**1. PRODUCT IDENTIFICATION**

**CHEMICAL NAME:** 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

**BUSINESS PHONE:** 1-410-228-6400 (8 a.m. to 5 p.m. U.S. EST)

**General MSDS Information:**

<table>
<thead>
<tr>
<th></th>
<th>1-713-868-0440</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fax on Demand</td>
<td>1-800-231-1366</td>
</tr>
</tbody>
</table>

**EMERGENCY PHONE:**

- Chemtrec: United States/Canada/Puerto Rico: 1-800-424-9300 [24-hours]
- Chemtrec International: 1-703-527-3897 [24-hours]

**2. COMPOSITION and INFORMATION ON INGREDIENTS**

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>CAS #</th>
<th>mole %</th>
<th>EXPOSURE LIMITS IN AIR</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>TWA ppm</td>
</tr>
<tr>
<td>Hydrogen Cyanide</td>
<td>74-90-8</td>
<td>0.0001- 0.020%</td>
<td>NE</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>7727-37-9</td>
<td>Balance</td>
<td>There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA).</td>
</tr>
</tbody>
</table>

**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.

**CONCENTRATION OF HYDROGEN CYANIDE**

<table>
<thead>
<tr>
<th>CONCENTRATION</th>
<th>OBSERVED EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-5 ppm</td>
<td>Detectable odor threshold.</td>
</tr>
<tr>
<td>18-36 ppm</td>
<td>Slight symptoms after several hours.</td>
</tr>
<tr>
<td>45-54 ppm</td>
<td>Tolerated for 0.5-1 hour without immediate or delayed effects.</td>
</tr>
<tr>
<td>110-135 ppm</td>
<td>Dangerous to life or fatal after 0.5-1 hour.</td>
</tr>
<tr>
<td>133 ppm</td>
<td>Fatal after 30 minutes.</td>
</tr>
<tr>
<td>180 ppm</td>
<td>Fatal after 10 minutes.</td>
</tr>
<tr>
<td>270 ppm</td>
<td>Immediately fatal.</td>
</tr>
</tbody>
</table>

**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**

- 10-15% Oxygen
- 5% Oxygen
- Below 5%

**OBSERVED EFFECT**

- Breathing and pulse rate increased, muscular coordination slightly disturbed
- Emotional upset, abnormal fatigue, disturbed respiration
- Nausea, vomiting, collapse, or loss of consciousness
- 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 skin or eyes may be slightly irritating.

**HEALTH EFFECTS OR RISKS FROM EXPOSURE:**

An over-exposure to Hydrogen Cyanide 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 and 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 nausea, nervousness, weakness, dizziness, giddiness, headache, nausea, abdominal pain, vomiting, heart irritations, changes in the perception of taste and smell, muscular 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 may 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

**RESCUEERS 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. Victims who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescue workers should be trained for medical attention if necessary. 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 as 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.

**PREVENTION:**

- 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. In cases of severe hydrogen cyanide exposure, personnel should be trained in the use of the kit to administer first-aid immediately.

- Personnel should be trained to administer initial first-aid to victims of exposure to Hydrogen Cyanide. Personnel should be trained to administer initial first-aid to victims of exposure to Hydrogen Cyanide poisining prior to response from medical professionals. If victim has difficulty breathing, is becoming confused and/or is losing consciousness, administer amyl nitrite. Crush one pear of amyl nitrite and hold to the victim’s nose 15 to 30 seconds of each minute. Use a new pear every 5 minutes (0.3 mg size), or every 3 minutes (0.18 mg size). While amyl nitrite is being administered, but less than 10% oxygen in the mixture, oxygen should be supplied.

**FIRST-AID MEASURES:**

- Administer oxygen. Victims of exposure to Hydrogen Cyanide must be monitored closely.
- Administer amyl nitrate inhalations. If victim does not respond, inject, intravenously, 0.3 grams sodium nitrite solution (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.

- 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.

- 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. In cases of severe hydrogen cyanide exposure, personnel should be trained in the use of the kit to administer first-aid immediately.

- Personnel should be trained to administer initial first-aid to victims of exposure to Hydrogen Cyanide. Personnel should be trained to administer initial first-aid to victims of exposure to 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 pear of amyl nitrite and hold to the victim’s nose 15 to 30 seconds of each minute. Use a new pear every 5 minutes (0.3 mg size), or every 3 minutes (0.18 mg size). While amyl nitrite is being administered, but less than 10% oxygen in the mixture, oxygen should be supplied.

**SECONDARY MEASURES:**

- 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 solution (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.

**FLAMMABILITY:**

- 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, 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.

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 exposed personnel, and provide trained personnel. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. The carbon dioxide 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 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's oxygen-deficient nature. In areas where this gas mixture is present, areas must be well-ventilated at all times.

- Detecting 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 a distributor in person. 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 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 respirator 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, if employees enter 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 5 ppv: Any Supplied-Air Respirator (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.

Up to 50 ppm: 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: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects or moving objects, where objects may penetrate the soles of the feet or where employee’s feet may be exposed to electrical hazards, use foot protection, and as prescribed 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: 0.072 lbs/ft³ (1.153 kg/m³)

SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): Not applicable.

COLLAPSIBILITY IN WATER @ 32°F (0°C) and 1 atm: 0.023

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO (nBuSc = 1): Not applicable.

SOLUBILITY IN WATER (at 20°C): Not applicable.

VAPOR PRESSURE @ 78°F (25.5°C): Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

The following information is for this gas mixture.

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

HANDS 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 oxides do not decompose, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Hydrogen Cyanide will 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 toxicity data are available for the components of this gas mixture:

HYDROGEN CYANIDE (continued): LD₅₀ (Intravenous-Rat) 810 µg/kg; LD₅₀ (Intramuscular-Rat) 2900 µg/kg; LD₅₀ (Subcutaneous-Guinea Pig) 100 µg/kg; LD₅₀ (Intravenous-Mouse) 990 µg/kg; LD₅₀ (Intraperitoneal-Rat) 1570 µg/kg; LD₅₀ (Intravenous-Dog) 1340 µg/kg; LD₅₀ (Intravenous-Cat) 810 µg/kg; LD₅₀ (Intravenous-Dog) 660 µg/kg; LD₅₀ (Subcutaneous-Pigeon) 2150 µg/kg; LD₅₀ (Oral-Dog) 4 mg/kg; LD₅₀ (Oral-Dog) 1500 µg/kg; LD₅₀ (Oral-Rat) 4 mg/kg; LD₅₀ (Subcutaneous-Pigeon) 1500 µg/kg; LD₅₀ (Oral-Bird-Domestic) 600 µg/kg; LD₅₀ (Oral-Bird-wild species) 7500 µg/kg; LD₅₀ (Subcutaneous-Bird-wild species) 100 µg/kg.

HYDROGEN CYANIDE: LD₅₀ (Subcutaneous-Mouse) 3 mg/kg; LD₅₀ (Subcutaneous-Dog) 1500 µg/kg; LD₅₀ (Subcutaneous-Cat) 1500 µg/kg; LD₅₀ (Subcutaneous-Guinea Pig) 100 µg/kg; LD₅₀ (Subcutaneous-Frog) 60 mg/kg; LD₅₀ (Subcutaneous-Pigeon) 2150 µg/kg; LD₅₀ (Oral-Rat) 4 mg/kg; LD₅₀ (Oral-Dog) 4 mg/kg; LD₅₀ (Oral-Pig) 14 mg/kg; LD₅₀ (Oral-Rabbit) 5 mg/kg; LD₅₀ (Subcutaneous-Pigeon) 1500 µg/kg; LD₅₀ (Oral-Bird-Domestic) 600 µg/kg; LD₅₀ (Oral-Bird-wild species) 7500 µg/kg; LD₅₀ (Subcutaneous-Bird-wild species) 100 µg/kg.

NITROGEN: There are no specific toxicity data available 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.

IRRITANT 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.

Embryotoxicity: No embryotoxicity effects have been described for this 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 embryo/toxin 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.

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-metally-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, slits), 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 3.9x10-14 cm3/molecule-sec at 25°C, and assuming an ambient hydroxyl radical concentration of 8x10+5 molecules/cm3, the half-life for the reaction of hydrogen cyanide vapor with hydroxyl radicals 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 may, in this state, metal cyanides (e.g., cyanide) that can be expected to be removed from air by 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+10 atm-cm/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 estimate of 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 inoculated microbial cultures and sludges, but is usually toxic at high concentrations to un-acclimated microbial systems.

Bioconcentration: Bioconcentration 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 (Aselas communis) 10-12 days = 1.90 mg/L
LTC (Gammarus pseudolimnaeus) 10-12 days = 0.07 mg/L
Toxic (t) 0.10 to 0.15 mg/L
LC50 (Daphnia) 48 hours = 1.8 mg/L
LC50 (Aselas communis) 96 hours = 2.29 mg/L
LC50 (Gammarus pseudolimnaeus) 96 hours = 0.17 mg/L
LC20 (piperch) 24 hours = 0.069 mg/L
LC20 (Daphnia) 24 hours = 0.18 mg/L
LC50 (piperch in seawater) 24 hours = 0.05 mg/L
LC50 (fish, carp) 24 hours = 0.18 mg/L
LC50 (fish, carp in seawater) 24 hours = 0.05 mg/L
LC10 (fish, carp) 96 hours = 535-693 mg/L
LC50 (fish, carp) 96 hours = 232-365 mg/L
LC50 (Daphnia) 96 hours = 75-125 mg/L
LC50 (Perca flavescens yellow perch eggs) 96 hours = 16 mg/L
LC50 (Perca flavescens yellow perch swim-up fry) 96 hours = 295–385 mg/L
LC50 (Gammarus pseudolimnaeus) 96 hours = 76-108 mg/L
LC50 (brook trout, y) 96 hours > 212-242 mg/L
LC50 (brook trout, sac fry) 96 hours = 108-158 mg/L

HYDROGEN CYANIDE (continued):
LC50,F (brook trout, swim-up fry) 96 hours = 56-106 mg/L
LC50,F (brook trout, juvenile) 96 hours = 53-143 mg/L
LC50,F (fathead minnow, (brook trout, swim-up fry) 96 hours = 56-106 mg/L
LC50,F (fathead minnow, juvenile) 96 hours = 82-137 mg/L
LC50,F (fathead minnow, (brook trout, swim-up fry) 96 hours = 56-106 mg/L
LC50,F (fathead minnow, juvenile) 96 hours = 82-137 mg/L
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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 1556

PACKING GROUP: Not applicable.

DOT LABEL(S) REQUIRED: Non-Flammable Gas

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: This gas is classified as Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

SPECIAL SHIPPING INFORMATION: This gas is consider ed as Dangerous Goods, per regulations of Transport Canada.

TRANSPORTATION 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 1556
14. TRANSPORTATION INFORMATION (Continued)

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:

<table>
<thead>
<tr>
<th>CHEMICAL NAME</th>
<th>SARA 302</th>
<th>SARA 304</th>
<th>SARA 313</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Cyanide</td>
<td>YES</td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

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:
  - Kansas – Section 302/313 List: No.
  - North Dakota – List of Hazardous Chemicals, Reportable Quantities: No.
  - Texas – Hazardous Substance List: Hydrogen Cyanide.
  - Virginia – Hazardous Substance List: Hydrogen Cyanide.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 list.

ADDITIONAL CANADIAN REGULATIONS:

- CANADIAN DSHINLDS INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.
- CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LIST: The components of this gas mixture are not on the Controlled Substances Lists.
- CANADIAN WHMS 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 1566. 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 their cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scraping 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) 412-0690.

P-1 “Safe Handling of Compressed Gases in Containers”

AV-1 “Safe Handling and Storage of Compressed Gases”

“AIR LIQUIDE” “Handbook of Compressed Gases”

This Material Safety Data Sheet is offered pursuant to OSHA’s Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.