



SAFETY DATA SHEET

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

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

IDENTIFICATION of the SUBSTANCE or PREPARATION 1,1,1,3,3-PENTAFLUOROPROPANE

SYNONYMS: Propane, 1,1,1,3,3-pentafluoro-; F 245fa; Fluorocarbon HFC245fa; HFC 245fa; R 245fa; Refrigerant gas R-245fa

CHEMICAL FAMILY NAME: Fluoropropane / Fluoroalkane

FORMULA: C₃H₃F₅ or C₃F₅H₃ or CHF₂CH₂CF₃

RELEVANT USE:

USES ADVISED AGAINST

Document Number: 80031

Various

Other than Relevant Use



MANUFACTURED/SUPPLIED FOR:

SUPPLIER/MANUFACTURER'S NAME:

ADDRESS:

AIR LIQUIDE AMERICA

2700 Post Oak Drive

Houston, TX 77056-8229

EMAIL ADDRESS FOR PRODUCT INFORMATION: webmaster.us@airliquide.com

EMERGENCY PHONE:

CHEMTREC: (U.S., Canada) 1-800-424-9300 (24 hrs)

(International) +01-703-527-3887 (collect-24 hrs)

BUSINESS PHONE:

General SDS Information: 1-713/896-2896 (8 am to 5 pm U.S. Central Time)

Fax on Demand: 1-800/231-1366

ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-2010 format. This product 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 2013.

2. HAZARD IDENTIFICATION

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: Gases Under Pressure, Acute Inhalation Toxicity Cat. 5, Eye Irritation Cat. 2B, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Aquatic Acute Toxicity Cat. 3, Aquatic Chronic Toxicity Cat. 3

Signal Words: Danger

Hazard Statement Codes: H280, H320, H333, H335, H402, H413

Precautionary Statement Codes: P261, P264, P271, P273, P281, P308 + P313, P305 + P351 + P338, P337 + P313, P304 + P340, P321, P410 + P403 + P233, P405, P501

Hazard Symbols/Pictograms: GHS04, GHS07



EU 67/548/EEC LABELING AND CLASSIFICATION: This compound has been classified per European Union Council Directive 67/548/EEC or subsequent Directives. The following is a self-classification based on anticipated hazards.

Classification: Irritant

Risk Phrase Codes: R36/37/38, R52/53

Safety Phrases: S36/37/39, S38, S45, S61

Hazard Symbols: Xi



See Section 16 for full text of classification

EMERGENCY OVERVIEW: Product Description: This compound is a clear, colorless compressed gas or liquefied gas with a slight ethereal odor. **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 or eye contact. Inhalation can cause cardiac disturbances and sensitization to epinephrine. **Flammability Hazards:** Although this is not a flammable gas, it can burn if heated at high temperatures or if involved in a fire. If involved in a fire, this material will ignite to produce toxic gases (carbon oxides, hydrogen fluoride, carbonyl fluoride, tetrafluoropropene). **Reactivity Hazards:** No information is available on the reactivity of this compound. **Environmental Hazards:** This gas is a greenhouse gas which may contribute to the global warming if released in large quantity. This gas is also harmful to aquatic organisms and may cause harm if released to an aquatic environment. **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 |
|------------------------------|----------|--------------------|--------|---|
| 1,1,1,3,3-Pentafluoropropane | 460-73-1 | 419-170-6 | 100% | <u>EU 67/548/EEC</u> Classification: Irritant Risk Phrases: R36/37, R52/53 Symbols: Xi <u>GHS & EU CLP: 1272/2008:</u> Classification: Gases Under Pressure, Oxidizing Gas Cat. 1, Acute Inhalation Toxicity Category 5, Eye Irritation Cat. 2B, STOT (Inhalation-Respiratory Irritation) SE Cat. 3, Aquatic Acute Toxicity Cat. 3, Aquatic Chronic Toxicity Cat. 3 Hazard Statement Codes: H280, H320, H333, H335, H402, H412 Hazard Symbols/Pictograms: GHS04, GHS07 |

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.

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 available.

AUTOIGNITION TEMPERATURE: 412°C (774°F)

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

FIRE EXTINGUISHING MEDIA: Extinguish fires of this gas by shutting-off the source of the gas. Use water spray to cool fire-exposed containers, 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.

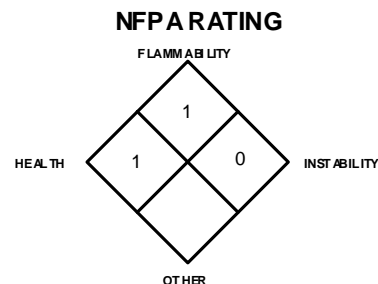
SPECIFIC HAZARDS ARISING FROM THE CHEMICAL: Although this is not a flammable gas, it can burn if heated at high temperatures or if involved in a fire. Decomposes above 350°C (662°F). Liquefied gas can accumulate static charge.

The gas can accumulate in confined spaces and low areas, resulting in an oxygen deficiency. During a fire, corrosive and very toxic gases such as hydrogen fluoride and carbonyl fluoride may be generated, as well as carbon oxides and tetrafluoropropene. 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.



5. FIRE-FIGHTING MEASURES (Continued)

SPECIAL PROTECTIVE ACTIONS FOR FIRE-FIGHTERS (continued): 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:

All Releases: Minimum Personal Protective Equipment should be **Level A: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), fully-encapsulating chemically resistant suit and boots, hard-hat, and Self Contained Breathing Apparatus.** The atmosphere must have 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

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 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. Non-sparking tools must be used.

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. Use piping and equipment adequately designed to withstand pressures to be encountered. Do not heat cylinder by any means to increase the discharge rate of the gas from the cylinder. Do not use oils or grease on gas-handling fittings or equipment. Do not "crack" valve open before connecting it, since self-ignition may occur. Leak check system with leak detection solution, never with flame. 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 overly tight or rusted caps. Never strike an arc on a compressed gas cylinder or make a cylinder part of an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. 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.

NOTE: Use only DOT or ASME code containers designed for liquefied gas storage.

SPECIFIC END USE(S): This product is for use within the electronics industry. Follow all industry standards for use of this product.

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.

7. HANDLING and USE (Continued)

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT (continued): Purge gas handling equipment with inert gas (i.e. argon) before attempting repairs. 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 | |
| 1,1,1,3,3-Pentafluoropropane | 460-73-1 | NE | NE | NE | NE | NE | NE | NE | NE |

NE = Not Established.

International Exposure Limits: Currently, there are no international exposure limits for this gas.

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), U.S. Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), 29 CFR 1910.133 for eye protection, 29 CFR 1910.138 for hand protection, 29 CFR 1910.136 for foot protection, equivalent standards of Canada (including CSA Standard Z94.4-02, CSA Standard Z94.3-02, CSA Standard Z94.4-93 for respiratory protection, CSA Standard Z94.3-M1982, *Industrial Eye and Face Protectors* and CSA Standard Z195-M1984, *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), those of Singapore, standards of Japan, including Japanese Standard JIS T 8150:200, 6 (respiratory protection), JIS T 8116:2005 (hand protection), JIS T 8147:2003 (eye protection) and JIS T 8030:2005 (body protection) or standards of Korea, China, Singapore and Taiwan. 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: Use approved safety goggles or safety glasses. If necessary, refer to appropriate regulations.

Hand Protection: Wear leather gloves when handling cylinders of this gas. Otherwise, wear glove protection appropriate to the specific operation for which this gas is used. 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.

MOLECULAR FORMULA: C₃H₃F₅ or C₃F₅H₃ or CHF₂CH₂CF₃

ODOR: Odorless.

VAPOR PRESSURE @ 20°C: 17.8 psia (1.227 bar)

FREEZING POINT: -103°C (-153.4°F)

GAS DENSITY: 4.6

SOLUBILITY IN WATER: 1.30 g/L

AUTOIGNITION TEMPERATURE: 412°C (774°F)

DECOMPOSITION TEMPERATURE: > 350°C (> 662°F) (est.)

CRITICAL PRESSURE: 3639 kPa (35.92 atm)

EVAPORATION RATE: Not applicable as a gas; liquefied gas rapidly returns to the gaseous state at room temperature.

COEFFICIENT WATER/OIL DISTRIBUTION: Log Pow: 1.35; Log P(oct) = 2.04 (est.)

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.

COLOR: Colorless.

MOLECULAR WEIGHT: 134.03 g/mol

ODOR THRESHOLD: Not applicable.

BOILING POINT: 15.3°C (59.54°F)

pH: Not available.

EXPANSION RATIO: Not available.

OTHER SOLUBILITIES: Not available.

FLASH POINT: Not flammable.

CRITICAL TEMPERATURE: 154°C (309°F)

DIELECTRIC CONSTANT @ 20°C: 6.8

10. STABILITY and REACTIVITY

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

DECOMPOSITION PRODUCTS: *Combustion:* Carbon oxides, hydrogen fluoride, carbonyl fluoride, tetrafluoropropene. *Hydrolysis:* None known.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: This compound is incompatible with strong oxidizing agents, alkaline-earth and alkali metals including magnesium and alloys containing more than 2% magnesium.

POSSIBILITY OF HAZARDOUS REACTION/POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to air, heat, sparks and other sources of ignition, water and moisture.

11. TOXICOLOGICAL INFORMATION

SYMPTOMS OF EXPOSURE BY ROUTE OF EXPOSURE: The main route of exposure for this gas is by inhalation. Skin and eye contact may cause frostbite or irritation.

Inhalation: Inhalation may cause irritation to the respiratory system. Inhalation can cause cardiac sensitization to epinephrine and subsequent abnormal heart rhythms. 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

12-16% Oxygen:

10-14% Oxygen:

6-10% Oxygen:

Below 6%:

OBSERVED EFFECT

Breathing and pulse rate increase, muscular coordination slightly disturbed.

Emotional upset, abnormal fatigue, disturbed respiration.

Nausea, vomiting, collapse, or loss of consciousness.

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.

Contact with Skin or Eyes: Contact of this gas 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. Rapidly expanding gas may cause frostbite. Frostbitten skin is pale and waxy and may have no immediate pain. Lack of rapid treatment can lead to tissue necrosis.

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 applicable to compressed gases.

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

Acute: Inhalation can cause cardiac sensitization and abnormal heart rhythms. 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, heart, eyes. CHRONIC: Skin, respiratory system, heart, central nervous system.

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

LC₅₀ (Inhalation-Rat) > 200,000 ppm/4 hours

LC₅₀ (Inhalation-Mouse) > 100,000 ppm/4 hours

LD₅₀ (Skin-Rabbit) > 2,000 mg/kg

LCLo (Inhalation-Mouse) 15 pph/2 hours: Behavioral: changes in motor activity (specific assay); Behavioral: ataxia; Lungs, Thorax, or Respiration: respiratory depression

TCLo (Inhalation-Rat) 50,000 ppm/6 hours: Liver: other changes; Kidney/Ureter/Bladder: other changes in urine composition

TCLo (Inhalation-Rat) 50,000 ppm/90 days-intermittent: Cardiac: cardiomyopathy including infarction

CARCINOGENIC POTENTIAL: This gas 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: This gas may be irritating if inhaled or by eye contact.

SENSITIZATION TO THE PRODUCT: No data is available as to whether this gas is a human skin or respiratory sensitizer. Animal testing indicate this material can be a cardiac sensitizer; may cause sensitization to epinephrine and subsequent heart arrhythmias.

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.



HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

| | | |
|---------------|--------|---|
| HEALTH HAZARD | (BLUE) | 1 |
|---------------|--------|---|

| | | |
|---------------------|-------|---|
| 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

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: 275.5; Log Koc: 2.440

12. ECOLOGICAL INFORMATION (Continued)

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): 0.1633

Biowin2 (Non-Linear Model): 0.0103

Expert Survey Biodegradation Results:

Biowin3 (Ultimate Survey Model): 2.3900 (weeks-months)

Biowin4 (Primary Survey Model): 3.3799 (days-weeks)

MITI Biodegradation Probability:

Biowin5 (MITI Linear Model): 0.3990

Biowin6 (MITI Non-Linear Model): 0.0

Anaerobic Biodegradation Probability:

Biowin7 (Anaerobic Linear Model): 0.6962

Ready Biodegradability Prediction: No

Atmospheric Oxidation (25 deg C) [AopWin v1.92]:

Hydroxyl Radicals Reaction:

Overall OH Rate Constant = $0.0297 \text{ E-12 cm}^3/\text{molecule-sec}$

Half-Life = 360.070days (12-hr day; $1.5\text{E6 OH}/\text{cm}^3$)

Ozone Reaction:

No Ozone Reaction Estimation

Fraction sorbed to airborne particulates (phi) [Junge,Mackay]: 1.16E-009

Note: the sorbed fraction may be resistant to atmospheric oxidation

Volatilization from Water:

Henry LC: $0.0689 \text{ atm-m}^3/\text{mole}$ (estimated by Bond SAR Method)

Half-Life from Model River: 1.191 hours

Half-Life from Model Lake: 110.1 hours (4.587 days)

Removal in Wastewater Treatment:

Total removal = 96.39%

Total Biodegradation: 0.02%

Total Sludge Adsorption: 0.57%

Total to Air: 95.81%, (using 10000 hr Bio P,A,S)

Level III Fugacity Model:

| | Mass Amount (percent) | Half-Life (hr) | Emissions (kg/hr) |
|----------|--------------------------|--------------------|----------------------|
| Air | 5.15 | $3.53\text{e}+004$ | 1000 |
| Water | 47 | 900 | 1000 |
| Soil | 1.38 | $1.8\text{e}+003$ | 1000 |
| Sediment | 0.19 | $8.1\text{e}+003$ | 0 |

Persistence Time: 167 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 = 0.869 (BCF = 7.404)

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 is not listed as having ozone depletion potential. This gas is a greenhouse gas which may contribute to the global warming if released in large quantity. Global Warming Potential: 950 ($\text{CO}_2 = 1$; 100 years).

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

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with any residual gas 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, away from all sources of ignition.

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 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. (1,1,1,3,3-Pentafluoropropane, R245fa)

Hazard Class Number and Description:

2.2 (Non-Flammable Gas)

Packing Group:

Not Applicable

Dot Label(s) Required:

Class 2.2 (Non-Flammable Gas)

North American Emergency Response Guidebook Number (2012): 126

Marine Pollutant: This material does not meet the criteria of a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

14. TRANSPORTATION INFORMATION (Continued)

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas 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.

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|---|--|
| UN Identification Number: | UN 3163 |
| Proper Shipping Name: | Liquefied gas, n.o.s. (1,1,1,3,3-Pentafluoropropane, R245fa) |
| Hazard Class Number and Description: | 2.2 (Non-Flammable Gas) |
| Packing Group: | None |
| Hazard Shipping Label(s) Required: | Class 2.2 (Non-Flammable Gas) |
| Special Provisions: | 16 |
| Explosive Limit & Limited Quantity Index: | 0.125 |
| ERAP Index: | Not Applicable |
| Passenger Carrying Ship Index: | None |
| Passenger Carrying Road or Rail Vehicle Index: | 75 |

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

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|--|--|
| UN Identification Number: | UN 3163 |
| Proper Shipping Name: | Liquefied gas, n.o.s. (1,1,1,3,3-Pentafluoropropane, R245fa) |
| 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 |
| 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 SHIPPING INFORMATION (IMO): This material is classified as dangerous goods, per the International Maritime Organization.

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|---|--|
| UN Identification Number: | UN 3163 |
| Proper Shipping Name: | Liquefied gas, n.o.s. (1,1,1,3,3-Pentafluoropropane, R245fa) |
| Hazard Class Number and Description: | 2.2 (Non-Flammable Gas) |
| Labels: | Class 2.2 (Non-Flammable Gas) |
| 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-C, S-V |
| Stowage Category: | Category A |

Marine Pollutant: This compound does not meet the criteria under the IMO to be a Marine Pollutant.

EUROPEAN AGREEMENT CONCERNING THE INTERNATIONAL CARRIAGE OF DANGEROUS GOODS BY ROAD

(ADR): This material is classified by the Economic Commission for Europe to be dangerous goods.

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|--|---|
| UN No.: | 3163 |
| Proper Shipping Name: | Liquefied gas, n.o.s. (1,1,1,3,3-Pentafluoropropane, R245fa) |
| Class: | 2.2 |
| Classification Code: | 2A |
| Packing Group: | Not Applicable |
| Labels: | 2.2 |
| Special Provisions: | 274 |
| Limited Quantities: | 120 mL |
| Excepted Quantities: | E1 |
| Packaging: | Packing Instructions: P200; Special Packing Instructions: None Mixed Packing Provisions: MP9 |
| Portable Tanks and Bulk Containers: | Instructions: (M) T50; 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 UNITED STATES 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 (TPQ): There are no specific Threshold Planning Quantities for this gas. 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. TSCA Inventory Status: This material is included in the TSCA Inventory.

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

Other U.S. Federal Regulations: Not applicable.

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

ADDITIONAL CANADIAN REGULATIONS:

Canadian DSL/NDL Inventory Status: This material is on the DSL Inventory.

Canadian Environmental Protection Act (CEPA) Priorities Substances Lists: This gas has the following CEPA Reporting Requirements:

- Any activity involving, in any one calendar year, more than 1 000 kg of Propane, 1,1,1,3,3-pentafluoro, other than
(a) its use in closed-loop cooling systems, whether for refrigeration or air conditioning; or
(b) its use as a foam-blowing agent or aerosol solvent.
- For each proposed significant new activity, the following information must be provided to the Minister at least 90 days before the day on which the quantity of the substance exceeds 1 000 kg in any one calendar year:
(a) a description of the significant new activity in relation to the substance;
(b) the information specified in Schedule 4 to the New Substances Notification Regulations (Chemicals and Polymers);
(c) the information specified in item 8 and subitems 10(a) to (d) of Schedule 5 to those Regulations;
(d) the pollution prevention measures proposed to prevent or reduce releases of the substance into the environment; and
(e) the specific substance name, the Chemical Abstracts Service registry number, if any, and the molecular formula of the substance it is replacing.
- The above information will be assessed within 90 days after the day on which it is received by the Minister.

Canadian WHMIS Regulations: This compound would be classified as a Controlled Product, Hazard Classes A and D2B as per the Controlled Product Regulations.



ADDITIONAL EUROPEAN REGULATIONS:

Safety, Health, and Environmental Regulations/Legislation Specific for the Product: Regulation on Fluorinated greenhouse gases 842/2006/EC: This gas is listed.

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) 1272/2008 LABELING AND CLASSIFICATION: This product has been classified per GHS Standards under U.S., Japanese and European regulations. For information on EU classification under (67/548/EEC), see below.

Classification: Gases Under Pressure, Acute Inhalation Toxicity Category 5, Eye Irritation Category 2B, Specific Target Organ Toxicity (Inhalation-Respiratory Irritation) Single Exposure Category 3, Aquatic Acute Toxicity Category 3, Aquatic Chronic Toxicity Category 3

Signal Words: Danger

Hazard Statements: H280: Contains gas under pressure; may explode if heated. H333: May be harmful if inhaled. H320: Causes eye irritation. H335: May cause respiratory irritation. H402: Harmful to aquatic life. H412: Harmful to aquatic life with long-lasting effects.

Prevention Statements:

Precautionary: P261: Avoid breathing gas. P264: Wash thoroughly after handling. P271: Use only outdoors or in a well-ventilated area. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response: P308 + P313: IF exposed or concerned: Get medical advice/attention. P304 + P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. 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. 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 + P403 + P233: Protect from sunlight. Keep container tightly closed. Store in a well-ventilated place. P405: Store locked up.

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

Hazard Symbol/Pictograms: GHS04, GHS07

16. OTHER INFORMATION (Continued)

EU 67/548/EEC LABELING AND CLASSIFICATION: This product has been classified as per European Union Council Directive 67/548/EEC or subsequent Directives.

Classification: Irritant

Risk Phrases: R36/37/38: Irritating to eyes, respiratory system and skin. R52/53: Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases: S36/37/39: Wear suitable protective clothing, gloves and eye/face protection. S45: In case of accident or if you feel unwell seek medical advice immediately (show the label where possible). S61: Avoid release to the environment. Refer to special instructions/safety data sheet.

Hazard Symbols: Xi

REFERENCES AND DATA SOURCES: Contact the supplier for information.

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

REVISION DETAILS: New

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 can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 421 Walney Road, 5th Floor, Chantilly, VA 20151. Telephone: (703) 788-2700, Fax: (703) 961-1831.

“Safe Handling of Compressed Gases in Containers” (P-1, 1999)

“Safe Handling and Storage of Compressed Gases” (AV-1, 1999)

“Handbook of Compressed Gases” (1992)

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc. • PO Box 1961, Hilo, HI 96721 • 800-441-3365 • 808-969-4846
Fax on Demand: 1-800/231-1366



This 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 Air Liquide America Electronics Chemicals & Services Inc.'s 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.