

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 One or More of the Following Components in a Nitrogen Balance Gas: Oxygen, 0-23.5%; Methane, 0-2.5%; Propane, 0-1.1%; Carbon Monoxide, 0.0005-1.0%; Sulfur Dioxide, 0.0001-10.00% SYNONYMS: Not Applicable **CHEMICAL FAMILY NAME:** Not Applicable **FORMULA:** Not Applicable **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.

Document Number: MSDS1019 **PRODUCT USE:** Calibration of Monitoring and Research Equipment

SUPPLIER/MANUFACTURER'S NAME: Portagas **ADDRESS:** 6717-B Polk Street, Houston, TX 77011 **BUSINESS PHONE:** General MSDS Info: (713) 928-6477 **EMERGENCY PHONE:** (800) 535-5053

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Sulfur Dioxide	7446-09-5	0.0001 - 10.00%	2	5	5 2 (Vacated 1989 PEL)	5 (Vacated 1989 PEL)	100	NIOSH REL: TWA = 2 STEL = 5 DFG MAKs: TWA = 0.5 PEAK = 2*MAK 15 min., average value, 1 hr interval; 1 (ceiling) DFG MAK Pregnancy Risk Classification: C Carcinogen: IARC-3, TLV-A4
Carbon Monoxide	630-08-0	0.0005-1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 [ceiling] (Vacated 1989 PEL)	1200	NIOSH REL: TWA = 35 STEL = 200 (ceiling) DFG MAKs: TWA = 30 PEAK = 1*MAK 15 min., average value, 1 hr interval DFG MAK Pregnancy Risk Classification: B
Propane	74-98-6	0-1.1%	2500 NIC = 1000	NE	1000	NE	2100	NIOSH REL: TWA = 1000 DFG MAKs: TWA = 1000 PEAK = 2*MAK 15 min., average value, 1 hr interval
Methane	74-82-8	0-2.5%	NIC = 1000	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA).				
Oxygen	7782-44-7	0-23.5%	There are no specific exposure limits for Oxygen.					
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. NIC = Notice of Intended Change 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 colorless and has a slight sulfur-like odor (due to the presence of Sulfur Dioxide). The Carbon Monoxide component of this gas mixture, is a chemical asphyxiant and can produce significant, adverse health effects at relatively low concentrations. Depending on the duration and concentration of Carbon Monoxide, over-exposure to this gas mixture may cause nausea, dizziness, headaches, and collapse. Sulfur Dioxide can also produce adverse health effects in extremely low concentrations (i.e. skin and eye irritation, dry throat, lung damage). Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small, 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. **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. Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm) can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs. Since the affinity of carbon monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly-ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

CONCENTRATION OF CARBON MONOXIDE

CONCENTRATION OF CARBON MONOXIDE

All exposure levels:
200 ppm:
400 ppm:
1,000 -2000 ppm:
200-2500 ppm:
> 2500 ppm:

Another potential health hazard associated with this gas mixture is the potential for over-exposure to Sulfur Dioxide. Exposures to Sulfur Dioxide in low concentrations are irritating to the mucous membranes of the eyes, nose, throat, and lungs. Over-exposures to this gas mixture may also result in dryness and irritation of the nose and throat, choking, coughing, and bronchospasm. Severe over-exposure may cause pulmonary edema, airway obstruction, respiratory arrest, unconsciousness, and death through systemic acidosis. The symptoms associated with exposure to specific Sulfur Dioxide concentrations are as follows:

CONCENTRATION OF SULFUR DIOXIDE

1 ppm (1-6 hr duration):
5 ppm (10-30 min duration):
8 ppm (20 min duration):
20 ppm:
500 ppm:

Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small, confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. 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. Under some circumstances of over-exposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN

12-16% Oxygen:
10-14% Oxygen:
6-10% Oxygen:
Below 6%:

SKIN and EYE CONTACT: Due to the presence of Sulfur Dioxide, this gas mixture may be irritating to the skin (especially in a moist environment). Sulfur Dioxide may react with moisture on the skin to produce acidic solutions containing sulfuric acid. Symptoms of skin over-exposure may include scratchiness, pain, and redness. If this gas mixture contaminates the eyes, damage to eye tissue will result in pain, inflammation, and potentially, blindness. **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. However, the Carbon Monoxide component of this gas mixture is toxic to humans. Symptoms of Carbon Monoxide poisoning can develop gradually, or can arise suddenly, depending on the concentration and duration of exposure. Lips and fingernails will turn bright red, which is a significant sign of Carbon Monoxide over-exposure. Other symptoms of over-exposure can include respiratory difficulty, headaches, shortness of breath, wheezing, headache, blurred vision, memory loss, dizziness, indigestion, nausea, unconsciousness, and death. Under certain circumstances, over-exposure to this gas may be fatal. Another potential health hazard associated with this gas mixture is the potential for over-exposure to Sulfur Dioxide, which can cause irritation and damage to the respiratory system, the skin, and eyes. Sulfur Dioxide may react with moisture on the skin to produce sulfuric acid; contact with the acid can produce scratchiness, pain, and redness of contaminated areas. Depending on the duration of over-exposure, contact with eye tissue may result in pain, inflammation, and blindness. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue color. **CHRONIC:** Prolonged or repeated over-exposures to Sulfur Dioxide, a component of this gas mixture, may cause respiratory problems, bronchitis, hacking cough, nasal irritation and discharge, increased fatigue, alteration in the senses of taste and smell. Repeated over-exposures to Sulfur Dioxide can also result in dental erosion and gum disorders. Propane (another component of this gas mixture) can cause sensitization of the heart to epinephrine, based on animal tests. Refer to Section 11 (Toxicology Information) for additional data on this gas mixture's components. Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. **TARGET ORGANS:** ACUTE: Respiratory system, blood system, skin and eyes. CHRONIC: Cardiovascular system, heart, reproductive system, teeth, skin, and eyes.

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. 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. 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). **SKIN EXPOSURE:** If irritation of the skin develops after exposure to this gas mixture, immediately begin decontamination with running water. **Minimum** flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention. **EYE EXPOSURE:** If irritation of the eye develops after exposure to

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		

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this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist. **MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE:** Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Additionally, due to the presence of Sulfur Dioxide, skin, eye and dental conditions may be aggravated by over-exposures to this gas mixture. **RECOMMENDATIONS TO PHYSICIANS:** Treat symptoms and eliminate over-exposure. If necessary, the use of hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Additionally, be observant for the signs of pulmonary edema (due to the presence of Sulfur Dioxide).

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:** Due to the presence of Sulfur Dioxide, this gas mixture is irritating to the respiratory system, skin, and eyes; this mixture may pose a health hazard to firefighters. Sulfur Dioxide can react with water to form a corrosive solution of sulfurous acid. This acidic solution may corrode metal and cause injury to firefighters. 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.

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-exposures to Carbon Monoxide and Sulfur Dioxide and exposure to 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. For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen, Carbon Monoxide, and Sulfur Dioxide. Carbon Monoxide and Sulfur Dioxide levels must be below exposure level listed in Section 2 (Composition and Information on Ingredients) before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder or its valve, contact your supplier.

7. HANDLING AND USE WORK PRACTICES AND HYGIENE PRACTICES: Be observant for the odor of sulfur; this odor is indicative of a potential over-exposure to this gas mixture. Employees should also be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of Carbon Monoxide could occur rapidly. Do not attempt to repair, adjust, or in any other way modify the cylinders of mixtures containing Carbon Monoxide or Sulfur Dioxide. 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 Carbon Monoxide, Sulfur Dioxide, and oxygen. **RESPIRATORY PROTECTION:** No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if Carbon Monoxide and Sulfur Dioxide levels exceed limits given in Section 2 (Composition Information on Ingredients) and oxygen levels are below 19.5% or unknown during emergency response to a release of this gas mixture. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Carbon Monoxide and Sulfur Dioxide are provided for further information.

CARBON MONOXIDE

CONCENTRATION

Up to 350 ppm:
Up to 875 ppm:
Up to 1200 ppm:

RESPIRATORY EQUIPMENT

Supplied Air Respirator (SAR).
SAR operated in a continuous flow mode.
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.

SULFUR DIOXIDE

CONCENTRATION

Up to 20 ppm:
Up to 50 ppm:
Up to 100 ppm:

RESPIRATORY EQUIPMENT

Chemical cartridge respirator with cartridge(s); or Supplied Air Respirator (SAR).
Powered air-purifying respirator with cartridge(s); or SAR operated in continuous-flow mode.
Full-Facepiece chemical cartridge respirator with cartridge(s); or gas mask with canister; or powered air-purifying respirator with a tight-fitting facepiece and cartridge(s); or full-facepiece SCBA; or full-facepiece SAR; or SAR with a tight-fitting facepiece operated in a continuous-flow mode.

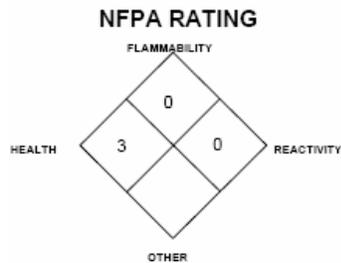
Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-facepiece SAR with an auxiliary positive pressure SCBA. The IDLH concentration for Sulfur Dioxide is 100 ppm. Escape: Gas mask with appropriate canister or escape-type 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, a main component of this gas mixture. **GAS DENSITY @ 32°F (0°C) and 1 atm:** 0.072 lbs/ft³ (1.153 kg/m³) **BOILING POINT:** -320.4°F (-195.8°C) **FREEZING/MELTING POINT @ 10 psig:** -210°C (-345.8°F) **SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 0.906 **pH:** Not applicable. **SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm:** 0.023 **MOLECULAR WEIGHT:** 28.01 **EVAPORATION RATE (nBuAc = 1):** Not applicable. **EXPANSION RATIO:** Not applicable. **ODOR THRESHOLD:** Not applicable. **SPECIFIC VOLUME (ft³/lb):** 13.8 **VAPOR PRESSURE @ 70°F (21.1°C) psig:** Not applicable. **COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable. The following information is for Oxygen, a main component of this gas mixture. **GAS DENSITY @ 32°F (0°C) and 1 atm:** 0.083 lb/cu ft (1.326 kg/m³) **FREEZING/MELTING POINT @ 10 psig:** -218.8°C (-361.8°F) **BOILING POINT:** -183.0°C (-297.4°F) **SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C):** 1.105 **pH:** Not applicable. **SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm:** 0.0491 **MOLECULAR WEIGHT:** 32.00 **EVAPORATION RATE (nBuAc = 1):** Not applicable. **EXPANSION RATIO:** Not applicable. **ODOR THRESHOLD:** Not applicable. **VOLUME (ft³/lb):** 12.1 **VAPOR PRESSURE @ 70°F (21.1°C) psig:** Not applicable. **COEFFICIENT WATER/OIL DISTRIBUTION:** Not applicable. The following information is for the gas mixture. **APPEARANCE AND COLOR:** This gas mixture is colorless and has a slight sulfur-like or acid odor. **HOW TO DETECT THIS SUBSTANCE (warning properties):** The odor is a distinctive characteristic of this gas mixture. 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. **DECOMPOSITION PRODUCTS:** Sulfur Dioxide (a component of this gas mixture) will react with water or moist air to form sulfurous acid. The thermal decomposition products of Methane and Propane (Components of this gas mixture) include carbon oxides. The other components of this gas mixture do 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. The Propane, Carbon Monoxide, Methane components are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). The Sulfur Dioxide component is not compatible with the following materials: strong bases, strong oxidizers, powdered metals, metal oxides, interhalogens, metal acetylides, sodium hydride, silver azide, cesium azide, fluorine, zinc, zinc compounds. Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). **HAZARDOUS POLYMERIZATION:** Will not occur. **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: **CARBON MONOXIDE:** LC₅₀ (Inhalation-Rat) 1807 ppm/4 hours LC₅₀ (Inhalation-Mouse) 2444 ppm/4 hours LC₅₀ (Inhalation-Guinea Pig) 5718 ppm/4 hours LC₅₀ (Inhalation-wild bird species) 1334 ppm LCLo (Inhalation-Human) 4 mg/m³/12 hours: Behavioral: coma; Vascular: BP lowering not characterized in autonomic section; Blood: methemoglobinemia-carboxyhemoglobin LCLo (Inhalation-Man) 4000 ppm/30 minutes LCLo (Inhalation-Human) 5000 ppm/5 minutes LCLo (Inhalation-Dog) 4000 ppm/46 minutes LCLo (Inhalation-Rabbit) 4000 ppm LCLo (Inhalation-Mammal-species unspecified) 5000 ppm/5 minutes TCLo (Inhalation-Human) 600 mg/m³/10 minutes: Behavioral: headache TCLo (Inhalation-Man) 650 ppm/45 minutes: Blood: methemoglobinemia-carboxyhemoglobin; Behavioral: changes in psychophysiological tests TCLo (Inhalation-Rat) 1800 ppm/1 hour/14 days-intermittent: Cardiac: other changes TCLo (Inhalation-Rat) 30 mg/m³/8 hours/10 weeks-intermittent: Brain and Coverings: other degenerative changes; Behavioral: muscle contraction or spasticity TCLo (Inhalation-Rat) 96 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes TCLo (Inhalation-Rat) 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 TDL0 (Subcutaneous-Rat) 5983 mg/kg/18 weeks-intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol) TCLo (Inhalation-Mouse) 50 ppm/30 days-intermittent: Lungs, Thorax, or Respiration: structural or functional change in trachea or bronchi TCLo (Inhalation-Monkey) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes TCLo (Inhalation-Rabbit) 200 mg/m³/3 weeks-intermittent: Brain and Coverings: other degenerative changes; Cardiac: other changes; Blood: hemorrhage TCLo (Inhalation-Rabbit) 50 ppm/24 hours/8 weeks-continuous: Blood: changes in platelet count TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/30 weeks-continuous: Cardiac: arrhythmias (including changes in conduction), EKG changes not diagnostic of specified effects, pulse rate increase, without fall in BP TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/4 weeks-intermittent: Endocrine: hyperglycemia TCLo (Inhalation-Guinea Pig) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Newborn: behavioral TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g., reduced weight gain), behavioral TCLo (Inhalation-Rat) 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) TCLo (Inhalation-Rat) 150 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and reticuloendothelial system TCLo (Inhalation-Mouse) 65 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Newborn: behavioral TCLo (Inhalation-Mouse) 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); Specific Developmental Abnormalities: musculoskeletal system TCLo (Inhalation-Mouse) 125 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus) TCLo (Inhalation-Mouse) 8 ppb/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 TCLo (Inhalation-Mouse) 8 ppb/1 hour: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous System TCLo (Inhalation-Rabbit) 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) Micronucleus Test (Inhalation-Mouse) 1500 ppm/10 minutes Sister Chromatid Exchange (Inhalation-Mouse) 2500 ppm/10 minutes **METHANE:** There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment. **NITROGEN:** There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment. **OXYGEN:** Oxygen is the vital element in the atmosphere in which we live and breathe. The atmosphere contains approximately 21% oxygen. Toxicological data are available for Oxygen, but due to the small cylinder size and subsequent small total amount of Oxygen in this mixture, no effects are anticipated. **PROPANE: Skin Contact (Rabbit):** Several formulations containing an isobutane-propane mixture have been tested for skin irritation effects.



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All formulations contained less than 13% propane. All of the formulations containing propane caused only mild irritation. **SULFUR DIOXIDE:** Eye, rabbit = 6 ppm/4 hours/32 days; mild effects Mutation in Microorganisms System Test = 10 mmol/L DNA damage System Test (human, lymphocyte) = 5700 ppb T_{CLo} (inhalation, mouse) = 32 ppm/ 24 hours (female 7-28 day post); reproductive effects. T_{CLo} (inhalation, mouse) = 25 ppm/7 hours (female 6-15 days post); teratogenic effects T_{CLo} (inhalation, mouse) = 500 ppm/5 minutes/30 weeks; equivocal tumorigenic data L_{CLo} (inhalation, human) = 1000 ppm/10 minutes; pulmonary effects T_{CLo} (inhalation, human) = 3 ppm/5 days; pulmonary effected T_{CLo} (inhalation, human) = 12 ppm/1 hour; pulmonary effects L_{CLo} (inhalation, human) = 3000 ppm/5 minutes LC₅₀ (inhalation, rat) = 2520 ppm/1 hour LC₅₀ (inhalation, mouse) = 3000 ppm/30 minutes L_{CLo} (inhalation, guinea pig) = 1039 ppm/24 hours L_{CLo} (inhalation, frog) = 1 pph/ 15 minute EYE IRRITATION: Temporary clouding of eyes was seen in rabbits, guinea pigs, and mice exposed to 400 ppm for 4 hours. Very severe eye injury in rabbits was produced by a 5-second exposure to a stream of pure sulfur dioxide. **SHORT-TERM INHALATION STUDIES:** Most studies indicate that high concentrations of Sulfur Dioxide effect the mechanics of respiration. A dose-related narrowing of the bronchioles tubes leading to bronchio-constriction was seen in guinea pigs exposed to concentrations of 0,2-100 ppm for 1 hour. Exposure of male mice for up to 72 hours to concentrations around 10 ppm produced nasal cavity injury (runny nose, ciliary loss, fluid accumulation, and tissue death). The effects became more severe as exposure time increased. **LONG-TERM INHALATION STUDIES:** Exposure to 5 ppm for 225 days produced pulmonary function changes in dogs. Increased swelling, secretions, and reddening of the trachea, as well as decreased mucosal flow was seen in dogs intermittently exposed to 1 ppm for 12 months. There was no apparent effect on pulmonary function. No adverse effects were seen in guinea pigs exposed for 22 hours day, 7 days a week, for 52 weeks to concentrations of 0.13-5.72 ppm. No adverse effects were seen in monkeys exposed for 78 weeks to 0.14 - 1.28 ppm. **SUSPECTED CANCER AGENT:** The components of this gas mixture are listed by agencies tracking the carcinogenic potential of chemical compounds, as follows: **SULFUR DIOXIDE:** ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen); IARC-3 (Unclassifiable as to Carcinogenicity in Humans) The remaining components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore are not considered to be, nor suspected to be, cancer-causing agents by these agencies. **IRRITANCY OF PRODUCT:** Due to the presence of Sulfur Dioxide, this gas mixture can be very irritating and potentially damaging to the skin, eyes, and respiratory system, especially in the presence of moisture. **SENSITIZATION OF PRODUCT:** The components of this gas mixture are not known to be skin or respiratory sensitizers. Based on animal tests, the Propane component of this gas mixture may cause cardiac sensitization to epinephrine. **REPRODUCTIVE TOXICITY INFORMATION:** Listed below is information concerning the effects of this gas mixture on the human reproductive system. **Mutagenicity:** The components of this gas mixture are not reported to cause mutagenic effects in humans. The Sulfur Dioxide component of this gas mixture has produced mutagenic effects on specific animal tissues exposed to relatively large doses. **Embryotoxicity:** The components of this gas mixture are not reported to cause embryotoxic effects in humans. Sulfur Dioxide has produced embryotoxic effects during clinical studies on test animals exposed to relatively large doses. **Teratogenicity:** The components of this gas mixture are not reported to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. Carbon Monoxide, a component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus. Sulfur Dioxide has produced teratogenic effects during clinical studies on test animals exposed to relatively large doses. **Reproductive Toxicity:** The components of this gas mixture are not reported to cause adverse reproductive effects in humans. A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process. **BIOLOGICAL EXPOSURE INDICES (BEIs):** Biological Exposure Indices (BEIs) have been determined for the components of this gas mixture, as follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in Blood • Carbon monoxide in End-Exhaled Air	• End of Shift • End of Shift	• 3.5% of Hemoglobin • 20 ppm

12. ECOLOGICAL INFORMATION ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in well-ventilated areas. Complex reactions of Sulfur Dioxide (a component of this gas mixture) occur in the atmosphere can contribute to air pollution. The following environmental data are applicable to the components of this gas mixture. **CARBON MONOXIDE:** Water solubility = 3.3 ml/100 cc at 0 °C, 2.3 ml at 20 °C. **NITROGEN:** Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C. **OXYGEN:** Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log K_{ow} = -0.65 **PROPANE:** Log K_{ow} = 2.38. Water Solubility = 62.4 ppm, 25°C. Propane is readily degraded by soil bacteria. **SULFUR DIOXIDE:** Sulfur Dioxide is extremely stable to heat (up to 2000 °C). Complex reactions of Sulfur Dioxide occur in the atmosphere, producing sulfates and other sulfur compounds which contribute to air pollution. Freshwater lakes and rivers, and the aquatic biota they support, are susceptible to acidification from atmospheric sulfur. Soil adsorption is dependent on pH and moisture content. **EFFECT OF MATERIAL ON PLANTS or ANIMALS:** No evidence is currently available on the effects of this gas mixture on plant and animal life. Carbon Monoxide, a component of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. Carbon Monoxide may also be harmful to plant life. : Due to the presence of Sulfur Dioxide in this gas mixture, over-exposed animals could develop respiratory system damage, as well as skin and eye disorders. Because Sulfur Dioxide produces corrosive solutions upon contact with moisture, plants may be damaged or destroyed. **EFFECT OF CHEMICAL ON AQUATIC LIFE:** If a release of this gas mixture occurs near a body water, the release may be harmful or fatal to fish and other aquatic life. Sulfur Dioxide, a component of this gas mixture, hydrolyzes to sulfurous acid solution when in contact with water. Sulfurous acid is very soluble in water, and even low concentrations of Sulfur Dioxide or sulfurous acid in water are detrimental to aquatic life. The presence of more than a trace of Carbon Monoxide (another component of this gas mixture) is also a hazard to fish. The following aquatic toxicity data are available for the components of this gas mixture. **CARBON MONOXIDE:** LD (sunfish) = 1.5 ppm/1-6 hours, fresh water. **SULFUR DIOXIDE:** 16-19 ppm; lethal to Sunfish, 10 ppm for 0.17 hour; Trout float helplessly, 5 ppm; lethal to Trout, 0.5 ppm for 1 hour; toxic to fish, 1 ppm for 2 hours; lethal to Tench

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. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen. **HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas) **UN IDENTIFICATION NUMBER:** UN 1956 **PACKING GROUP:** Not applicable. **DOT LABEL(S) REQUIRED:** Class 2.2 (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 (overpack). Pertinent shipping information goes on the outside of the overpack. 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. ("Oxygen, Nitrogen") or the gas component with the next highest concentration next to Nitrogen. **HAZARD CLASS NUMBER and DESCRIPTION:** 2.2 (Non-Flammable Gas) **UN IDENTIFICATION NUMBER:** UN 1956 **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):** 126 **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)
Sulfur Dioxide	Yes	Yes	Yes

U.S. SARA SECTION 302 EXTREMELY HAZARDOUS THRESHOLD PLANNING QUANTITY (TPQ): Sulfur Dioxide = 500 lb (227 kg) U.S. SARA SECTION 304 EXTREMELY HAZARDOUS REPORTABLE QUANTITY (RPQ): Sulfur Dioxide = 500 lb (227 kg) U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory. U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable. OTHER U.S. FEDERAL REGULATIONS: Carbon Monoxide, Propane, and Sulfur Dioxide are subject to the reporting requirements of CFR 29 1910.1000; these compounds are listed on Table Z.1. Methane, Propane and Sulfur Dioxide are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for Sulfur Dioxide (anhydrous form only) 5,000 lb (2270 kg). The Threshold Quantity for each of other gases is 10,000 lb (454 kg) and so this mixture will not be affected by the regulation. Sulfur Dioxide is listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. The threshold quantity for Sulfur Dioxide under this regulation is 1000 lb (454 kg). This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82). Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Sulfur Dioxide is listed under this regulation in Table 1, as a Regulated Substance (Toxic Substance), in quantities of 5,000 pounds (4,553 kg) or greater. Carbon Monoxide, Methane, and Propane are listed under this regulation in Table 3, as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,554 kg) or greater, and so this mixture will not be affected by the regulation. 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: Carbon Monoxide, Methane, Propane, Sulfur Dioxide. California - Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide, Nitrogen, Methane, Propane, Sulfur Dioxide. Florida - Substance List: Oxygen, Carbon Monoxide, Sulfur Dioxide. Illinois - Toxic Substance List: Carbon Monoxide, Propane, Sulfur Dioxide. Kansas - Section 302/313 List: Sulfur Dioxide. Massachusetts - Substance List: Oxygen, Carbon Monoxide, Methane, Propane, Sulfur Dioxide. Michigan - Critical Materials Register: No Minnesota - List of Hazardous Substances: Carbon Monoxide, Methane, Propane, Sulfur Dioxide. Missouri - Employer Information/Toxic Substance List: Methane, Propane, New Jersey - Right to Know Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Methane, Propane, Sulfur Dioxide. North Dakota - List of Hazardous Chemicals, Reportable Quantities: No. Pennsylvania - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Methane, Propane, Sulfur Dioxide. Rhode Island - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Methane, Propane, Sulfur Dioxide. Texas - Hazardous Substance List: Propane, Sulfur Dioxide. West Virginia - Hazardous Substance List: Propane, Sulfur Dioxide. Wisconsin - Toxic and Hazardous Substances: Propane, Sulfur Dioxide CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists as a chemical known to the State of California to cause birth defects or other reproductive harm. ADDITIONAL CANADIAN REGULATIONS: **CANADIAN DSL/NDL 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 REGULATIONS:** This gas mixture is categorized as a Controlled Product, Hazard Classes A D2A 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. **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. **Disclaimer:** To the best of Portagas's knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness is not guaranteed and no warranties of any type either express or implied are provided. The information contained herein relates only to this specific product. Data may be changed from time to time. Be sure to consult the latest edition.