relatively low concentrations, due to the presence of Carbon Monoxide. 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.

SECTION 3. HAZARD IDENTIFICATION (Continued)

INHALATION (continued): 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 25 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is inhaled, symptoms from Carbon Monoxide which may develop include those described below.

CONCENTRATION
of CARBON MONOXIDE

All exposure levels:

200 ppm:

400 ppm:

1,000 -2000 ppm:

2000-2500 ppm:

> 2500 ppm:

EXPOSURE SYMPTOM

Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning 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 occur. Within 1.5 hours, there is a tendency to stagger. Within 2 hours, there is mental confusion, headache, and nausea.

Unconsciousness within 30 minutes.

Potential for collapse and death before warning symptoms are produced.

SKIN CONTACT: Not applicable.

HMIS RATINGS: HEALTH: = 2; FLAMMABILITY: = 0; REACTIVITY: = 0;

PPE: Level B (see Section 8, Exposure Controls/Personal protective Equipment)

ROUTES OF ENTRY, SYMPTOMS OF CHRONIC EXPOSURE:

ROUTE OF ENTRY: Inhalation

TARGET ORGANS: Respiratory system, circulatory system, cardiovascular system, central nervous system, reproductive system.

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

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Acute or chronic respiratory conditions and cardiac conditions may be aggravated by over-exposure to this gas mixture.

CARCINOGENICITY: Carbon Monoxide is not found on the FEDERAL OSHA Z LIST, NTP, CAL/OSHA, or IARC Carcinogenicity lists and therefore are neither considered to be nor suspected to be cancer-causing agents by these agencies..

SECTION 4. FIRST AID MEASURES

EYE CONTACT: Open victim's eyes while under gentle, lukewarm, running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Consultation with an ophthalmologist is suggested if exposure has led to mechanical injury.

INGESTION: Ingestion is an unlikely route of exposure for this gas.

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

SKIN CONTACT: No adverse effect is expected after skin contact.

NOTES TO PHYSICIANS: Administer oxygen, if necessary and treat symptoms. Patients with 40% carboxyhemoglobin or more and an uncompensated metabolic acidosis (arterial pH less than 7.4) should be managed aggressively with ventilatory support or hyperbaric oxygenation. Infuse sodium bicarbonate and balanced electrolyte solutions if blood analyses indicate a significant metabolic acidosis. Ancillary therapy for brain edema may be necessary if hypoxia has been severe. Ensure absolute bed rest for at least 48 hours; in severe poisonings, 2-4 weeks in bed may prevent sequelae. Watch for late neurological, psychiatric and cardiac complications.

SECTION 5. FIRE FIGHTING MEASURES

FLASH POINT: Not Applicable

AUTOIGNITION: Not Applicable

FLAMMABLE RANGE: Lower (LEL): 12.5%; Upper (UEL): 74.0%

NFPA RATINGS:

HEALTH: = 2

FLAMMABILITY: = 0

REACTIVITY: = 0

SPECIAL: None

EXTINGUISHING MEDIA: This is a non-flammable gas mixture; use fire-extinguishing media appropriate for the surrounding materials.

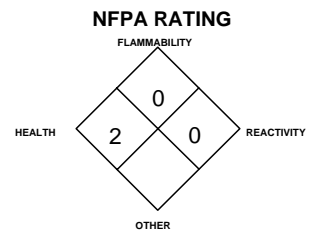
SPECIAL FIRE-FIGHTING PROCEDURES: Evacuate all personnel from area. If possible without risk, shut off source of gas, then fight fire according to types of materials burning. If cylinder is not actively a part of the fire, remove from fire area. If this is not possible, cool cylinder with a water spray to prevent violent rupture. Fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture presents a significant inhalation hazard to firefighters, due to the presence of Carbon Monoxide. This gas mixture does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

EXPLOSION SENSITIVITY TO MECHANICAL IMPACT: Not sensitive.

EXPLOSION SENSITIVITY TO STATIC DISCHARGE: Not sensitive.

HAZARDOUS COMBUSTION PRODUCTS: If involved in a fire, the Carbon Monoxide in this mixture will decompose to form oxides of carbon and carbon dioxide between 400-700°C (752-1292°F).



**See Section 16 for
Definition of Ratings**

SECTION 6. ACCIDENTAL RELEASE MEASURES

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: In the event of a leak of this product, operator should close the gas source if possible to do so safely. Evacuate immediate area. Only trained personnel, wearing Self-Contained Breathing Apparatus (SCBA) and a chemically resistant suit should re-enter a contaminated area.

If leak is in user's gas handling equipment or system, close cylinder valve, safely vent high pressure and purge with inert gas, being sure to bring purge gas to near atmospheric pressure before attempting repairs. If leak is from the cylinder, cylinder valve or the valve pressure relief device (PRD), contact your supplier.

Levels of Carbon Monoxide should be below applicable exposure levels listed in Section 2 (Composition / Information on Ingredients) before personnel can be allowed in the area without SCBA.

Detection systems should be available to monitor for leaks and to measure the level of Carbon Monoxide.

SECTION 7. HANDLING AND STORAGE

STORAGE: Cylinders should be stored upright (with valve protection caps or plugs in place) and firmly secured to prevent falling or being knocked over. Cylinders should be stored in dry, well-ventilated areas. Protect from salt or other corrosive materials. Storage should be away from heavily traveled areas, walkways, elevators, platform edges or other objects or situations that could damage the cylinder wall. Do not store in a manner that will block emergency exits, fire extinguishers or other safety equipment. Do not allow storage temperature to exceed 125°F (52°C). Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. Store empty cylinders away from full cylinders. Consideration should be taken to install leak detection and alarm equipment for storage areas. **NOTE:** Use only DOT or ASME code cylinders designed for compressed gas storage. Cylinders must not be recharged except by or with the consent of owner.

HANDLING: This mixture can be dangerous and should only be handled by trained personnel. Wearing contact lenses is not recommended when handling this gas mixture. Spectra Gases, Inc., strongly recommends that this gas mixture only be handled in areas with extensive venting capabilities, preferably a gas handling cabinet.

Before using this gas, meticulous leak checking using inert gas is strongly recommended, particularly after new connections are made. Cylinder valves should be inspected regularly for physical damage or corrosion (apparent by discoloration or rust). Care should be taken to inspect the following valve locations for corrosion: neck (where valve inserts into cylinder); bonnet nut (where handle attaches to valve body). Close valve after each use and when empty.

Carbon Monoxide detectors are strongly recommended. Do not drag, roll, slide or drop cylinder. Use a suitable hand truck designed for cylinder movement. Never attempt to lift a cylinder by its cap. Secure cylinders at all times while in use. Use a pressure regulator to safely discharge product from cylinder. Use a check valve to prevent reverse flow into cylinder. Once cylinder has been connected to properly purged process, open cylinder valve slowly and carefully.

SECTION 7. HANDLING AND STORAGE (Continued)

25 ppm - 10% Carbon Monoxide in Air

If user experiences any difficulty operating cylinder valve, discontinue use and contact supplier. Never insert an object (e.g., wrench, screwdriver, etc.) into valve cap openings; doing so may damage valve, causing a leak to occur. Use an adjustable strap-wrench to remove over-tight or rusted caps.

Do not heat cylinders by any means to increase the discharge rate of product from the cylinder. Never apply flame or localized heat directly to any part of the cylinder. Cylinders should not be artificially cooled as certain types of steel undergo property changes when cryogenically cooled, thus making the cylinder unstable.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Purge gas handling equipment with inert gas and relieve pressure before attempting repairs.

SPECIAL PRECAUTIONS: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Carbon Monoxide could occur without any significant warning symptoms. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, Inc. (telephone 703-412-0900) pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers*. Local regulations may require specific equipment for storage and use.

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Forced ventilation systems for the general work area should be provided. Spectra Gases, Inc. recommends that cylinders in use be secured within a ventilated enclosure such as a gas cabinet. Employee exposure should be monitored and reduced to the lowest practical levels using ventilation or other appropriate engineering controls. If appropriate, install automatic monitoring equipment to detect the level of Carbon Monoxide.

RESPIRATORY PROTECTION: Maintain exposure levels of Carbon Monoxide below the levels listed in Section 2 (Composition / Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Carbon Monoxide levels exceed exposure limits, if oxygen level is below 19.5%, or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent U.S. State standards, standards of Canada, the European Standard EN166, and EC member states. The following NIOSH respiratory protection recommendations are for Carbon Monoxide.

<u>CONCENTRATION of CARBON MONOXIDE</u>	<u>RESPIRATORY EQUIPMENT</u>
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: End of Service Life Indicator (ESLI) required for gas masks. The IDLH concentration for Carbon Monoxide is 1200 ppm.

EYE PROTECTION: Use approved safety goggles or safety glasses, as described in OSHA 29 CFR 1910.133 or by the European Standard EN166.

SKIN PROTECTION: Work (such as leather) gloves are recommended when handling cylinders of this gas mixture. Natural rubber and neoprene are attacked by Carbon Monoxide. Wear gloves appropriate for the task.

OTHER PROTECTIVE EQUIPMENT: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders. Transfer of large quantities under pressure may require use of chemically impervious clothing.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

The following information is for Air, the component of greatest percentage:

MOLECULAR WEIGHT: 28.975

GAS DENSITY @ 21.1°C (70°F): 0.07493 lb/ ft³ (1.2 kg/m³)

BOILING POINT @ 1 atm: -194.3°C (-317.8°F)

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES (Continued)

FREEZING/MELTING POINT @ 1 atm: -216.2°C (-357.2°F)
SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F): 1.00
SOLUBILITY IN WATER vol/vol at 0°C (32°F) and 1 atm: 0.0292
SPECIFIC VOLUME @ 21.1°C (70°F): 13.346 ft³/lb (0.8333 m³/kg)
CRITICAL PRESSURE (psia): 547 psia (3771 kPa abs)
COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for the Carbon Monoxide component of this gas mixture.

ODOR THRESHOLD: Not applicable.
GAS DENSITY @ 21.1°C (70°F): 0.0725 lb./ft³ (1.161 kg/m³)
VAPOR PRESSURE @ 20°C (68°F): > 760 mm Hg

Information for gas mixture:

APPEARANCE, ODOR AND STATE: Colorless, odorless gas.

WARNING PROPERTIES FOR THIS GAS MIXTURE: There are no distinct warning properties. Installation of monitors for levels of Carbon Monoxide and oxygen should be considered.

SECTION 10. STABILITY AND REACTIVITY

CHEMICAL STABILITY: Stable.

CONDITIONS TO AVOID: Cylinders should not be exposed to temperatures in excess of 125°F (52°C).

MATERIALS WITH WHICH GAS MIXTURE IS INCOMPATIBLE: This gas mixture is incompatible with strong oxidizers (e.g., chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride), due to the presence of Carbon Monoxide. Carbon Monoxide is also incompatible with the following substances: metal oxides, chromium, alkali and alkaline earth metals, aluminum powder, iodine heptafluoride, sulfur, bromine, bromine trifluoride, bromine pentafluoride, chlorine dioxide, peroxodisulfuryl difluoride. Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Natural rubber and neoprene are attacked by Carbon Monoxide.

REACTIVITY:

A) HAZARDOUS DECOMPOSITION PRODUCTS: None, other than combustion products (see Section 5, Fire-Fighting Measures).

B) HAZARDOUS POLYMERIZATION: Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION**TOXICITY DATA ON COMPONENTS:****CARBON MONOXIDE:**

DOT's LC₅₀ Inhalation, 1 hour: 3760 ppm
 Inhalation-Man LCLo: 4000 ppm/30 minutes
 Inhalation-Man TCLo: 650 ppm/45 minutes: Central nervous system effects, Blood effects
 Inhalation-Human LCLo: 5000 ppm/5 minutes
 Inhalation-Human TCLo: 600 mg/m³/10 minutes
 Inhalation-Rat LC₅₀: 1807 ppm/4 hours
 Inhalation-rat TCLo: 1800 ppm/1 hour/14 days-intermittent: Cardiac
 Inhalation-rat TCLo: 30 mg/m³/8 hours/10 weeks-intermittent: Brain and Coverings: other degenerative changes; Behavioral: muscle contraction or spasticity
 Inhalation-rat TCLo: 96 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
 Inhalation-rat TCLo: 250 ppm/5 hours/20 days-intermittent: Blood: pigmented or nucleated red blood cells, changes in other cell count (unspecified), changes in erythrocyte (RBC) count

CARBON MONOXIDE (continued):

Inhalation-rat TCLo: 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system
 Inhalation-rat TCLo: 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g. %, reduced weight gain), behavioral
 Inhalation-rat TCLo: 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system
 Inhalation-rat TCLo: 1 mg/m³/24 hours: female 72 day(s) pre-mating: Reproductive: Maternal Effects: menstrual cycle changes or disorders, parturition, Fertility: female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated)
 Inhalation-rat TCLo: 150 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral

CARBON MONOXIDE (continued):

Subcutaneous-rat TDLo: 5983 mg/kg/18 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol)
 Inhalation-Mouse LC₅₀: 2444 ppm/4 hours
 Inhalation-Mouse TCLo: 65 ppm/24 hours (female 7-18 days post): Reproductive effects
 Inhalation-Mouse TCLo: 8 pph/1 hour (female 8 days post): Teratogenic effects
 Inhalation-mouse TCLo: 65 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Newborn: behavioral
 Inhalation-mouse TCLo: 250 ppm/7 hours: female 6-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants), Reproductive: Specific Developmental Abnormalities: musculoskeletal system
 Inhalation-mouse TCLo: 125 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus)
 Inhalation-mouse TCLo: 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System

SECTION 11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA ON COMPONENTS (continued):

CARBON MONOXIDE (continued):

Inhalation-mouse TCLo: 8 pph/1 hour:
female 8 day(s) after conception:
Reproductive: Fertility: litter size (e.g.
fetuses per litter; measured before
birth), Effects on Embryo or Fetus:
fetotoxicity (except death, e.g.,
stunted fetus), fetal death
Inhalation-mouse TCLo: 180 ppm/24
hours: female 1-30 day(s) after
conception: Reproductive: Effects on
Newborn: stillbirth, viability index
(e.g., # alive at day 4 per # born alive)

CARBON MONOXIDE (continued):

Inhalation-mouse Micronucleus test: 1500
ppm/10 minutes
Inhalation-mouse Sister chromatid
exchange: 2500 ppm/10 minutes
Inhalation-Dog, adult LCLo: 4000 ppm/46
minutes
Inhalation-Rabbit, adult LCLo: 4000 ppm
Inhalation-rabbit TCLo: 200 mg/m³/3
hours/13 weeks-intermittent: Brain and
Coverings: other degenerative changes;
Cardiac: other changes, Blood:
hemorrhage
Inhalation-rabbit TCLo: 50 ppm/24 hours/8
weeks-continuous: Blood: changes in
platelet count

CARBON MONOXIDE (continued):

Inhalation-Guinea Pig, adult LC₅₀: 5718 ppm/4
hours
Inhalation-guinea pig TCLo: 200 mg/m³/5 hours/4
weeks-intermittent: Endocrine: hyperglycemia
Inhalation-guinea pig TCLo: 200 mg/m³/5 hours/30
weeks-intermittent: Cardiac: arrhythmias
(including changes in conduction), EKG
changes not diagnostic of specified effects,
pulse rate increase, without fall in BP
Inhalation-guinea pig TCLo: 200 ppm/24 hours/90
days-continuous: Blood: pigmented or
nucleated red blood cells, other changes
Inhalation-Mammal LCLo: 5000 ppm/5 minutes
Inhalation-Bird-wild species LD₅₀: 1334 ppm
Inhalation-monkey TCLo: 200 ppm/24 hours/90
days-continuous: Blood: pigmented or
nucleated red blood cells, other changes

CARCINOGENICITY: The components of this gas mixture have not been found to be carcinogenic.

IRRITANCY OF PRODUCT: This gas mixture is not expected to irritate contaminated tissue.; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION OF PRODUCT: Carbon Monoxide and Nitrogen (components of this gas mixture) are not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans.

Embryotoxicity: This gas mixture is not expected to cause embryotoxic effects in humans. Animal embryotoxic data are available for Carbon Monoxide (a component of this gas mixture); these data were obtained during clinical studies on specific animal tissues exposed to this compound.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans. Animal teratogenic data are available for Carbon Monoxide (a component of this gas mixture); these data were obtained during clinical studies on specific animal tissues exposed to this compound.

Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans. Animal reproductive data are available for Carbon Monoxide (a component of this gas mixture); these data were obtained during clinical studies on specific animal tissues exposed to this compound.

A *mutagen* is a chemical that causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An *embryotoxin* is a chemical that 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 that causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance that interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) are applicable for this gas mixture, as follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE <ul style="list-style-type: none"> • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air 	<ul style="list-style-type: none"> • End of shift • End of shift 	<ul style="list-style-type: none"> • 3.5% of hemoglobin • 20 ppm

SECTION 12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas mixture will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

CARBON MONOXIDE: Water solubility = 3.3 ml/100 cc at 0 EC, 2.3 ml at 20 EC. The presence of more than a trace of carbon monoxide is a hazard to fish.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on plants would be related to oxygen-deficient environments or frost from rapidly expanding gases, unless exposure occurs in a confined space. This gas mixture may have adverse effects on animal life exposed to very high concentrations.

SECTION 12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE: This gas mixture may have adverse effects on aquatic life. Currently, the following aquatic toxicity data are available for Carbon Monoxide, a component of this gas mixture:

Lethal (minnows and sunfish) 1-6 hours = 1.5 ppm (fresh water)

MOBILITY: The components of this gas mixture will not be mobile in the soil.

PERSISTENCE AND BIODEGRADABILITY: Persistence: Carbon Monoxide presents no hazard of persistence. Biodegradation: No data are available on the biodegradation of Carbon Monoxide.

POTENTIAL TO BIOACCUMULATE: The components of this gas mixture do not have bioaccumulation or food chain contamination potential.

OZONE-DEPLETION POTENTIAL: The components of this gas mixture are not Class I or Class II ozone depleting chemicals (40 CFR Part 82).

SECTION 13. DISPOSAL CONSIDERATIONS

UNUSED PRODUCT / EMPTY CONTAINER: Do not dispose of residual product. Return residual product in cylinders to: Spectra Gases, Inc., 80 Industrial Drive, Alpha, NJ 08865 or Spectra Gases, Inc., 1261 Activity Drive, Vista, CA 92083.

DISPOSAL INFORMATION: Residual product in the system may be burned if suitable burning unit (flair incinerator) is available on-site. This shall be done in accordance with U.S. Federal, State and local regulations, regulations of the provinces of Canada or EC member states.

SECTION 14. TRANSPORT INFORMATION**U.S. SHIPPING INFORMATION:**

U.S. DOT PROPER SHIPPING NAME: Compressed gases, n.o.s. (Air, Carbon Monoxide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

U.S. DOT SHIPPING LABEL(S) REQUIRED: Non-Flammable Gas

PLACARD (When required): Not Applicable

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position in a well-ventilated truck (never transport in passenger compartment of a vehicle). Ensure cylinder valve is properly closed, valve outlet cap has been reinstalled, and valve protection cap is secured before shipping cylinder.

CAUTION: Compressed gas cylinders shall not be refilled except by qualified producers of compressed gases. Shipment of a compressed gas cylinder which has not been filled by the owner or with the owner's written consent is a violation of Federal law (49 CFR 173.301).

NAERG (NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK) #: 126

CANADIAN SHIPPING INFORMATION:

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as dangerous goods; use the above information for the preparation of Canadian Shipments.

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA):

IATA DESIGNATION: This gas mixture is considered as dangerous goods, per the International Air Transport Association.

PROPER SHIPPING NAME: Compressed gas, n.o.s. (Air, Carbon Monoxide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

HAZARD LABEL(S) REQUIRED: Not Applicable

The following Packaging Information is applicable to this product:

PASSENGER AND CARGO AIRCRAFT		CARGO AIRCRAFT ONLY			
Limited Quantity					
Packing Instruction	Max. Qty per Pkg	Packing Instruction	Max. Qty per Pkg	Packing Instruction	Max. Qty per Pkg
//////	//////	200	75 kg	200	150 kg

SECTION 14. TRANSPORT INFORMATION (Continued)
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INTERNATIONAL MARITIME ORGANIZATION SHIPPING INFORMATION (IMO):

IMO DESIGNATION: This gas mixture is considered as dangerous goods, per the International Maritime Organization.

PROPER SHIPPING NAME: Compressed gas, n.o.s. (Air, Carbon Monoxide)

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)

UN IDENTIFICATION NUMBER: UN 1956

HAZARD LABEL(S) REQUIRED: Not Applicable

IMDG CODE: Page 2124

MARINE POLLUTANT: The components of this product are not designated by the IMO to be Marine Pollutants.

EUROPEAN SHIPPING INFORMATION:

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD (ADR): This gas mixture is considered by the Economic Commission for Europe to be dangerous goods. Additional information is as follows:

SUBSTANCE IDENTIFICATION NO.: 1956

NAME OF SUBSTANCE: Compressed gas, n.o.s. (Air, Carbon Monoxide)

HAZARD IDENTIFICATION NO.: 20

LABEL: 2

CLASS AND ITEM NUMBER: 2, 1^oA

SECTION 15. REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS:**EPA - ENVIRONMENTAL PROTECTION AGENCY:**

CERCLA: Comprehensive Environmental Response, Compensation, and Liability Act of 1990 (40 CFR Parts 117 and 302)

Reportable Quantity (RQ): Not applicable.

SARA TITLE III: Superfund Amendment and Reauthorization Act

SECTIONS 302/304: Emergency Planning and Notification (40 CFR Part 355)

Extremely Hazardous Substances: Not applicable.

Threshold Planning Quantity (TPQ): Not applicable.

Reportable Quantity (RQ): Not applicable.

SECTIONS 311/312: Hazardous Chemical Reporting (40 CFR Part 370)

IMMEDIATE HEALTH: Yes

PRESSURE: Yes

DELAYED HEALTH: No

REACTIVITY: No

FIRE: No

SECTION 313: Toxic Chemical Release Reporting (40 CFR 372)

Releases of Carbon Monoxide and Air do not require reporting under Section 313.

CLEAN AIR ACT:

SECTION 112 (r): Risk Management Programs for Chemical Accidental Release (40 CFR Part 68)

Carbon Monoxide is listed under Table 1 as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Release Prevention, as a flammable substance.

Threshold Planning Quantity (TPQ): Carbon Monoxide = 10,000 lb (4,553 kg).

TSCA: Toxic Substances Control Act

The components of this gas mixture are listed on the TSCA Inventory.

OSHA - OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR Part 1910.119: Process Safety Management of Highly Hazardous Chemicals.

Threshold Planning Quantity (TPQ): Not applicable

U.S. STATE REGULATORY INFORMATION:

CALIFORNIA PROPOSITION 65: Carbon Monoxide (a component of this gas mixture) 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.

SECTION 15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION (Continued):

The components of this gas mixture are covered under the following specific State regulations:

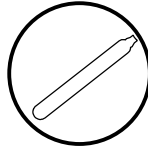
<p>Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide.</p> <p>California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide.</p> <p>Florida - Substance List: Carbon Monoxide.</p> <p>Illinois - Toxic Substance List: Carbon Monoxide.</p> <p>Kansas - Section 302/313 List: No.</p> <p>Massachusetts - Substance List: Carbon Monoxide.</p>	<p>Michigan - Critical Materials Register: Carbon Monoxide.</p> <p>Minnesota - List of Hazardous Substances: Carbon Monoxide.</p> <p>Missouri - Employer Information/Toxic Substance List: Carbon Monoxide.</p> <p>New Jersey - Right to Know Hazardous Substance List: Carbon Monoxide.</p> <p>North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.</p>	<p>Pennsylvania - Hazardous Substance List: Carbon Monoxide.</p> <p>Rhode Island - Hazardous Substance List: Carbon Monoxide.</p> <p>Texas - Hazardous Substance List: Carbon Monoxide.</p> <p>West Virginia - Hazardous Substance List: Carbon Monoxide.</p> <p>Wisconsin - Toxic and Hazardous Substances: Carbon Monoxide.</p>
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CANADIAN FEDERAL REGULATIONS:

CANADIAN DSL INVENTORY STATUS: The components of this gas mixture are listed on the Canadian DSL Inventory.

OTHER CANADIAN REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations. The components of this product are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS SYMBOLS: **Class A: Compressed Gas**

**EUROPEAN ECONOMIC COMMUNITY REGULATIONS:**

EC LABELING AND CLASSIFICATION: This product does not meet the definition of any hazard class as defined by the European Community Council Directive 67/548/EEC.

EC CLASSIFICATION: Not applicable.

EC RISK PHRASES: Not applicable.

EC SAFETY PHRASES: Not applicable.

EUROPEAN COMMUNITY ANNEX II HAZARD SYMBOL: Not applicable.

EUROPEAN COMMUNITY INFORMATION FOR COMPONENTS:**CARBON MONOXIDE:**

EC EINECS/ELINCS NUMBER: 211-128-3

EC CLASSIFICATION: Extremely flammable. Toxic. [F+; T]

EC RISK PHRASES: Extremely flammable. Toxic by inhalation. Toxic: danger of serious damage to health by prolonged exposure through inhalation. May cause harm to the unborn child. [R: 12, 23-48/23, 61]

EC SAFETY PHRASES: Keep locked up and out of the reach of children.* **This safety phrase can be omitted from the label when the substance or preparation is sold for industrial use only.* Keep container tightly closed and in a well ventilated place. Keep away from sources of ignition - No smoking. In case of accident or if you feel unwell, seek medical advice immediately (show label where possible). Avoid exposure; obtain special instructions before use. [S:(1/2-)* 7/9-16, 45, 53]

EC COMMENTS: In mixtures containing Carbon Monoxide, the EC has not assigned specific levels of toxicity according to the percentage of Carbon Monoxide.

AIR:

EC EINECS/ELINCS NUMBER: Unlisted.

EC CLASSIFICATION: An official classification for this substance has not been published in Commission Directives 93/72/EEC, 94/69 EC, or and 96/54/EC.

SECTION 16. OTHER INFORMATION

Information contained in this Material Safety Data Sheet is provided to our customers so they may comply with 29 CFR 1910.1200, Hazard Communication Standard, the Canadian WHMIS Standard, and the requirements of the European Community Directives. The intent of this Material Safety Data Sheet is to provide end users of this product with the health and physical hazards associated with possible exposure to this product. All statements, technical data and recommendations are based on readily available texts and data that Spectra Gases, Inc., believes to be reliable and accurate. Spectra Gases, Inc., makes no warranties, guarantees or representations of any kind with respect to this product or this data. It is the responsibility of the user to obtain and use the most recent version of this MSDS.

Further information about compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 "Safe Handling of Compressed Gases in Containers"
AV-1 "Safe Handling and Storage of Compressed Gases"
"Handbook of Compressed Gases"

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
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619/565-0302

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 (**STEL**), 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 could cause death or major residual injury). 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 **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

REGULATORY INFORMATION:

U.S. and CANADA: 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. This section also includes information on the precautionary warnings which appear on the material's package label.

EUROPEAN: **EC** is the European Community (formerly known as the **EEC**, European Economic Community). **EINECS:** This is the European Inventory of Now-Existing Chemical Substances. The **ARD** is the European Agreement Concerning the International Carriage of Dangerous Goods by Road and the **RID** are the International Regulations Concerning