AIR LIQUIDE

MATERIAL SAFETY DATA SHEET

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

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE
Containing the Following Component in a Nitrogen Balance Gas:
Hydrogen Cyanide: 0.0001- 0.02%

SYNONYMS: Not Applicable **CHEMICAL FAMILY NAME:** Not Applicable **FORMULA:** Not Applicable

Document Number: 50024

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE:	Calibration of Monitoring and Research Equipment
U.S. SUPPLIER/MANUFACTURER'S NAME:	CALGAZ
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
BUSINESS PHONE:	1-410-228-6400 (8 a.m. to 5 p.m. U.S. EST)
General MSDS Information**:**	1-713-868-0440
Fax on Demand:	1-800-231-1366
EMERGENCY PHONE:	
Chemtrec: United States/Canada/Puerto Rico:	1-800-424-9300 [24-hours]
Chemtrec International:	1-703-527-3887 [24-hours]

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA		NIOSH	OTHER
			TWA ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	ppm
Hydrogen Cyanide	74-90-8	0.0001-0.020%	NE	4.7 (ceiling) [skin]	10 (skin)	4.7 (skin)	50	NIOSH REL: STEL = 4.7 (skin) DFG MAKs: TWA = 11.9 (skin) PEAK = 5•MAK 30 min., average value
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

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: This gas mixture is a colorless gas which is odorless. Hydrogen Cyanide (a component of this gas mixture) is an extremely toxic gas; even brief over-exposures to relatively low doses may have significant health consequences. Acute low-level exposure can cause symptoms such as cyanosis, headache, dizziness, unsteadiness of gait, a feeling of suffocation and nausea. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation, as well as eye and skin absorption.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. The health hazards associated with this gas mixture are the potential for over-exposure to Hydrogen Cyanide (a component of this gas mixture) and oxygen displacement if this gas mixture is released in small, poorly-ventilated areas (i.e. enclosed or confined spaces). Hydrogen Cyanide is an extremely toxic gas. It is anticipated that, due to the low concentration (1-200 ppm) of Hydrogen Cyanide and the fact this gas mixture is quickly dissipated, employees will not be exposed to levels above those listed in Section 2 (Composition and Information on Ingredients). However, because Hydrogen Cyanide can produce significant health effects at relatively low levels, individuals using this gas mixture must be aware of the symptoms of over-exposure. Hydrogen Cyanide is a protoplasmic poison, combining in tissues with the enzymes associated with oxidation, thereby rendering oxygen unavailable to these tissues, and causing death by chemical asphyxiation. Exposure to low concentrations of this gas can cause headache, vertigo, irritation of the throat, difficulty breathing, reddening of eyes, salivation, nausea and vomiting. Chronic, low level exposure to Hydrogen Cyanide over long periods of time may lead to fatigue and weakness. Exposures to high concentrations of Hydrogen Cyanide gas produces symptoms including tachypnea (causing increased intake of cyanide), then dyspnea, weakness of arms and legs, paralysis, unconsciousness, convulsions and respiratory arrest. Exposure to 150 ppm for one-half to one hour may endanger life. In cases where the victim recovers, there is rarely any residual injury or disability. The action of Hydrogen Cyanide in cases of high concentration exposure is extremely rapid. Specific effects, based on the concentration of Hydrogen Cyanide, are presented below:

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			

For Routine Industrial Use and Handling Applications

CONCENTRATION OF HYDROGEN CYANIDE	**OBSERVED EFFECT**
2-5 ppm	Detectable odor threshold.
18-36 ppm	Slight symptoms after several hours.
45-54 ppm	Tolerated for 0.5-1 hour without immediate or delayed effects.
110-135 ppm	Dangerous to life or fatal after 0.5-1 hour.
133 ppm	Fatal after 30 minutes.
180 ppm	Fatal after 10 minutes.
270 ppm	Immediately fatal.
NOTE:	This gas mixture contains 1-200 ppm Hydrogen Cyanide. Data pertinent to higher concentrations of Hydrogen Cyanide are provided to give complete information on effects observed in humans after over-exposures have occurred.

Additionally, under some circumstances, an oxygen-deficient environment may occur. 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 effects associated with various levels of oxygen are listed on the following page.

3. HAZARD IDENTIFICATION (Continued)

INHALATION (continued)::

CONCENTRATION OF OXYGEN	OBSERVED EFFECT
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, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

CONTACT WITH THE EYES AND SKIN: Contact with the skin is not irritating, however, Hydrogen Cyanide (a component of this gas mixture) can be absorbed through intact skin and may be absorbed though eyes. The symptoms of such absorption are the same as by inhalation. Contact of the gas mixture with the eyes may be slightly irritating.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. Hydrogen Cyanide (a component of this gas mixture) is an extremely toxic gas; even brief over-exposures to relatively low doses may have significant health consequences. Acute low-level exposure can cause symptoms such as cyanosis, headache, dizziness, unsteadiness of gait, a feeling of suffocation and nausea. Contact with the eyes with Hydrogen Cyanide can cause irritation.

CHRONIC: There are a wide range of chronic symptoms that are thought to occur with chronic, low-level cyanide compound exposure. These include persistent runny nose, weakness, dizziness, giddiness, headache, nausea, abdominal pain, vomiting, throat irritation, changes in the perception of taste and smell, muscle cramps, weight loss, flushing of the face and enlargement of the thyroid gland. As these symptoms are not exclusive to cyanide exposure, the symptoms of chronic cyanide toxicity are not conclusive. Some evidence exists that low-level, long-term exposure to Hydrogen Cyanide on the eyes will result in damage to the nerves of the eyes. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes, enzymes associated with oxidation. CHRONIC: Skin, respiratory system, eyes, thyroid, heart, central nervous system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

A complete Cyanide Antidote Kit should be available near all areas of use. Personnel should be trained in the use of the kit to administer first-aid in advance of medical assistance. The kit should contain at least the following:

- Two boxes (2 dozen) of amyl nitrite pearls.
- Two ampoules of sterile sodium nitrite solution (10 mL of a 3% solution in each).
- Two ampoules of sterile sodium thiosulfate solution (50 mL of a 25% solution of each).
- Two 10 mL sterile syringes.
- Two 50 mL sterile syringes.
- Two sterile intravenous needles.
- One tourniquet.
- Twelve gauze pads.
- One bottle of 70% alcohol.
- One ampoule file.

Because of the special hazard of Cyanide compounds, special treatment procedures are administered to victims of exposure to Hydrogen Cyanide. Personnel should be trained to administer initial first-aid treatment to victims of Hydrogen Cyanide poisoning prior to response from medical professionals. If victim has difficulty breathing, is becoming confused and/or is losing consciousness, administer amyl nitrite. Crush one pearl of amyl nitrite onto a cloth and hold to the victim's nose 15 to 30 seconds of each minute. Use a new pearl every 5 minutes (0.3 mg size), or every 3 minutes (0.18 mg size). While amyl nitrite is being administered, if possible, monitor blood pressure. If blood pressure of the victim drops below 80/60, stop amyl nitrite treatment and obtain advice of professional medical personnel immediately. Administration of oxygen should only be done by trained personnel. If cardiac arrest occurs, begin CPR, again by trained personnel. While waiting for response by professional medical personnel, provide general supportive measures to victim such as keeping them warm and quiet. Take copy of label and MSDS to physician or other health professional with victim(s). **Physicians should refer below for specific recommendations to physicians.**

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Any respiratory disorder may be aggravated by over-exposure to gas mixtures containing. Additionally, skin and eye conditions may be aggravated by Hydrogen Cyanide exposures.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen. Victims of exposure to Hydrogen Cyanide must be monitored closely. IN CASES OF SEVERE HYDROGEN CYANIDE EXPOSURE: Administer amyl nitrate inhalations. If victim does not respond, inject, intravenously, 0.3 grams sodium nitrite (10 mL of a 3% solution at a rate of 2.5-5.0 mL/minute), followed at once by 12.5 grams of sodium thiosulfate intravenously (50 mL of a 25% solution injected at about the same rate as the sodium nitrite solution). The same needle and vein can be used for both injections. Watch victim continuously for 24-48 hours. If symptoms recur or persist, repeat the sodium nitrite and sodium thiosulfate therapy at one-half the original dose.

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): Not applicable.
Upper (UEL): Not applicable.

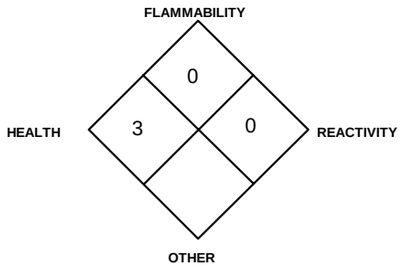
FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Hydrogen Cyanide is toxic to humans in relatively low concentrations, and in the concentrations present in this gas mixture, poses a potential hazard to fire-fighters. This gas mixture is not flammable; 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.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

NFPA RATING



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Cyanide, an oxygen-deficient environment, and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. A colorimetric tube is available for Hydrogen Cyanide. The level of Hydrogen Cyanide must be at acceptable levels (less than 50% of the TLV; TLV = 4.7 ppm) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area.

If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to harmful or fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to Hydrogen Cyanide over-exposure and oxygen deficiency. If necessary, areas in which this gas mixture is used should be monitored with very sensitive gas detection instruments. Detection of Hydrogen Cyanide concentrations below 50% of the TLV level of 4.7 ppm should trigger immediate response and corrective action. Detection of higher levels should initiate an alarm calling for evacuation of all personnel with the potential to be exposed.

7. HANDLING and USE (Continued)

Do not attempt to repair, adjust, or in any other way modify cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. **STORAGE AND HANDLING PRACTICES**: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage.

Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. **WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.**

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Hydrogen Cyanide and Oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Maintain Hydrogen Cyanide levels below 50% of the TLV (TLV = 4.7 ppm) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection when Hydrogen Cyanide levels exceed 50% of the TLV (TLV = 4.7 ppm), oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of Hydrogen Cyanide and Oxygen. 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 19.16.33% 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). The following NIOSH respirator recommendations are in place for the Hydrogen Cyanide component of this gas mixture.

HYDROGEN CYANIDE

CONCENTRATION	RESPIRATORY PROTECTION
Up to 47 ppm:	Any Supplied-Air Respirator (SAR)
Up to 50 ppm:	Any SAR operated in a continuous-flow mode, or any Self-Contained Breathing Apparatus (SCBA) with a full facepiece, or any SAR with a full facepiece.
Emergency or Planned Entry into Unknown Concentrations or IDLH Conditions:	Any SCBA that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any SAR that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive-pressure mode.
Escape:	Any air-purifying, full-facepiece respirator (gas mask) with a chin-style, front- or back-mounted organic vapor canister, or any appropriate escape-type, SCBA.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. 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 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 32°F (0°C) and 1 atm: .072 lbs/ ft^3 (1.153 kg/m^3)

FREEZING/MELTING POINT @ 10 psig: -345.8°F (-210°C)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906

SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023

EVAPORATION RATE (nBuAc = 1): Not applicable.

VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

BOILING POINT: -320.4°F (-195.8°C)

pH: Not applicable.

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft^3/lb): 13.8

The following information is for this gas mixture.

APPEARANCE, ODOR AND COLOR: This gas mixture is a colorless gas mixture which is odorless.

HOW TO DETECT THIS SUBSTANCE (warning properties): 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: Normally stable in gaseous state. Pure Hydrogen Cyanide is very unstable as it is sensitive to heat, light and moisture; however, due to the low concentration of this component in the gas mixture, this is not a potential hazard.

DECOMPOSITION PRODUCTS: When heated to combustion, Hydrogen Cyanide emits toxic fumes of carbon monoxide, carbon dioxide and nitrogen oxides. Nitrogen does not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Hydrogen Cyanide will attack some forms of plastics and rubber. Hydrogen Cyanide can react with many other compounds, but not usually violently unless the other chemical is also highly reactive.

HAZARDOUS POLYMERIZATION: Will not occur. Hydrogen Cyanide may polymerize explosively; however, due to the low concentration of this component in the gas mixture, this is not a potential hazard.

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

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

HYDROGEN CYANIDE:

TCLo (Inhalation-Man) 500 mg/m^3/3 minutes-continuous: Sense Organs and Special Senses (Eye): mydriasis (pupillary dilation); Behavioral: coma; Lungs, Thorax, or Respiration: respiratory depression

LCLo (Inhalation-Human) 120 mg/m^3/1hour

LCLo (Inhalation-Human) 200 mg/m^3/10 minutes: Behavioral: general anesthetic; Lungs, Thorax, or Respiration: dyspnea; Gastrointestinal: nausea or vomiting

LCLo (Inhalation-Man) 400 mg/m^3/2 minutes

LDLo (Oral-Human) 570 μg/kg

LDLo (Subcutaneous-Human) 1 mg/kg

LDLo (Unreported-Man) 1471 μg/kg

TDLo (Intravenous-Man) 55 μg/kg: Lungs, Thorax, or Respiration: respiratory stimulation

LC_{50} (Inhalation-Rat) 160 ppm/30 minutes

LC_{50} (Inhalation-Mouse) 323 ppm/5 minutes

LC_{50} (Inhalation-Rabbit) 208 mg/m^3/35 minutes: Brain and Coverings: other degenerative changes; Cardiac: other changes; Blood: other changes

HYDROGEN CYANIDE (continued):

LD_{50} (Intravenous-Rat) 810 μg/kg

LD_{50} (Oral-Mouse) 3700 μg/kg

LD_{50} (Intraperitoneal-Mouse) 2990 μg/kg

LD_{50} (Intraperitoneal-Rabbit) 1570 μg/kg

LD_{50} (Intravenous-Mouse) 990 μg/kg

LD_{50} (Intravenous-Dog) 1340 μg/kg

LD_{50} (Intravenous-Cat) 810 μg/kg

LD_{50} (Intravenous-Rabbit) 660 μg/kg

LD_{50} (Intravenous-Guinea Pig) 1430 μg/kg

LD_{50} (Intravenous-Mammal-domestic) 660 μg/kg

LD_{50} (Intramuscular-Mouse) 2700 μg/kg

LD_{50} (Intramuscular-Rabbit) 486 μg/kg

LD_{50} (Intravenous-Monkey) 1300 μg/kg

LD_{50} (Subcutaneous-Rabbit) 2500 μg/kg

LD_{50} (Ocular-Rabbit) 1040 μg/kg: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Behavioral: ataxia; Lungs, Thorax, or Respiration: respiratory stimulation

LCLo (Inhalation-Mammal-species unspecified) 200 ppm/5 minutes

LCLo (Inhalation-Mammal-species unspecified) 36 ppm/2 hours

HYDROGEN CYANIDE (continued):

LDLo (Subcutaneous-Mouse) 3 mg/kg

LDLo (Subcutaneous-Dog) 1700 μg/kg

LDLo (Subcutaneous-Cat) 1100 μg/kg

LDLo (Subcutaneous-Guinea Pig) 100 μg/kg

LDLo (Subcutaneous-Frog) 60 mg/kg

LDLo (Subcutaneous-Pigeon) 2150 μg/kg

LDLo (Oral-Rabbit) 4 mg/kg

LDLo (Oral-Dog) 4 mg/kg

LDLo (Oral-Pig) 2 mg/kg

LDLo (Oral-Pigeon) 14 mg/kg

LDLo (Oral-Duck) 3280 μg/kg

LDLo (Intramuscular-Pigeon) 1500 μg/kg

LDLo (Oral-Bird-Domestic) 600 μg/kg

LDLo (Oral-Bird-wild bird species) 7500 μg/kg

LDLo (Subcutaneous-Bird-wild bird species) 100 μg/kg

LDLo (Subcutaneous-Bird-domestic) 100 μg/kg

NITROGEN: There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: Hydrogen Cyanide (a component of this gas mixture) may be irritating to contaminated eyes.

SENSITIZATION TO THE PRODUCT: The 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: No mutagenicity effects have been described for this gas mixture.

Embryotoxcity: No embryotoxic effects have been described for this gas mixture.

Teratogenicity: No teratogenicity effects have been described for this gas mixture.

Reproductive Toxicity: No reproductive toxicity effects have been described for gas mixture.

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) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

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

HYDROGEN CYANIDE:

Terrestrial Fate: By analogy to the fate of cyanides in water, it is predicted that the fate in soil would be pH dependent. Cyanide may occur in the form of hydrogen cyanide, alkali metal salts, or immobile metallo-cyanide complexes. At soil surfaces with pH < 9.2, it is expected that volatilization of Hydrogen Cyanide would be an important loss mechanism for cyanides. In subsurface soil, cyanide present at low concentrations would probably biodegrade. In soil with pH < 9.2, Hydrogen Cyanide is expected to be highly mobile, and in cases where cyanide levels are toxic to microorganisms (i.e., landfills, spills), this compound may leach into groundwater.

Atmospheric Fate: The reaction of Hydrogen Cyanide with photochemically generated hydroxyl radicals proceeds fairly slowly. Based on a reaction rate constant of 3x10-14 cu m/(molecules-sec) at 25°C, and assuming an ambient hydroxyl radical concentration of 8x10+5 molecules/cu m, the half-life for the reaction of hydrogen cyanide vapor with hydroxyl radicals in the atmosphere has been approximately 334 days. Hydrogen Cyanide is expected to be resistant to direct photolysis. The relatively slow rate of degradation of Hydrogen Cyanide suggests that this compound has the potential to be transported over long distances before being removed by physical or chemical processes. Since hydrogen cyanide is miscible in water, it appears that wet deposition may be an important fate process. Metal cyanide particles are expected to be removed from air by both wet and dry deposition.

Aquatic Fate: Hydrogen cyanide is not expected to adsorb to suspended solids and sediment in water. Volatilization from water surfaces is expected based upon a Henry's Law constant of 1.33X10-4 atm-cu m/mole. Using this Henry's Law constant and an estimation method, volatilization half-lives for a model river and model lake are 3 hours and 3 days, respectively. According to a classification scheme (4), an estimated BCF of 3, from its log Kow of -0.25 and a regression-derived equation, suggests the potential for bioconcentration in aquatic organisms is low. Hydrogen Cyanide can be biodegraded by acclimated microbial cultures and sludges, but is usually toxic at high concentrations to un-acclimated microbial systems.

Bioconcentration: Cyanide compounds are not accumulated or stored in any mammalian species that have been studied. An estimated BCF of 3 was calculated for Hydrogen Cyanide, using a log Kow of -0.25 and a regression-derived equation. According to a classification scheme, this BCF suggests the potential for bioconcentration in aquatic organisms is low.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Due to the presence of Hydrogen Cyanide, this gas mixture may be harmful to over-exposed plant or animal life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: The Hydrogen Cyanide component of this gas mixture is soluble in water and highly toxic; therefore, this gas mixture may be harmful or fatal to aquatic life in contaminated bodies of water. The following are aquatic toxicity data for the Hydrogen Cyanide component of this gas mixture:

HYDROGEN CYANIDE:

LTC (*Asellus communis*) 10-12 days = 1.90 mg/L
LTC (*Gammarus pseudolimnaeus*) 10-12 days = 0.07 mg/L
Toxic (trout) 0.10 to 0.15 mg/L
IC_{50} (Daphnia) 48 hours = 1.8 mg/L
LC_{50} (*Asellus communis*) 96 hours = 2.29 mg/L
LC_{50} (*Gammarus pseudolimnaeus*) 96 hours = 0.17 mg/L
LC_{50} (pinperch) 24 hours = 0.069 mg/L
LC_{50} (sunfish) 24 hours = 0.18 mg/L
LC_{50} (pinperch in seawater) 24 hours = 0.05 mg/L
LTC,F (bluegill, eggs) 96 hours = 535-693 mg/L
LC_{50},F (bluegill swim-up fry) 96 hours = 232-365 mg/L
LC_{50},F (bluegill juvenile) 96 hours = 75-125 mg/L
LC_{50},F (*Perca flavescens* yellow perch eggs) 96 hours = > 276-> 389 mg/L
LC_{50},F (*Perca flavescens* yellow perch swim-up fry) 96 hours = 295-> 395 mg/L
LC_{50},F (*Perca flavescens* yellow perch juvenile) 96 hours =76-108 mg/L
LC_{50},F (brook trout, eggs) 96 hours = > 212-> 242 mg/L
LC_{50},F (brook trout, sac fry) 96 hours = 108-518 mg/L

HYDROGEN CYANIDE (continued):

LC_{50},F (brook trout, swim-up fry) 96 hours = 56-106 mg/L
LC_{50},F (brook trout, juvenile) 96 hours = 53-143 mg/L
LC_{50},F (*Pimephales promelas* fathead minnow, eggs) 96 hours = 121-352 mg/L
LC_{50},F (*Pimephales promelas* fathead minnow, juvenile) 96 hours = 82-137 mg/L
LC_{50},F (*Pimephales promelas* fathead minnow, juvenile wild stock) 96 hours = 157–191 mg/L
LC_{50} (*Goniobasis livescens* snail) 48 hours = 760,000 μg/L/Conditions of bioassay not specified
LC_{50} (*Lymnaea emarginata* snail) 48 hours = 3,300 μg/L/Conditions of bioassay not specified
LC_{50} (*Lymnaea sp*, snail, embryo) 96 hours = 51,900 μg/L
LC_{50} (*Physa integra* snail) 48 hours = 1,350 μg/L/Conditions of bioassay not specified
LC_{50} (*Stemonema rubrum* mayfly) 48 hours = 500 μg/L/Conditions of bioassay not specified
LC_{50} (*Hyfropsyche sp* caddis fly) 48 hours = 2,000 μg/L/Conditions of bioassay not specified

HYDROGEN CYANIDE (continued):

LC_{50} (*Salmo gairdneri* rainbow trout) 48 hours = 68 μg/L/Conditions of bioassay not specified
LC_{50} (*Pimephales promelas* fathead minnow) 48 hours = 240 μg/L/Conditions of bioassay not specified
LC_{50} (*Pimephales promelas* fathead minnow, juvenile) 5 days = 20 μg/L/Conditions of bioassay not specified
LC_{50} (*Pimephales promelas* fathead minnow, juvenile) 96 hours = 123 μg/L/Conditions of bioassay not specified
LC_{50} (*Lepomis macrochirus* bluegill, juvenile) 48 hours = 134 μg/L/Conditions of bioassay not specified
LC_{50} (*Lepomis macrochirus* bluegill, juvenile) 72 hours = 154 μg/L/Conditions of bioassay not specified
LC_{50} (*Lepomis macrochirus* bluegill) 48 hours = 160 μg/L/Conditions of bioassay not specified
LC_{50}, (*Perca flavescens* yellow perch, embryo) 96 hours = 281 μg/L, Conditions of bioassay not specified

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

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

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Hydrogen Cyanide, Nitrogen)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Non-Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (outer package). Pertinent shipping information goes on the outside of the outer package. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (Hydrogen Cyanide, Nitrogen)
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1956

14. TRANSPORTATION INFORMATION (Continued)

PACKING GROUP: Not Applicable
HAZARD LABEL: Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS: None
EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0.12
ERAP INDEX: None
PASSENGER CARRYING SHIP INDEX: None
PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 121
NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:
U.S. SARA REPORTING REQUIREMENTS: This gas mixture is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Hydrogen Cyanide	YES	YES	YES

U.S. SARA SECTION 302 EXTREMELY HAZARDOUS SUBSTANCE THRESHOLD PLANNING QUANTITY: Hydrogen Cyanide = 100 lb (45.4 kg)
U.S. SARA SECTION 304 EXTREMELY HAZARDOUS SUBSTANCE REPORTABLE QUANTITY: Hydrogen Cyanide = 10 lb (4.54 kg)
U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.
U.S. CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Cyanide = 10 lb (4.54 kg)
OTHER U.S. FEDERAL REGULATIONS:

- Hydrogen Cyanide is subject to the requirements of CFR 29 1910.1000 (under the 1989 PELs). Hydrogen Cyanide is listed on Table Z.1.
- Hydrogen Cyanide is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 2,500 lb (1135 kg).
- Depending on specific operations involving the use of Hydrogen Cyanide, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Cyanide is listed in Appendix A of this regulation. The threshold quantity for Hydrogen Cyanide under this regulation is 1,000 pounds; therefore, the requirements of this regulation are not applicable to one cylinder of this gas mixture.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).
- Nitrogen is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Cyanide is listed under Table 1 as a Regulated Toxic Substance; the threshold quantity for Hydrogen Cyanide under this regulation is 2,500 pounds.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

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

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists.
ADDITIONAL CANADIAN REGULATIONS:
CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.
CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.
CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2B, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death. Further information about the handling of 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"

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