SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI, Canadian WHMIS Standards, REACH, European Union CLP EC 1272/2008, and the Global Harmonization Standard

1. SECTION 1 – IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

CHEMICAL NAME; CLASS: MARIANA

SYNONYMS: Proprietary
CHEMICAL FAMILY NAME: Hydrofluoroalkane
FORMULA: Proprietary

	Document Number: EL-1001-03902
PRODUCT USE:	Various
MANUFACTURED/SUPPLIED FOR:	AIR LIQUIDE
SUPPLIER/MANUFACTURER'S NAME:	AIR LIQUIDE AMERICA
ADDRESS:	2700 Post Oak Blvd. Houston, TX 77056-8229
EMAIL ADDRESS FOR PRODUCT INFORMATION:	sds@airliquide.com
WEBSITE:	www.us.airliquide.com
EMERGENCY PHONE:	CHEMTREC: (U.S., Canada) 1-800-424-9300 (24 hrs) (International) +703-527-3887 (collect-24 hrs)
BUSINESS PHONE:	General SDS Information: 1-713/896-2896/1-800/819-1704 (8 am to 5 pm U.S. Central Time)

ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2010 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the SDS contains all the information required by the CPR. The product is also classified per all applicable European Union CLP EC 1272/2008, REACH and the Global Harmonization Standard.

TSCA Status: This material is not included in the TSCA Inventory. In accordance with the conditions listed in 40 CFR 720.36 and 721.47, this product must be used only for research and development, pharmaceutical manufacture, or export. It must be used by, or directly under the supervision of, a technically qualified individual. The manufacturer should be consulted prior to using this material for other applications. Other requirements may apply.

2. HAZARD IDENTIFICATION

NOTE: The information in this SDS is provisional and may be subject to change upon further testing of product.

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2208 LABELING AND CLASSIFICATION: This product has been classified per GHS Standards under European regulations. For information on EU classification under (67/548/EEC), see below. This is a self-classification.

Classification: Liquefied Gas Under Pressure, Skin Irritation Cat. 2, Eye Irritation Cat. 2A, STOT (Inhalation-Respiratory Irritation) SE Cat. 3

Signal Word: Danger **Hazard Statement Codes:** H280, H315 + H320, H335

Precautionary Statement Codes: P261, P264, P271, P280, P304 + P340, P312, P302 + P352, P332 + P313, P362 + P364, P305 + P351 + P338, P337 + P313, P312, P321, P410, P403+ P233 + P405, P501

Hazard Symbols/Pictograms: GHS04, GHS07

EU 67/548/EEC LABELING AND CLASSIFICATION: This product meets the classification of hazardous, as defined by the European Union Council Directive 67/548/EEC or subsequent Directives. This is a self-classification.

Classification: Irritant **Risk Phrase Codes:** R36/37/38

Safety Phrase Codes: S36/37/39, S45

Hazard Symbols: Xi

See Section 16 for a full definition of Classification

EMERGENCY OVERVIEW: THE TOXICOLOGICAL AND PHYSICAL PROPERTIES OF THIS GAS HAVE NOT BEEN FULLY INVESTIGATED. FOR RESEARCH USE ONLY. ALL EXPOSURE MUST BE MINIMIZED. **Product Description:** This compound is a clear colorless, odorless to slight ammonia-like, liquefied gas at room temperature and pressure. **Health Hazards:** High concentrations of this gas can cause an oxygen-deficient environment. Contact with rapidly expanding gases may cause frostbite. This gas may cause irritation by inhalation, skin or eye contact. **Flammability Hazards:** This gas is not known to be flammable, but may be combustible may ignite if highly heated. If involved in a fire, this material will ignite to produce toxic gases (carbon and nitrogen oxides, carbonyl fluoride, hydrogen fluoride, butene). **Reactivity Hazards:** No information is available on the reactivity of this compound. **Environmental Hazards:** This compound may cause harm if accidentally released to the environment, although details of environmental effects are not currently available. **Emergency Response Procedures:** Emergency responders must wear the proper personal protective equipment (and have appropriate fire-suppression equipment) suitable for the situation to which they are responding.

3. COMPOSITION and INFORMATION ON INGREDIENTS

Chemical Name	CAS #	EINECS or ELNICS #	MOLE %	LABEL ELEMENTS EU Classification (67/548/EEC) GHS & EU Classification (1272/2008) Risk Phrases/Hazard Statements
Proprietary Hydrofluoroalkane		Not Listed	100%	SELF-CLASSIFICATION EU 67/548/EEC Classification: Irritant Risk Phrases: R36/37/38 GHS & EU CLP: 1272/2008: Classification: Liquefied Gas Under Pressure, Skin Irritation Cat. 2, Eye Irritation Cat. 2B, STOT (Inhalation-Respiratory Irritation) SE Cat. 3 Hazard Statement Codes: H280, H315 + H320, H335

See Section 16 for full text of classification.

4 FIRST-AID MEASURES

PROTECTION OF FIRST AID RESPONDERS: RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus, and other appropriate personal protective equipment should be worn. Rescuers should be taken for medical attention, if necessary. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.

DESCRIPTION OF FIRST AID MEASURES: Remove victim(s) to fresh air, as quickly as possible. 100% oxygen should be administered to victims of exposure to this gas as soon as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary. Remove and isolate contaminated clothing and shoes. Seek immediate medical attention. Take copy of label and SDS to physician or other health professional with victim(s).

Inhalation Exposure: If inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Seek immediate medical attention.

Skin Exposure: If this gas contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 20 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention. Remove any clothing that may restrict circulation to any frozen area. Do not rub frozen parts as tissue damage may occur. As soon as practicable, place any affected area in warm water bath which has a temperature that does not exceed 105°F (40°C). NEVER USE HOT WATER. NEVER USE DRY HEAT. If area of frostbite is extensive, and if possible, remove clothing while showering with warm water. If warm water is not available, or is impractical to use, wrap the affected parts gently in blankets. Alternatively, if the fingers or hands are frostbitten, place the affected area of the body in the armpit. Encourage victim to gently exercise the affected part while being warmed. Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the area with a dry sterile dressing and a large bulky protective covering.

Eye Exposure: If this gas enters the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 20 minutes. An ophthalmologist should be sought as soon as possible.

Ingestion: Ingestion is not a likely route of exposure for this gas.

MOST IMPORTANT SYMPTOMS/EFFECTS (ACUTE & CHRONIC): See Sections 2 (Hazard Identification) and 11 (Toxicological Information) for description of possible health effects from exposure to this gas mixture.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing dermatitis, other skin conditions, cardiovascular conditions, and respiratory disorders may be aggravated by exposure to this gas mixture.

INDICATION OF IMMEDIATE MEDICAL ATTENTION AND SPECIAL TREATMENT IF NEEDED: Administer oxygen. Treatment is symptomatic and supportive.

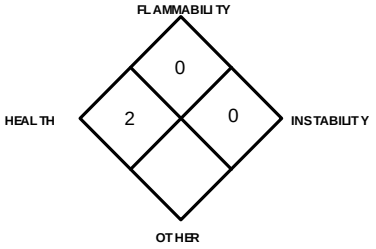
5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable.

FLAMMABLE LIMITS (in air by volume, %): Not applicable.

NFPA RATING



FIRE EXTINGUISHING MEDIA: Use water spray to cool fire-exposed structures and equipment. Alcohol foam, halons, carbon dioxide or dry chemical forms of fire extinguishing agents can be used against fires involving this gas.

UNSUITABLE FIRE EXTINGUISHING MEDIA: None known.

SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: This gas not known to be flammable, but may be combustible and ignite if exposed to direct flame or extreme temperature. Fires impinging (direct flame) on the outside surface of unprotected cylinders of this product can be very dangerous. Direct flame exposure on the cylinder wall can cause a catastrophic failure of the cylinder. The resulting explosion can cause severe equipment damage and personnel injury or death over a large area around the cylinder.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS: Evacuate all personnel from danger area. Immediately cool cylinders with water spray from maximum distance to prevent failure. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. When cool, move cylinders from fire area if this can be done without risk to firefighters.

6. ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS AND EMERGENCY PROCEDURES: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a large release, clear the affected area, protect people, and respond with trained personnel. Call CHEMTREC (1-800-424-9300) for emergency assistance. Or if in Canada, call CANUTEC (613-996-6666). The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection. If gas is leaking incidentally from the cylinder or its valve, contact your supplier.

PERSONAL PROTECTIVE EQUIPMENT: Proper protective equipment should be used.

All Releases: Minimum Personal Protective Equipment should be **Level B: Self-Contained Breathing Apparatus.** Note: chemically protective clothing may provide little or no thermal protection against the hazard of frostbite. The atmosphere must at least 19.5 percent Oxygen before non-emergency personnel can be allowed in the area without Self-Contained Breathing Apparatus and fire protection. If gas is leaking incidentally from the cylinder or its valve, contact your supplier.

METHODS FOR CLEAN-UP AND CONTAINMENT: Follow the guidelines of the North American Emergency Response Guidebook (Guide #126) for liquefied gases.

All Releases: Evacuate area of release. Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas to dissipate, if it can be done to an area in which there are no personnel. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there. Non-emergency personnel should not be allowed in area until a breathing oxygen level has been confirmed and this gas cannot be detected.

ENVIRONMENTAL PRECAUTIONS: Avoid unintentional release to the environment. Run-off water may be contaminated by other materials and should be contained to prevent possible environmental damage.

REFERENCE TO OTHER SECTIONS: See information in Section 8 (Exposure Controls – Personal Protection) and Section 13 (Disposal Considerations) for additional information.

7. HANDLING and USE

PRECAUTIONS FOR SAFE HANDLING: Be aware of any signs of dizziness or fatigue; exposure to fatal concentrations of this gas could occur without any significant warning symptoms. Follow all safety and work practices for handling of compressed gases safely. Avoid breathing this gas. Do not eat or drink while handling chemicals. All work practices should minimize the release of this gas mixture. Compressed gases can present significant safety hazards. As with all chemicals, wash hands after handling. Do not smoke or eat in work areas. Use a check valve or other protective device in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition. Emergency response equipment should be available near the point of use. Be aware that and oxygen-deficient atmosphere can happen rapidly, causing dizziness or asphyxiation without warning.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Compressed gases can present significant safety hazards. The following rules are applicable to work situations in which cylinders are being used.

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap (where provided) in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Immediately contact the supplier if there are any difficulties associated with operating cylinder valve. Never insert an object (e.g., wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing a leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Never strike an arc, on a compressed gas cylinder or make a cylinder part of and electric circuit.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

CONDITIONS FOR SAFE STORAGE: Always store and handle liquefied, compressed gas cylinders in accordance with Compressed Gas Association, Inc. at www.cganet.com pamphlet CGA P-1, *Safe Handling of Compressed Gases in Containers.* Local regulations may require specific equipment for storage and use. Emergency equipment should be available near the point of storage. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked-over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Cylinders should be stored in dry, well-ventilated areas away from sources of heat, ignition and direct sunlight. Cylinders should be separated incompatible materials (refer to Section 10, Stability and Reactivity, for more information). Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers). Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store cylinders away from heavily trafficked areas and emergency exits. Isolate from other non-compatible chemicals (refer to Section 10, Stability and Reactivity). Store away from process and production areas, away from elevators, building and room exits or main aisles leading to exits. Protect cylinders against physical damage. Keep the smallest amount necessary on-site at any one time. Full and empty cylinders should be segregated. Use a first-in, first-out inventory systems to prevent full containers from being stored for long periods of time.

SPECIFIC END USE(S): This product is for experimental use. Follow all industry standards for use of this gas.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. argon) before attempting repairs.

7. HANDLING and USE (Continued)

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT (continued): Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

EXPOSURE LIMITS/CONTROL PARAMETERS:

Ventilation and Engineering Controls: : If appropriate, install automatic monitoring equipment to detect the level of oxygen. Use with adequate ventilation. Local exhaust ventilation is preferred, because it prevents gas dispersion into the work place by eliminating it at its source.

Occupational/Workplace Exposure Limits/Guidelines:

CHEMICAL NAME	CAS #	EXPOSURE LIMITS IN AIR							
		ACGIH-TLVs		OSHA-PELs		NIOSH-RELs		NIOSH	OTHER
		TWA ppm	STEL ppm	TWA ppm	STEL ppm	TWA ppm	STEL ppm	IDLH ppm	
Proprietary Hydrofluoroalkane		NE	NE	NE	NE	NE	NE	NE	NE

NE = Not Established

International Exposure Limits: Currently, there are no international exposure limits are in force for components of this gas mixture. Exposure limits can change and should be checked for currency.

PROTECTIVE EQUIPMENT: The following information on appropriate Personal Protective Equipment is provided to assist employers in complying with OSHA regulations found in 29 CFR Subpart I (beginning at 1910.132, including U.S. Federal OSHA Respiratory Protection (29 CFR 1910.134), OSHA Eye Protection 29 CFR 1910.133, OSHA Hard Protection 29 CFR 1910.138, OSHA Foot Protection 29 CFR 1910.136 and OSHA Body Protection 29 CFR1910.132), equivalent standards of Canada (including CSA Respiratory Standard Z94.4-02, Z94.3-M1982, *Industrial Eye and Face Protectors* and CSA Standard Z195-02, *Protective Footwear*), or standards of EU member states (including EN 529:2005 for respiratory PPE, CEN/TR 15419:2006 for hand protection, and CR 13464:1999 for face/eye protection). Please reference applicable regulations and standards for relevant details.

Respiratory Protection: Maintain the Oxygen level above 19.5% in the workplace. If necessary, use only respiratory protection authorized in appropriate country regulations and standards. 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 U.S. OSHA's Respiratory Protection Standard (1910.134-1998).

Eye Protection: Splash goggles or safety glasses, with a face shield for additional protection. If necessary, refer to appropriate regulations for further information.

Hand Protection: Wear leather gloves when handling cylinders of this product. Wear appropriate gloves for industrial use. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this SDS. If necessary, refer to appropriate regulations.

Body Protection: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders. 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 appropriate regulations.

9. PHYSICAL and CHEMICAL PROPERTIES

FORM: Liquefied gas at room temperature and pressure.
COLOR: Colorless.
MOLECULAR FORMULA: Proprietary.
MOLECULAR WEIGHT: Proprietary.
ODOR: Odorless to slight ammonia-like.
ODOR THRESHOLD: Not applicable.
VAPOR DENSITY (air = 1): 5.7 (calc.)
BOILING POINT @ 760 mmHg: 7.5-8.5°C (45.5-47.3°F)
FREEZING/MELTING POINT: Not available.
pH: Not available.
SPECIFIC GRAVITY @ -20°C (water = 1): > 12; 1.356 g/cm^3
EXPANSION RATIO: Not available.
SOLUBILITY IN WATER: Not available.
OTHER SOLUBILITIES: Not available.
EVAPORATION RATE (nBuAc = 1): Not available.
VAPOR PRESSURE @ 25°C: 1340 Torr
COEFFICIENT WATER/OIL DISTRIBUTION: Log P: 2.411 (predict.)

HOW TO DETECT THIS SUBSTANCE (identification/warning properties): There are no adequate identification properties for this material in event of an accidental release. 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

CHEMICAL STABILITY: This material is stable under conditions of normal temperature and pressure.

DECOMPOSITION PRODUCTS: ***Combustion:*** Carbon and nitrogen oxides, carbonyl fluoride, hydrogen fluoride, butene. ***Hydrolysis:*** None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: This compound is incompatible with strong oxidizing agents and alkali metals.

POSSIBILITY OF HAZARDOUS REACTION/POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture.

11. TOXICOLOGICAL INFORMATION

SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE: The health hazards of this material have not been fully investigated. This material may be a powerful irritant to skin, eyes, and mucous membranes and cause moderate to severe irritation by all routes of exposure, depending on concentration and duration of exposure.

Inhalation: Inhalation of this material may cause irritation to the respiratory system. High concentrations of this gas can cause an oxygen-deficient environment. 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 skin of a victim of exposure may have a blue color. Under some circumstances of exposure, death may occur. The effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN	OBSERVED EFFECT
12-16% Oxygen:	Breathing and pulse rate increase, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

WARNING: Exposure to atmospheres containing 8-10% or less oxygen will bring about unconsciousness without warning and so quickly that individuals cannot help or protect themselves. Lack of sufficient oxygen may cause serious injury or death.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

HEALTH HAZARD	(BLUE)	2
FLAMMABILITY HAZARD	(RED)	0
PHYSICAL HAZARD	(YELLOW)	0

PROTECTIVE EQUIPMENT

EYES	RESPIRATORY	HANDS	BODY
	SEE SECTION 8		SEE SECTION 8

For Routine Industrial Use and Handling Applications

Contact with Skin or Eyes: This gas presents a severe hazard for frostbite if accidentally released. Contact of this material with the skin may be irritating. Repeated or prolonged skin contact may cause dermatitis (dry, red, cracked skin). Eye contact with vapors from this material can cause immediate eye irritation. Contact with rapidly expanding gases (which are released under high pressure) may cause frostbite.

Skin Absorption: Currently, there are no data for possible skin absorption of this material. All skin contact should be avoided.

Ingestion: Not applicable to compressed gases.

Injection: Not a likely route of exposure for this material.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. The toxicological properties of this material have not been fully investigated. Over-exposure to this compound may cause the following health effects:

Acute: Inhalation may result in oxygen-deficiency. At high concentrations, unconsciousness or death may occur. Inhalation of high concentrations may cause irritation.

Chronic: Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. Chronic skin exposure may cause dermatitis.

TARGET ORGANS: Acute: Respiratory system, skin, eyes. **Chronic:** Skin, respiratory system, heart, central nervous system.

TOXICITY DATA: Currently, the following toxicology data are available for this compound.

LC_{50} (Inhalation-Rat) 4 hours; > 17,000 ppm; Central nervous system effects
NOAEL (Inhalation-Dog) 70,000 ppm

CARCINOGENIC POTENTIAL: This compound is not found on the following lists: U.S. EPA, U.S. NTP, U.S. OSHA, U.S. NIOSH, GERMAN MAK, IARC, and ACGIH, and is therefore not considered to be, nor suspected to be, cancer-causing agents by these agencies.

IRRITANCY OF PRODUCT: The liquid or vapors of this compound may be irritating by all routes of exposure. Rapidly expanding gases can cause significant irritation or burns to exposed tissue.

SENSITIZATION TO THE PRODUCT: No data is available as to whether this gas is a human skin or respiratory sensitizer.

REPRODUCTIVE TOXICITY INFORMATION: Currently, there are no data or other information available on possible mutagenic, embryotoxic, teratogenic or reproductive effects for this gas.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, there are no Biological Exposure Indices (BEIs) determined for this compound.

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

The values given in this section are predicted data generated using the U.S. Environmental Protection Agency's EPISuite™.

MOBILITY IN SOIL: This compound has not been tested for mobility in soil. The following estimated values are available.

Soil Adsorption Coefficient (PCKOCWIN v1.66): Koc: 725.3; Log Koc: 2.861

PERSISTENCE AND BIODEGRADABILITY: This compound has not been tested for persistence or biodegradability. The following predicted values are available below.

Probability of Rapid Biodegradation (BIOWIN v4.10):
Biowin1 (Linear Model): -0.3714 Biowin2 (Non-Linear Model): 0.0
Expert Survey Biodegradation Results:
Biowin3 (Ultimate Survey Model): 1.8107 (months) Biowin4 (Primary Survey Model): 3.0623 (weeks)

12. ECOLOGICAL INFORMATION (Continued)

PERSISTENCE AND BIODEGRADABILITY (continued):

MITI Biodegradation Probability:
Biowin5 (MITI Linear Model): 0.3407 Biowin6 (MITI Non-Linear Model): 0.0
Anaerobic Biodegradation Probability:
Biowin7 (Anaerobic Linear Model): 0.6890
Ready Biodegradability Prediction: No

Atmospheric Oxidation (25 deg C) [AopWin v1.92]:
Hydroxyl Radicals Reaction:
Overall OH Rate Constant = 36.9664 E-12 cm^3/molecule-sec
Half-Life = 3.472 hours (12-hr day; 1.5E6 OH/cm^3)
Ozone Reaction:
OVERALL Ozone Rate Constant = 0.175000 E-17 cm^3/molecule-sec
Half-Life = 6.549 days (at 7E11 mol/cm^3)

Fraction sorbed to airborne particulates (phi) [Junge,Mackay]: 5.38E-010
Note: the sorbed fraction may be resistant to atmospheric oxidation
Volatilization from Water:
Henry LC: 9.4 atm atm-m^3/mole (estimated by Bond SAR Method)
Half-Life from Model River: 1.307 hours
Half-Life from Model Lake: 121.7 hours (5.069 days)
Removal in Wastewater Treatment:
Total removal = 99.97%
Total Biodegradation: 0.02%
Total Sludge Adsorption: 2.15%
Total to Air: 97.80%, (using 10000 hr Bio P,A,S)
Level III Fugacity Model:

	Mass Amount (percent)	Half-Life (hr)	Emissions (kg/hr)
Air	9.21	7.69	1000
Water	88.2	1.44e+003	1000
Soil	0.783	2.88e+003	1000
Sediment	1.83	1.3e+004	0

Persistence Time: 95 hours

BIO-ACCUMULATIVE POTENTIAL: This compound has not been tested for bioaccumulation potential. The following predicted values are available.

Bioaccumulation Estimates from Log Kow (BCFWIN v2.17):
Log BCF from regression-based method = 1.550 (BCF = 35.49)

ECOTOXICITY: This gas has not been fully tested for aquatic or animal toxicity. All release to terrestrial, atmospheric and aquatic environments should be avoided.

OTHER ADVERSE EFFECTS: This gas does not have ozone depletion potential.

ENVIRONMENTAL EXPOSURE CONTROLS: Controls should be engineered to prevent release to the environment, including procedures to prevent spills, atmospheric release and release to waterways.

RESULTS OF PBT and vPvB ASSESSMENT: No data available. PBT and vPvB assessments are part of the chemical safety report required for some substances in European Union Regulation (EC) 1907/2006, Article 14.

13. DISPOSAL CONSIDERATIONS

PRECAUTIONS TO BE FOLLOWED DURING WASTE HANDLING: Wear proper protective equipment when handling waste materials.

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual product to Air Liquide. Do not dispose of locally. For emergency disposal, secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors.

U.S. EPA WASTE NUMBER: Not applicable.

EUROPEAN (EWC) WASTE CODES: 16 05 05: Gases in pressure containers other than those mentioned in 16 05 04.

14. TRANSPORTATION INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION REGULATIONS: This gas mixture is classified as dangerous goods, per U.S. DOT regulations, under 49 CFR 172.101.

UN Identification Number: UN 3163
Proper Shipping Name: Liquefied gas, n.o.s. [(E)-1,1,1,4,4,4-Hexafluoro-2-Butene]
Hazard Class Number and Description: 2.2 (Non-Flammable Gas)
Packing Group: Not Applicable
Label(s) Required: Class 2.2 (Non-Flammable Gas)
North American Emergency Response Guidebook Number (2012): 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).

14. TRANSPORTATION INFORMATION (Continued)

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is classified as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable.

UN Identification Number:	UN 3163
Proper Shipping Name:	Liquefied gas, n.o.s. (Proprietary Hydrofluoroalkane)
Hazard Class Number and Description:	2.2 (Non-Flammable Gas)
Packing Group:	Not Applicable
Hazard Label(s) Required:	Class 2.2 (Non-Flammable Gas)
Special Provisions:	None
Explosive Limit & Limited Quantity Index:	0.125
ERAP Index:	None
Passenger Carrying Ship Index:	None
Passenger Carrying Road or Rail Vehicle Index:	75
Marine Pollutant:	Not Applicable

INTERNATIONAL AIR TRANSPORT ASSOCIATION SHIPPING INFORMATION (IATA): This gas is classified as dangerous goods, per the International Air Transport Association.

UN Identification Number:	UN 3163
Proper Shipping Name/Description:	Liquefied gas, n.o.s. (Proprietary Hydrofluoroalkane)
Hazard Class or Division:	2.2 (Non-Flammable Gas)
Hazard Label(s) Required:	Class 2.2 (Non-Flammable Gas)
Packing Group:	Not Applicable
Excepted Quantities:	E1
Passenger and Cargo Aircraft Packing Instruction:	200
Passenger and Cargo Aircraft Maximum Net Quantity per Pkg.:	75 kg
Passenger and Cargo Aircraft Limited Quantity Packing Instruction:	Forbidden
Passenger and Cargo Aircraft Limited Quantity Maximum Net Quantity per Pkg.:	Forbidden
Cargo Aircraft Only Packing Instruction:	200
Cargo Aircraft Only Maximum Net Quantity per Pkg.:	150 kg
Special Provisions:	None
ERG Code:	2L

INTERNATIONAL MARITIME ORGANIZATION (IMO): This gas is classified as Dangerous Goods, per rules of IMO.

UN No.:	3163
Proper Shipping Name:	Liquefied gas, n.o.s. (Proprietary Hydrofluoroalkane)
Hazard Class Number:	2.2
Packing Group:	Not Applicable.
Special Provisions:	274
Limited Quantities:	120 mL
Excepted Quantities:	E1
Packing:	Instructions: P200; Provisions: None
IBCs:	Instructions: None; Provisions: None
Tanks:	Instructions: T50; Provisions: None
EmS:	F-E, S-V
Stowage Category:	Category A

Marine Pollutant: This material is not designated by the IMO to be a Marine Pollutant.

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

UN No.:	3163
Proper Shipping Name:	Liquefied gas, n.o.s. (Proprietary Hydrofluoroalkane)
Class:	2
Classification Code:	2A
Packing Group:	None
Labels:	2.2
Special Provisions:	274, 652
Limited Quantities:	120 mL
Excepted Quantities:	E1
Packing Instructions:	P200
Special Packing Instructions:	None
Mixed Packing Provisions:	MP9
Portable Tank and Bulk Container:	Instructions: (M) T50; Special Provisions: None
Hazard Identification No.:	20

TRANSPORT IN BULK ACCORDING TO THE IBC CODE: See the information under the individual jurisdiction listings for IBC information.

14. TRANSPORTATION INFORMATION (Continued)

ENVIRONMENTAL HAZARDS: This gas does not meet the criteria of environmentally hazardous according to the criteria of the UN Model Regulations (as reflected in the IMDG Code, ADR, RID, and ADN); this gas is not specifically listed in Annex III under MARPOL 73/78.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA Reporting Requirements: This gas is not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA Threshold Planning Quantity: There are no specific Threshold Planning Quantities for components. The default Federal SDS submission and inventory requirement filing threshold of 10,000 lbs (4,540 kg) therefore applies, per 40 CFR 370.20.

U.S. SARA Title III SARA Sections 311/312 Hazardous Categories (40 CFR 370.21): ACUTE: Yes; CHRONIC: No; FIRE: No; REACTIVE: No; SUDDEN RELEASE: Yes

U.S. CERCLA Reportable Quantities (RQ): Not applicable.

U.S. TSCA Inventory Status: This material is not included in the TSCA Inventory. In accordance with the conditions listed in 40 CFR 720.36 and 721.47, this product must be used only for research and development, pharmaceutical manufacture, or export. This compound must be used by, or directly under the supervision of, a technically qualified individual. The manufacturer should be consulted prior to using this product for other applications.

Other U.S. Federal Regulations: Not applicable.

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): This gas is not on the California Proposition 65 lists.

ADDITIONAL CANADIAN REGULATIONS:

Canadian DSL/NDSL Inventory Status: This material is not on the DSL or NDSL Inventories. This gas must be used for research purposes only.

Canadian Environmental Protection Act (CEPA) Priorities Substances Lists: This gas is not listed on the CEPA Priority Substances Lists.

Canadian WHMIS Regulations: This gas is classified as a Controlled Product, Hazard Class A, Class D2B, as per the Controlled Product Regulations.

ADDITIONAL EUROPEAN REGULATIONS:

Safety, Health, and Environmental Regulations/Legislation Specific for the Product: Currently, there is no specific legislation pertaining to this gas mixture.

Chemical Safety Assessment: No data available. The chemical safety assessment is required for some substances according to European Union Regulation (EC) 1907/2006, Article 14.

16. OTHER INFORMATION

GLOBAL HARMONIZATION AND EU CLP REGULATION (EC) 1272/2208 LABELING AND CLASSIFICATION: Classified in accordance with CLP Regulation (EC) 1272/2008. For information on classification under (67/548/EEC), see below.

Classification: Gases under Pressure, Skin Irritation Category 2A, Eye Irritation Category 2B

Signal Words: Danger

Hazard Statements: H280: Contains gas under pressure; may explode if heated. H315 + H320: Causes skin and eye irritation. H335: May cause respiratory irritation.

Prevention Statements: P410 + P403+ P233, P405, P501

Precautionary: P261: Avoid breathing mists, sprays, fume. P264: Wash thoroughly after handling. P271: Use only outdoors or in a well-ventilated area. P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response: P304 + P340: If inhaled, remove victim to fresh air and keep at rest in a position comfortable for breathing. P312: Call a POISON CENTER or doctor if you feel unwell. P305 + P351 + P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. P337 + P313: If eye irritation persists: Get medical advice/attention. P302 + P352: IF ON SKIN: Wash with plenty of soap and water. P332 + P313: If skin irritation occurs, get medical attention. P362 + P364: Take off contaminated clothing and wash it before reuse. P321: Specific treatment (remove from exposure and treat symptoms). Refer to other portions of precautionary text on this label, SDS or other product information sheets, as appropriate.

Storage: P410: Protect from sunlight. P403 + P233 + P405: Store in a well-ventilated place. Keep container tightly closed. Store locked up.

Disposal: P501: Dispose of contents/containers in accordance with all local, regional, national and international regulations.

Hazard Symbol: GHS04, GHS07

EU 67/548/EEC LABELING AND CLASSIFICATION: Under European Union Council Directive 67/548/EEC and subsequent Directives, this is no classification for simple compressed gases.

Classification: Irritant

Risk Phrases: R36/37/38: Irritating to eyes, respiratory system and skin.

Safety Phrases: S3/7/9: Keep container tightly closed in a cool, well-ventilated place. S23: Do not breathe gas. S36/37/39: Wear suitable protective clothing, gloves and eye/face protection.

Hazard Symbol: Xi

16. OTHER INFORMATION (Continued)

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 use 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 gas mixtures can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 4221 Wainey Road, 5th Floor, Chantilly, VA 20151-2923 Telephone: (703) 788-2700.

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

REFERENCES AND DATA SOURCES: Contact the supplier for information.

REVISION DETAILS: New

METHODS OF EVALUATING INFORMATION FOR THE PURPOSE OF CLASSIFICATION: Bridging principles were used to classify this product.

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. • PO 1961, Hilo, HI 96721 • (800) 441-3365 • (808) 969-4846

SDS INFORMATION: 1-800-819-1704

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