



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT AND COMPANY INFORMATION

CHEMICAL NAME; CLASS: TETRAFLUOROMETHANE

SYNONYMS: Carbon Tetrafluoromethane; Carbon Tetrafluoride; Fluorocarbon 14; FC 14; Freon 14, Halon 14; R-14

CHEMICAL FAMILY NAME: Halogenated Aliphatic Hydrocarbon

FORMULA: CF₄

PRODUCT USE:

Document Number: 20159

Refrigerant; gaseous insulator; propellant in insecticidal aerosols, as a solvent; chemical intermediate; dry etchant in microchip manufacture.

**MANUFACTURED/SUPPLIED FOR:
ADDRESS:**



2700 Post Oak Drive
Houston, TX 77056-8229

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300

BUSINESS PHONE:

General MSDS Information 1-713/896-2896
Fax on Demand: 1-800/231-1366

2. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Tetrafluoromethane is an odorless, colorless non-flammable, liquefied gas. Tetrafluoromethane can cause central nervous system depression after inhalation exposures. Symptoms of such over-exposure can include drowsiness, fatigue, and weakness. At high concentrations, the gas can act as an asphyxiant, by displacing oxygen. Therefore, exposure to high concentrations of this gas can be fatal. Frostbite can be caused by contact with rapidly expanding gases or the liquefied gas. This gas is not flammable and not reactive in normal emergency response situations. However, if involved in a fire, this product can decompose to produce toxic gases (i.e. hydrogen fluoride, phosgene).

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas is by inhalation.

INHALATION: Exposures to high concentrations of this gas may cause sensitization of the heart to adrenaline and nor-adrenaline. Effects of such over-exposure can include light-headedness, giddiness, shortness of breath and in extreme cases, irregular heartbeats, cardiac arrest, and death.

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.

Under some circumstances of over-exposure, death may occur, due to the displacement of oxygen. The following effects associated with various levels of oxygen are as follows:

<u>CONCENTRATION</u>	<u>SYMPTOM OF EXPOSURE</u>
12-16% Oxygen:	Breathing and pulse rate increased, muscular coordination slightly disturbed.
10-14% Oxygen:	Emotional upset, abnormal fatigue, disturbed respiration.
6-10% Oxygen:	Nausea and vomiting, collapse or loss of consciousness.
Below 6%:	Convulsive movements, possible respiratory collapse, and death.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to Tetrafluoromethane may cause the following health effects:

ACUTE: The most significant hazard associated with this gas is inhalation of oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, and, at high concentrations, unconsciousness or death may occur. The skin of a victim of over-exposure may have a blue color.

CHRONIC: There are currently no known adverse health effects associated with chronic exposure to this product.

TARGET ORGANS: Respiratory system.

3. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA			OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm	IDLH ppm	
Tetrafluoromethane	75-73-0	100	There are no specific exposure limits for Tetrafluoromethane. Tetrafluoromethane an asphyxiant. Oxygen levels should be maintained above 19.5%.					

This material is classified as hazardous under OSHA regulations in the United States and the WHMIS in Canada.

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used.

NOTE: all WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-2004 format.

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 should be worn.

Remove victim(s) to fresh air, as quickly as possible. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Only trained personnel should administer supplemental oxygen.

4 FIRST-AID MEASURES (Continued)

SKIN EXPOSURE: Contact with the liquid or rapidly expanding gases can cause frostbite. In the event of frostbite, medical attention must be sought. 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 liquid is splashed into eyes, or if irritation of the eye develops after exposure to liquid or gas, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

Victim(s) must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to physician or other health professional with victim(s).

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, inert gas. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: When involved in a fire, this material may decompose and produce toxic gases (i.e. hydrogen fluoride, and carbonyl fluoride). Tetrafluoromethane does not burn; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural fire-fighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be: **Level B: Self-Contained Breathing Apparatus.** Locate and seal the source of the leaking gas. Allow the gas, which is heavier than air to dissipate. Monitor the surrounding area for oxygen levels. The atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

If leaking incidentally from the cylinder or its valve, contact your supplier.

7. HANDLING AND STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: 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.

STORAGE AND HANDLING PRACTICES: 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. Keep storage area clear of materials which can burn. Do not allow area where cylinders are stored to exceed 52°C (125°F). Store containers away from heavily trafficked areas and emergency exits. 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. Use only storage containers and equipment (pipes, valves, fittings to relieve pressure, etc.) designed for the temperatures and pressures for the use and storage of Liquid Tetrafluoromethane.

Use a check valve or other protective device in the discharge line to prevent hazardous backflow. Never tamper with pressure relief valves and cylinders.

7. HANDLING AND STORAGE (Continued)

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.

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 an electric circuit.

After Use: Close main cylinder valve. Valves should be closed tightly. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers designed for gas storage. Close valve after each use and when empty.

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA: Use the proper CGA connections, DO NOT USE ADAPTERS:

<u>THREADED:</u>	0-3000 psig - CGA 580
<u>PIN-INDEXED YOKE:</u>	Not Applicable.
<u>ULTRA HIGH INTEGRITY:</u>	Not Applicable.

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. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

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

RESPIRATORY PROTECTION: Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if oxygen levels are below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards.

EYE PROTECTION: Safety glasses.

HAND PROTECTION: Wear leather gloves or glove protection appropriate to the specific operation for which this product is used.

BODY PROTECTION: Use body protection appropriate for task. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.228 lb/ft³ (3.65 kg/m³)

BOILING POINT @ 1 atm: -127.9°C (198.3°F -)

FREEZING/MELTING POINT @ 325 psia: -183.6°C (-298.5°F)

SPECIFIC GRAVITY (air = 1) @ 21.1°C (70°F) and 1 atm: 3.050

SOLUBILITY IN WATER weight % @ 25°C (77°F): 0.0015

EVAPORATION RATE (nBuAc = 1): Not applicable.

ODOR THRESHOLD: Not applicable.

VAPOR PRESSURE: Not applicable.

COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

APPEARANCE AND COLOR: Colorless, odorless, non-flammable gas.

pH: Not applicable.

MOLECULAR WEIGHT: 88.01

EXPANSION RATIO: Not applicable.

SPECIFIC VOLUME (ft³/lb): 4.38

9. PHYSICAL and CHEMICAL PROPERTIES (Continued)

HOW TO DETECT THIS SUBSTANCE (warning properties): There are no distinct warning properties. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Tetrafluoromethane is exposed to fire, it may decompose yielding toxic products (i.e. hydrogen fluoride, carbonyl fluoride).

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: The following materials are not compatible with this product: aluminum, carbon dioxide above 1000 °C; alloys of more than 2% magnesium in the presence of water. Silver and copper-bearing alloys can act as catalysts for the decomposition of this product at high temperatures.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials and avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Tetrafluoromethane.

LCLo (inhalation, rat) = 890000 ppm/15 minutes

SUSPECTED CANCER AGENT: Tetrafluoromethane is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, IARC, and therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Tetrafluoromethane is not irritating; however, contact with rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION OF PRODUCT: Tetrafluoromethane is not known to cause sensitization in humans.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects Tetrafluoromethane on the human reproductive system.

Mutagenicity: Tetrafluoromethane is not expected to cause mutagenic effects in humans.

Embryotoxicity: Tetrafluoromethane is not expected to cause embryotoxic effects in humans.

Teratogenicity: Tetrafluoromethane is not expected to cause teratogenic effects in humans.

Reproductive Toxicity: Tetrafluoromethane is not expected to cause adverse reproductive effects in humans.

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions and cardio-vascular conditions may be aggravated by over-exposure to Tetrafluoromethane.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and reduce over-exposure.

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Tetrafluoromethane.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Any adverse effect on animals would be related to adverse effects on the cardiovascular system and to exposure to oxygen deficient environments. The symptoms experienced by over-exposed animals would be similar to those described for exposed humans. No adverse effect is anticipated to occur to plant-life, except for frost produced in the presence of rapidly expanding gases.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this product's effects on aquatic life.

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 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.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Tetrafluoromethane
HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER: UN 1982
PACKING GROUP: Not applicable.
DOT LABEL(S) REQUIRED: Non-Flammable Gas
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 126

MARINE POLLUTANT: Tetrafluoromethane is not classified by the DOT as a Marine Pollutant (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 present serious safety hazards and should be discouraged.

NOTE: Shipment of compressed gas cylinders which have not been filled with the owners consent is a violation of Federal law (49 CFR, Part 173.301 (b)).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: Tetrafluoromethane is not subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act.

SARA Threshold Planning Quantity: Not applicable.

TSCA INVENTORY STATUS: Tetrafluoromethane is listed on the TSCA Inventory.

CERCLA REPORTABLE QUANTITIES (RQ): Not applicable.

CALIFORNIA PROPOSITION 65: Tetrafluoromethane is not on the California Proposition 65 lists.

STATE REGULATORY INFORMATION: Tetrafluoromethane is covered under the following specific State regulations:

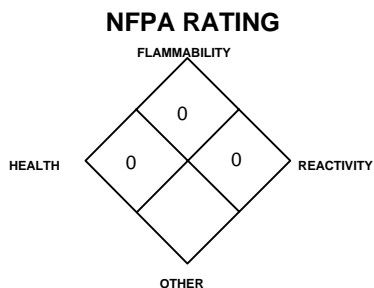
Alaska - Designated Toxic and Hazardous Substances: No.	Minnesota - List of Hazardous Substances: No.	Pennsylvania - Hazardous Substance List: No.
California - Permissible Exposure Limits for Chemical Contaminants: No.	Missouri - Employer Information/Toxic Substance List: No.	Rhode Island - Hazardous Substance List: No.
Florida - Substance List: No.	New Jersey - Right to Know Hazardous Substance List: Tetrafluoromethane.	Texas - Hazardous Substance List: No.
Illinois - Toxic Substance List: No.	North Dakota - List of Hazardous Chemicals, Reportable Quantities: No.	West Virginia - Hazardous Substance List: No.
Kansas - Section 302/313 List: No.		Wisconsin - Toxic and Hazardous Substances: No.
Massachusetts - Substance List: No.		

OTHER U.S. FEDERAL REGULATIONS:

- Tetrafluoromethane does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82).
- Tetrafluoromethane is not listed as a Regulated Substance, per 40 CFR, Part 68, of the Risk Management for Chemical Accidental Release Prevention.
- Tetrafluoromethane is not subject to the reporting requirements of Section 112(r) of the Clean Air Act.
- Tetrafluoromethane is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals.

OTHER CANADIAN REGULATIONS: Tetrafluoromethane is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

16. OTHER INFORMATION



HAZARDOUS MATERIAL INFORMATION SYSTEM		
HEALTH	(BLUE)	0
FLAMMABILITY	(RED)	0
REACTIVITY	(YELLOW)	0
PROTECTIVE EQUIPMENT	B	
EYES	RESPIRATORY	HANDS
BODY		
See Section 8		
For routine industrial applications		

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

- P-1 *"Safe Handling of Compressed Gases in Containers"*
- P-14 *"Accident Prevention in Oxygen-Rich, Oxygen-Deficient Atmospheres"*
- SB-2 *"Oxygen Deficient Atmospheres"*
- AV-1 *"Safe Handling and Storage of Compressed Gases"*
- "Handbook of Compressed Gases"*

PREPARED BY: CHEMICAL SAFETY ASSOCIATES, Inc.
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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 Air Liquide'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.