

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Silicon tetrafluoride, compressed (MSDS No. P-4652-D)		Trade Name: Silicon Tetrafluoride	
Chemical Name: Silicon tetrafluoride		Synonyms: Tetrafluorosilane	
Formula: F ₄ Si		Chemical Family: Silicon halide	
Telephone:	Emergencies: 1-800-645-4633*	Company Name: Praxair, Inc.	39 Old Ridgebury Road
	CHEMTREC: 1-800-424-9300*		Danbury, CT 06810-5113
	Routine: 1-800-PRAXAIR		

* Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Composition/Information on Ingredients

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA (2001)
Silicon tetrafluoride	7783-61-1	>99%*	None currently established**	None currently established**

*The symbol > means "greater than"; the symbol <, "less than."

**See section 3.

3. Hazards Identification

EMERGENCY OVERVIEW



DANGER! Toxic, corrosive high-pressure gas.
Harmful if inhaled.
Can cause eye, skin, and respiratory tract burns.
Contact with organic or silica materials may cause fire.
Contact with water may cause violent reaction.
Self-contained breathing apparatus and protective clothing must be worn by rescue workers.
Odor: Suffocating



THRESHOLD LIMIT VALUE: TLV-TWA, none currently established (ACGIH, 2001). Praxair recommends compliance with the OSHA and ACGIH (2001) limits of 3 ppm (ceiling) for hydrogen fluoride, formed by the hydrolysis of silicon tetrafluoride. NOTE: Ceiling limits are not Time Weighted Average (TWA). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION—May be fatal if inhaled. Extremely irritating to mucous membranes and respiratory tract. May cause throat irritation, coughing, choking sensation, chills, bronchospasm, laryngospasm, chest pain, permanent lung damage, pulmonary edema, and death.

SKIN CONTACT—Silicon tetrafluoride causes chemical burns; pain may be delayed. Skin burns may result in the absorption of potentially harmful amounts of material.

SWALLOWING—This product is a gas at normal temperature and pressure.

EYE CONTACT—Silicon tetrafluoride burns eye tissue.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE May cause bronchitis, nasal congestion, and fluorosis. May injure the cornea of the eye.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Breathing of vapor and/or mist may aggravate asthma and inflammatory or fibrotic pulmonary disease.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION: None known.

CARCINOGENICITY: Silicon tetrafluoride is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. Rescuer should avoid breathing air exhaled by victim. Call a physician. Oxygen should be administered by qualified personnel as follows: In minor exposures, give oxygen at half-hour intervals for 3 to 4 hours. In severe exposures, give oxygen under positive pressure (less than 4 cm) for half hour periods for at least 6 hours until breathing is easy and skin and mucous membrane color is normal.

SKIN CONTACT: Immediately remove contaminated clothing and flush skin with plenty of water. Soak burned areas in an iced, aqueous solution of 0.2% benzethonium chloride. Call a physician. Wash clothing before reuse.

SWALLOWING: An unlikely route of exposure. This product is a gas at normal temperature and pressure.

EYE CONTACT: Immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN: Do not give morphine, barbiturates, or cardiac and respiratory stimulants. If it is impractical to immerse the burned area, apply the iced solution with saturated compresses, which should be changed at least every 2 minutes.

5. Fire Fighting Measures

FLASH POINT (test method):	Not applicable
AUTOIGNITION TEMPERATURE:	Not applicable
FLAMMABLE LIMITS IN AIR, % by volume:	LOWER: Not applicable UPPER: Not applicable

EXTINGUISHING MEDIA: CO₂, dry chemical foam. Water may be ineffective. Use water spray or fog to reduce flammable vapors.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, corrosive high-pressure gas (see section 3). Reacts with water to form hydrogen fluoride fumes. Evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Immediately cool cylinders with water spray from maximum distance. Remove ignition sources if without risk. If cylinders are leaking, reduce toxic vapors with water spray or fog. Stop flow of gas if without risk, while continuing cooling water spray. Remove all cylinders from area of fire if without risk. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Heat of fire can build pressure in cylinder and cause it to rupture. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). Silicon tetrafluoride cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) Reverse flow into cylinder may cause rupture. Vapors are extremely irritating; contact may burn the skin and eyes.

HAZARDOUS COMBUSTION PRODUCTS: Not applicable.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED DANGER! Toxic, corrosive high-pressure gas (see section 3). Reacts with water to form hydrogen fluoride fumes. Evacuate all personnel from danger area. Reverse flow into cylinder may cause rupture. Do not approach area without self-contained breathing apparatus and full protective clothing. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Contain spills in protected areas; prevent runoff from exposing personnel to liquid and vapors and contaminating the surrounding environment. Poisonous, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device.

WASTE DISPOSAL METHOD: Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Store only where temperature will not exceed 125°F (52°C). Store full and empty cylinders separately. Use a first-in, first-out inventory system to prevent storing full cylinders for long periods.

PRECAUTIONS TO BE TAKEN IN HANDLING: Protect cylinders from damage. Use a suitable hand truck to move cylinders; do not drag, roll, slide, or drop. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. Never insert an object (e.g., wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Open valve slowly. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using silicon tetrafluoride, see section 16.

For additional information on storage and handling, refer to Compressed Gas Association (CGA) pamphlet P-1, *Safe Handling of Compressed Gases in Containers*, available from the CGA. Refer to section 16 for the address and phone number along with a list of other available publications.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—Use a corrosion-resistant local exhaust ventilation system.

MECHANICAL (general)—Inadequate; see Special.

SPECIAL—Use a closed system; a corrosion-resistant, forced-draft fume hood is preferred.

OTHER—See SPECIAL.

RESPIRATORY PROTECTION: Respirators must meet MSHA and NIOSH requirements. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

SKIN PROTECTION: Wear work gloves when handling cylinders; neoprene when changing them out.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles or face mask during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing where needed. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	104.08
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	3.64
GAS DENSITY at 70°F (21.1°C) and 1 atm:	0.273 lb/ft ³ (4.37 kg/m ³)
SOLUBILITY IN WATER:	Reacts
PERCENT VOLATILES BY VOLUME:	100
SUBLIMATION POINT at 1 atm:	-138.6°F (-94.8°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; suffocating odor.

10. Stability and Reactivity

STABILITY: Unstable Stable

INCOMPATIBILITY (materials to avoid): Water, trimethylamine, sodium, alkali metals

HAZARDOUS DECOMPOSITION PRODUCTS: Fluorine, silicon

HAZARDOUS POLYMERIZATION: May Occur Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

LC₅₀ = 450 ppm, mouse

12. Ecological Information

Silicon tetrafluoride does not contain any Class I or Class II ozone-depleting chemicals. Silicon tetrafluoride is not listed as a marine pollutant by DOT.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Silicon tetrafluoride, compressed

HAZARD CLASS:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.3	UN 1859	None

SHIPPING LABEL(s): POISON GAS, CORROSIVE*

PLACARD (when required): POISON GAS, CORROSIVE*

**The words in the POISON GAS diamond are INHALATION HAZARD.*

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. Cylinders transported in an enclosed, nonventilated compartment of a vehicle can present serious safety hazards.

Additional Marking: INHALATION HAZARD

Shipment of compressed gas cylinders that have been filled without the owner's consent is a violation of federal law [49 CFR 173.301(b)].

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

Threshold Planning Quantity (TPQ): None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: Yes

REACTIVITY: Yes

FIRE: No

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

This product does not require reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Silicon tetrafluoride is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Silicon tetrafluoride is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Silicon tetrafluoride is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Silicon tetrafluoride is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Silicon tetrafluoride is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Be sure to read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Toxic, corrosive high-pressure gas.* Harmful if inhaled. Do not breathe gas. Do not get liquid or vapor in eyes, on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. *Store and use with adequate ventilation at all times.* Always secure cylinder prior to use. *Use piping and equipment adequately designed to withstand pressures to be encountered.* Use only in a closed system constructed of corrosion-resistant materials. Close cylinder valve after each use; keep closed even when empty. *Prevent reverse flow.* Reverse flow into cylinder may cause rupture. Use a check valve or other protective device in any line or piping from the cylinder. *Never work on a pressurized system.* If there is a leak, close the cylinder valve. Blow the system down in a safe and environmentally sound manner in compliance with all federal, state, and local laws; then repair the leak. *When returning cylinder to supplier,* be sure valve is closed; then install valve outlet plug tightly. *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

NOTE: Prior to using any plastics, confirm their compatibility with silicon tetrafluoride.

Recommended Equipment: In semiconductor process gas and other suitable applications, Praxair recommends the use of engineering controls such as gas cabinet enclosures, automatic gas panels (used to purge systems on cylinder changeout), excess-flow valves throughout the gas distribution system, double containment for the distribution system, and continuous gas monitors.

MIXTURES: When you mix two or more gases or liquefied gases, you can 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 evaluate the end product. Remember, gases and liquids have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH	= 3
FLAMMABILITY	= 0
REACTIVITY	= 2
SPECIAL	= W

HMIS RATINGS:

HEALTH	= 3
FLAMMABILITY	= 0
REACTIVITY	= 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: CGA-330

PIN-INDEXED YOKE: Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: CGA-642

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlet V-1 listed below.

Ask your supplier about free Praxair safety literature as referred to in this MSDS and on the label for this product. Further information about this product can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700.

AV-1	<i>Safe Handling and Storage of Compressed Gases</i>
P-1	<i>Safe Handling of Compressed Gases in Containers</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair MSDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current Praxair MSDSs for these products, contact your Praxair sales representative or local distributor or supplier. If you have questions regarding Praxair MSDSs, would like the form number and date of the latest MSDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (**Phone:** 1-800-PRAXAIR;
Address: Praxair Call Center, Praxair, Inc., PO Box 44, Tonawanda, NY 14151-0044).

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