



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 < 2% 1,3-Butadiene, < 23.5% Oxygen in a Nitrogen Balance Gas

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50066

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
SUPPLIER/MANUFACTURER'S NAME:	CALGAZ
ADDRESS:	821 Chesapeake Drive Cambridge, MD 21613
EMERGENCY PHONE:	CHEMTREC: 1-800-424-9300
BUSINESS PHONE:	1-410-228-6400
	General MSDS Information: 1-713/868-0440
	Fax on Demand: 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		NIOSH	OTHER
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
1,2-Butadiene	590-19-2	< 2%	2	NE	1 See 29 CFR 1910.1051; 29 CFR 1910.19(1)	5 See 29 CFR 1910.1051; 29 CFR 1910.19(1)	2000 (Based on 10% of LEL)	NIOSH REL: Reduce to lowest feasible concentration (LOQ 0.19) DFG MAK Germ Cell Mutagen Class: 2 Carcinogen: EPA-B2, IACR-2A, MAK-1, NIOSH-Ca, NTP-K, TLV- A2
Oxygen	7782-44-7	< 23.5%	There are no specific exposure limits for Oxygen. Oxygen levels should be maintained above 19.5%.					
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 product 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 is a colorless, gas mixture, which may have a mild gasoline-like odor, due to the presence of 1,3-Butadiene. Inhalation of this gas mixture in high concentrations may cause irritation of the respiratory system and central nervous system effects. Contact with the skin and eyes may cause irritation, especially if the irritation is prolonged. Additionally, releases of this product may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. The 1,3-Butadiene component is a suspected human carcinogen. All contact with this gas mixture should be prevented.

3. HAZARD IDENTIFICATION(Continued)

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: The most significant route of overexposure for this product is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this product, no unusual health effects from overexposure to the product are anticipated under routine circumstances of use. Releases of this product may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. The 1,3-Butadiene component of this product produces slight lung irritation at 2000-4000 ppm. At 8000 ppm, with an 8-hour exposure, lung irritation has been experienced. Coughing and symptoms of CNS depression were experienced by volunteers exposed to 8000 ppm for 8 hours.

SKIN AND EYES: This gas mixture may be irritating to the skin, especially if contact is prolonged. The 1,3-Butadiene component of this product has been found to be irritating to the eyes upon exposure to a level of 10,000 ppm for an hour. Due to the presence of this compound, this gas mixture may be irritating to the eyes.

OTHER HEALTH EFFECTS: Harmful effects on the blood and blood-forming system, kidneys, liver and lungs have been observed in animal studies of the 1,3-Butadiene component of this product.

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

ACUTE: Due to the small size of the individual cylinder of this product, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. Depending on the concentration and duration of exposure, inhalation of this gas mixture may cause irritation, central nervous system effects and an oxygen-deficient atmosphere. Skin and eye contact may be irritating, especially if the contact is prolonged.

CHRONIC: The 1,3-Butadiene component of this product is a suspect human carcinogen. See Section 11 (Toxicological Information) for further information.

TARGET ORGANS: ACUTE: Respiratory system, skin, eyes, central nervous system. CHRONIC: The 1,3-Butadiene component is a suspect human carcinogen and possible reproductive toxin. Based on animal data, adverse effects on the blood-forming system, kidneys, and liver may occur after prolonged exposure to this gas mixture, due to the presence of 1,3-Butadiene. See Section 11 (Toxicological Information).

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH		(BLUE)	1
FLAMMABILITY		(RED)	0
REACTIVITY		(YELLOW)	1
PROTECTIVE EQUIPMENT		B	
EYES	RESPIRATORY	HANDS	BODY
See Section 8			
For Routine Industrial Use and Handling Applications			

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS PRODUCT WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after overexposure to this product 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 product, due to the small cylinder size. If any adverse symptom develops after overexposure to this product, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions and other disorders may be aggravated by overexposure to this product.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate overexposure. Some jurisdictions have specific regulations for 1,3-Butadiene. These regulations may include requirements for medical surveillance programs, including pre-employment and pre-placement examinations, periodic medical examinations, clinical tests, health education and record keeping. Obtain detailed information from the appropriate government agency in relevant jurisdictions.

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.

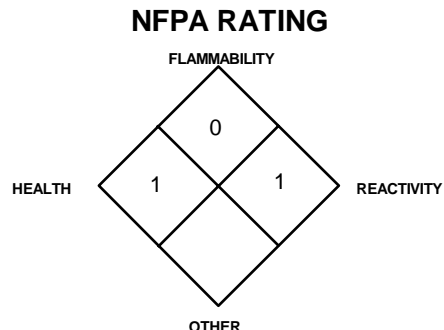
FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: 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: The 1,3-Butadiene component is considered to be is very toxic and a suspected human carcinogen. Do not enter fire area without wearing specialized protective/equipment suitable for the situation. Firefighter's normal protective clothing (Bunker Gear) will not provide adequate protection. A full-body encapsulating chemical resistant suit with positive pressure Self-Contained Breathing Apparatus (NIOSH-approved or equivalent) may be necessary.



6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this product presents significantly less risk of 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 and protect people. For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a

6. ACCIDENTAL RELEASE MEASURES(Continued)

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 and the level of 1,3-Butadiene. Oxygen levels must be above 19.5% and the level of 1,3-Butadiene must be below the TLV 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: Due to the potential carcinogenic effect of the 1,3-Butadiene component of this product, requirements under OSHA 29 CFR 1910.1051; 29 CFR 1910.19(1) must be followed. Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this product could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders of this product. 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: Due to the presence of the 1,3-Butadiene component in this gas mixture, refer to OSHA 29 CFR 1910.1051; 29 CFR 1910.19(1) for specific ventilation requirements. As with all chemicals, use this product in well-ventilated areas. If this product is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Isobutane and oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the levels of Isobutane exceeds exposure limits presented in Section 2 (Composition and Information of Ingredients) and Oxygen levels are below 19.5%, or unknown, during emergency response to a release of this product. 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 are NIOSH respiratory protection guidelines for 1,3-Butadiene:

1,3-BUTADIENE

CONCENTRATION RESPIRATORY PROTECTION

At Concentrations Above the NIOSH REL, or Where There is no REL, at Any Detectable Concentration: Any Self-Contained Breathing Apparatus (SCBA) that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode, or any Supplied-Air Respirator(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 canister providing protection against the compound of concern, 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: Due to the presence of 1,3-Butadiene, it is recommended that gloves, such as Viton™, Saranex™, Barricade™, Responder™, or Teflon™. 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

Unless otherwise specified, the following information is for Nitrogen, the main component of this gas mixture.

GAS DENSITY @ 0°C (32°F) and 1 atm: .072 lb./ft³ (1.153 kg/m³)

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

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

SOLUBILITY IN WATER vol/vol @ 0°C (32°F) 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.

SPECIFIC VOLUME (ft³/lb): 13.8

MOLECULAR WEIGHT: 28.01

EXPANSION RATIO: Not applicable.

The following information is for this gas mixture.

ODOR THRESHOLD (values for 1,3-Butadiene): Detection: 4.50x10⁻¹ ppm, purity not specified; 0.35 mg/m³ (odor low) 2.86 mg/m³ (odor high).

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

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

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state, under conditions of normal pressure and temperature. The 1,3-Butadiene component of this mixture can polymerize if exposed to high temperatures.

DECOMPOSITION PRODUCTS: Acetaldehyde and acrolein have been identified as products of photo-oxidation.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: The 1,3-Butadiene component is incompatible with strong oxidizers (e.g. chlorine, chlorine dioxide, nitrogen oxides, nitrates, perchlorates, peroxides), copper, copper alloys or Monel, Aluminum Tetrahydroborate, buten-3-yne (vinylacetylene), crotonaldehyde, boron trifluoride and phenol.

HAZARDOUS POLYMERIZATION: The 1,3-Butadiene component of this product may polymerize explosively when exposed to elevated temperatures, air, sunlight, rust, and in the presence of incompatible materials, such as peroxides. Cylinders and closed containers may rupture violently if heated. The 1,3-Butadiene component may form explosive peroxides in the presence of air or oxygen. Can decomposes explosively at high temperatures and pressure. 1,3-Butadiene vapor in contact with cobalt metal will initiate "popcorn" polymerization of the diene.

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 product:

1,3-BUTADIENE:

TCLo (Inhalation-Human) 2000 ppm/7 hours: Sense Organs and Special Senses (Eye): effect, not otherwise specified; Behavioral: hallucinations, distorted perceptions

TCLo (Inhalation-Human) 8000 ppm: Sense Organs and Special Senses (Eye): visual field changes, conjunctive irritation; Lungs, Thorax, or Respiration: cough

LD₅₀ (Oral-Rat) 5480 mg/kg

LD₅₀ (Oral-Mouse) 3210 mg/kg

LC₅₀ (Inhalation-Rat) 285 gm/m³/4 hours: Behavioral: general anesthetic; Lungs, Thorax, or Respiration: respiratory depression

LC₅₀ (Inhalation-Mouse) 270 gm/m³/2 hours

LCLo (Inhalation-Rabbit) 25 pph/23 minutes: Sense Organs and Special Senses (Eye): mydriasis (pupillary dilation); Behavioral: tremor, muscle weakness

TCLo (Inhalation-Rat) 1000 ppm/6 hours/13 weeks-intermittent: Liver: changes in liver weight; Kidney, Ureter, Bladder: changes in bladder weight

TCLo (Inhalation-Rat) 1000 ppm/6 hours/1 years-intermittent: Liver: changes in liver weight; Related to Chronic Data: death

TCLo (Inhalation-Rat) 2200 mg/m³/4 hours/17 weeks-intermittent: Blood: leukopenia; Biochemical: Metabolism (Intermediary): lipids including transport, other proteins

TCLo (Inhalation-Rat): 625 ppm/6 hours/61 weeks: Tumorigenic: Carcinogenic by RTECS criteria; Cardiac: tumors; Lungs, Thorax, or Respiration: tumors

TCLo (Inhalation-Rat) 1000 ppm/6 hours/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Skin and Appendages: tumors

TCLo (Inhalation-Rat) 8000 ppm/6 hours/2 years-intermittent: Tumorigenic: neoplastic by RTECS criteria; Gastrointestinal: tumors; Endocrine: thyroid tumors

TCLo (Inhalation-Mouse) 1250 ppm/6 hours/14 weeks-intermittent: Related to Chronic Data: death

TCLo (Inhalation-Mouse) 1250 ppm/6 hours/6 weeks-intermittent: Blood: normocytic anemia, changes in bone marrow (not otherwise specified), changes in erythrocyte (RBC) count

TCLo (Inhalation-Mouse) 8000 ppm/6 hours/15 days-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain

1,3-BUTADIENE (continued):

TCLo (Inhalation-Mouse) 1250 ppm/6 hours/24 weeks-intermittent: Blood: pigmented or nucleated red blood cells, changes in erythrocyte (RBC) count, changes in leukocyte (WBC) count

TCLo (Inhalation-Rabbit) 100 mg/m³/4 hours/17 weeks-intermittent: Immunological Including Allergic: decrease in cellular immune response; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase

TCLo (Inhalation-Mouse) 625 ppm/6 hours/13 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Sense Organs and Special Senses (Olfaction): tumors; Cardiac: tumors

TC (Inhalation-Rat) 8000 ppm/6 hours/15 weeks-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Endocrine: tumors

TC (Inhalation-Rat) 8000 ppm/6 hours/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Endocrine: thyroid tumors; Skin and Appendages: tumors

TC (Inhalation-Mouse) 200 ppm/40 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Gastrointestinal: tumors

TC (Inhalation-Mouse) 625 ppm/6 hours/65 weeks-intermittent: Tumorigenic: equivocal tumorigenic agent by RTECS criteria; Sense Organs and Special Senses (Eye): tumors; Cardiac: tumors

TC (Inhalation-Mouse) 63 ppm/6 hours/2 years-intermittent: Tumorigenic: Carcinogenic by RTECS criteria; Vascular: tumors; Liver: tumors

TCLo (Inhalation-Rat) 8000 ppm/6 hours: female 6-15 day(s) after conception: Reproductive: Specific Developmental Abnormalities: musculoskeletal system

TCLo (Inhalation-Mouse) 500 ppm/6 hours: male 5 day(s) pre-mating: Reproductive: Paternal Effects: testes, epididymis, sperm duct; Effects on Embryo or Fetus: cytological changes (including somatic cell genetic material)

TCLo (Inhalation-Mouse) 1000 ppm/6 hours female 6-15 day(s) after conception: Reproductive: Maternal Effects: uterus, cervix, vagina

1,3-BUTADIENE (continued):

TCLo (Inhalation-Mouse) 1000 ppm/6 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); Effects on Embryo or Fetus: extra-embryonic structures (e.g., placenta, umbilical cord), fetotoxicity (except death, e.g., stunted fetus)

Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 20 pph/2 hours-continuous

Mutation in Microorganisms (Bacteria-*Salmonella typhimurium*) 2 pph

Sister Chromatid Exchange (Human-Lymphocyte) 500 µmol/L

Micronucleus Test (Inhalation-Mouse) 6250 ppb/6 hours/13 weeks-intermittent

Specific Locus Test (Inhalation-Mouse) 500 ppm/6 hours/5 days-continuous

DNA Damage (Inhalation-Mouse) 125 ppm/6 hours-continuous

DNA Adduct (Inhalation-Mouse) 200 ppm/5 days/6 hours-continuous

Cytogenetic Analysis (Inhalation-Mouse) 625 ppm/6 hours/10 days-intermittent

Sister Chromatid Exchange (Inhalation-Mouse) 6250 ppb/6 hours/10 days-intermittent

Dominant Lethal Test (Inhalation-Mouse) 1250 ppm/6 hours/10 weeks-intermittent

Mutation in Mammalian Somatic Cells (Mouse-Lymphocyte) 20 pph

Mutation in Mammalian Somatic Cells (Inhalation-Mouse) 625 ppm/6 hours/2 weeks-intermittent

Sperm Morphology (Inhalation-Mouse) 130 ppm/5 days/6 hours-continuous

Heritable Translocation Test (Inhalation-Mouse) 500 ppm/6 hours/5 days-continuous

Sister Chromatid Exchange (Hamster-Ovary) 25 µmol/L

NITROGEN:

There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant.

OXYGEN:

There are toxicity data for oxygen, but are only related to exposure to oxygen in an elevated pressure environment, such as a hyperbaric chamber.

OTHER TOXICOLOGICAL DATA: Blood system effects (changes in bone marrow stem cell development, reduction in white and red blood cells and an increase in the volume of circulating red blood cells) were observed in several studies involving male mice exposed to 1250 ppm of the 1,3-Butadiene component of this gas mixture for 6-31 weeks. Effects on red blood cell enzymes, grooming activity and salivation were observed in rats exposed to 1000-8000 ppm for 13 weeks.

SUSPECTED CANCER AGENT: The components of this gas mixture are listed by agencies that track the cancer potential of chemicals as follows:

1,3-BUTADIENE: ACGIH TLV-A2 (Suspected Human Carcinogen); EPA-B2 (Probable Human Carcinogen. Sufficient evidence from animal studies; inadequate evidence or no data from epidemiologic studies); IARC-2A (Probably Carcinogenic to Humans); MAK-1 (Substances that Cause Cancer in Man and Can be Assumed to Make a Significant Contribution to Cancer Risk); NIOSH-Ca (Potential Occupational Carcinogen with No Further Categorization); NTP-K (Known to be a Human Carcinogen).

Inhalation carcinogenesis studies of 1,3-Butadiene were conducted by exposing groups of 50 male and 50 female B6C3F1 mice 6 hours/day 5 days/week to air containing 1,3-Butadiene at concentrations of 0 (chamber controls), 625, or 1,250 ppm. These studies were planned for 103 week exposures but were terminated at weeks 60 for male mice and weeks 61 for female mice because of the rapidly declining survival, primarily due to neoplasia. Under the conditions of these studies, there was clear evidence of carcinogenicity for 1,3-Butadiene in male and female B6C3F1

11. TOXICOLOGICAL INFORMATION (Continued)

mice as shown by increased incidences and early induction of hemangiosarcomas of the heart, lymphomas, alevolar/bronchiolar adenomas and carcinomas, and papillomas of the stomach in males and females; and of acinar cell carcinomas of the mammary gland, granulosa cell tumors of the ovary, and hepatocellular adenomas and adenomas or carcinomas (combined) in females.

The remaining components of this gas mixture are not found on the following lists: U.S. 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: The 1,3-Butadiene component of this gas mixture can cause some irritation to mucus membranes.

SENSITIZATION OF PRODUCT: No component of this gas mixture is known to be a skin or respiratory sensitizer.

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

Mutagenicity: This gas mixture is not expected to cause mutagenic effects in humans. Despite their limitations, some human studies have shown mutagenic effects in the blood cells of people occupationally exposed to the 1,3-Butadiene. Animal information clearly indicates that 1,3-Butadiene is mutagenic to both somatic and germ cells. Positive and negative results have been obtained in cultured mammalian cells, including some tests with human cells.

Embryotoxicity: This gas mixture is not expected to cause embryotoxic effects in humans. A fetotoxic effect (reduced body weight) has been observed in mice, in the absence of harmful effects on mothers in tests involving the 1,3-Butadiene component of this gas mixture.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans. Teratogenic effects were observed in rats in tests involving the 1,3-Butadiene component, at maternally toxic concentrations.

Reproductive Toxicity: This gas mixture is not expected to cause adverse reproductive effects in humans; however, in animal tests 1,3-Butadiene is mutagenic to sperm which has reproductive implications.

*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.*

ACGIH BIOLOGICAL EXPOSURE INDICES (BEIs): Currently there are no ACGIH Biological Exposure Indices (BEIs) applicable for this gas mixture's components.

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. The following environmental data are applicable to the components of this product.

1,3-BUTADIENE:

Terrestrial Fate: : If spilled on land, 1,3-Butadiene will predominately volatilize very rapidly due to its very low boiling point. Dissolved in water, it may leach through soil into groundwater due to its high water solubility and low estimated soil adsorption coefficient. It will not appreciably hydrolyze but may be subject to biodegradation based on screening tests.

Aquatic Fate: When released into water, 1,3-Butadiene will volatilize rapidly with a half-life estimated to be 5.7 hours. It will not hydrolyze appreciably, but may be subject to biodegradation, based on screening test.

Atmospheric Fate: Reaction with hydroxyl radicals is the dominant removal mechanism, with an estimated half life 5 hours. Reaction with ozone and nitrate radicals may also contribute to the degradation of the chemical. Polluted urban atmospheres increase the rate of degradation somewhat during day light hours as suggested by the detection of the highest atmospheric levels of the chemical in the early morning hours. Acetaldehyde and acrolein have been identified as products of photo-oxidation. Rainout may contribute to removal of 1,3-Butadiene from the atmosphere; However, evaporation from the rain may be rapid and the compound returned to the atmosphere relatively quickly unless it leaches into the soil.

Bioconcentration: No information on the bioconcentration factor for 1,3-Butadiene could be found in the literature. However, based on its octanol/water partition coefficient (log K_{ow}=1.99(1)) its estimated bioconcentration factor is 9.1 and, therefore, the chemical is not expected to appreciably bioconcentrate.

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

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on the effects of this product on plants or animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this product on aquatic life. The following are aquatic toxicity data for the 1,3-Butadiene component of this gas mixture:

1,3-BUTADIENE:

TLm (Pin perch) 71.5 mg/L/24 hours

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate U.S. Federal, State, and local regulations, or the applicable standards of Canada and its Provinces. 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, 1,3-Butadiene, 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.

14. TRANSPORTATION INFORMATION (Continued)

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 mixture is considered as dangerous goods, per regulations of Transport Canada. Use the above U.S. DOT information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this product are 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)
1,3-Butadiene	No	No	Yes

ADDITIONAL U.S. REGULATIONS (continued):

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this material. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITY (RQ): 1,3-Butadiene = 10 lb (0.45 kg)

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are on the U.S. TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS:

- The 1,3-Butadiene component of this gas mixture has requirements under OSHA 29 CFR 1910.1051; 29 CFR 1910.19(1).
- The 1,3-Butadiene component of this gas mixture is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The reportable quantity (RQ) of 1,3-Butadiene under this regulation is 10,000 lb (4550 kg). 1,3-Butadiene listed as a Hazardous Air Pollutant (HAP) generally known or suspected to cause serious health problems.
- This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Nitrogen, Oxygen, and 1,2-Butadiene are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases.

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: 1,3-Butadiene.

California - Permissible Exposure Limits for Chemical Contaminants: 1,3-Butadiene, Nitrogen.

Florida - Substance List: 1,3-Butadiene.

Illinois - Toxic Substance List: 1,3-Butadiene.

Kansas - Section 302/313 List: 1,3-Butadiene.

Massachusetts - Substance List: 1,3-Butadiene.

Michigan - Critical Materials Register: No.

Minnesota - List of Hazardous Substances: 1,3-Butadiene.

Missouri - Employer Information/Toxic Substance List: 1,3-Butadiene.

New Jersey - Right to Know Hazardous Substance List: 1,3-Butadiene, Nitrogen.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: None.

Pennsylvania - Hazardous Substance List: 1,3-Butadiene, Nitrogen.

Rhode Island - Hazardous Substance List: 1,3-Butadiene, Nitrogen.

Texas - Hazardous Substance List: 1,3-Butadiene.

West Virginia - Hazardous Substance List: 1,3-Butadiene.

Wisconsin - Toxic and Hazardous Substances: 1,3-Butadiene.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The 1,3-Butadiene component of this gas mixture is on the California Proposition 65 lists. **WARNING!** This gas mixture contains a compound that is known to the State of California to cause cancer.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDL INVENTORY STATUS: The components of this product are on the Canadian DSL Inventory.

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this product are not on the CEPA Priorities Substances List.

CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Class A, D2A, 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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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 product. 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 product 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.