

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Sulfur tetrafluoride (MSDS No. P-4658-C)	Trade Name: Sulfur Tetrafluoride
Chemical Name: Sulfur Tetrafluoride	Synonyms: Tetrafluorosulfurane
Formula: SF ₄	Chemical Family: Sulfur Bearing
Telephone:	Company Name: Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
Emergencies: 1-800-645-4633*	
CHEMTREC: 1-800-424-9300*	
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

For custom mixtures of this product, request an MSDS for each component.
See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCENTRATION	OSHA PEL	ACGIH TLV (1999)
Sulfur Tetrafluoride	7783-60-0	>99%*	None currently established	0.1 ppm (ceiling)**

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

** Ceiling values are not Time-Weighted Average (TWA).

3. Hazards Identification

EMERGENCY OVERVIEW



**DANGER! Toxic, corrosive liquid and gas under pressure.
Harmful if inhaled.**



Causes eye and skin 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: Pungent, irritating

THRESHOLD LIMIT VALUE: 0.1 ppm TLV-ceiling ACGIH (1999) Note: Ceiling limits are *not* Time-Weighted Average (TWA).

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION—Sulfur tetrafluoride is corrosive and extremely irritating to the upper and lower respiratory tracts. Symptoms include coughing; rapid, labored breathing; and abnormal fluid buildup in the nose, mouth, and throat. Pneumonitis (deep lung inflammation) and pulmonary edema (buildup of fluid in the lungs) can be fatal. Symptoms may be delayed.

SKIN CONTACT—Vapor and liquid form hydrofluoric acid on contact with moisture and will burn the skin and mucous membranes. Symptoms include severe pain, redness, possible swelling, and tissue destruction, which continues as long as any active fluorides remain on tissues.

SWALLOWING—An unlikely route of exposure. This product is a gas at normal temperature and pressure, but burns of the mouth, esophagus, and stomach may result.

EYE CONTACT—Sulfur tetrafluoride is irritating and corrosive to eye tissue. Symptoms are burning and tears, resulting in scarring and possible blindness.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Absorption of low-levels of fluorides may cause fluorosis, an abnormal buildup of calcium in the bones.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Inhalation may aggravate asthma, emphysema, and other conditions involving respiratory distress.

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

CARCINOGENICITY: Sulfur tetrafluoride is not listed by NTP, OSHA, and IARC.

4. First Aid Measures

NOTE: *In case of contact or suspicion of contact with sulfur tetrafluoride, prompt medical attention is absolutely necessary. On severe exposure, such symptoms of shock as rapid pulse, sweating, and collapse may appear. Keep shock victims warm and at rest; call a physician.*

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration, preferably with simultaneous administration of oxygen. **Rescuer should avoid breathing any exhaled air from victim.** If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: Avoid breathing vapor. Immediately flush skin with large quantities of cool water while removing contaminated clothing and shoes. Follow by applying iced alcoholic or aqueous 0.2% zephiran chloride solution or Hyamine 1622 solution. If not available, continue washing in cool water for two to four hours or until medical attention arrives. Discard clothing and shoes. Call a physician.

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

EYE CONTACT: Remove contact lenses if present. Immediately flush eyes thoroughly with cool water for 15 to 30 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: *Severe burns due to concentrated fluoride or prolonged exposures may require calcium gluconate 10% infiltration in and around damaged tissue, including subungual areas if involved. Keep victims of exposure under medical observation for at least 24 hours.*

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: Sulfur tetrafluoride cannot catch fire. Use media appropriate for surrounding fire. Reacts with water forming hydrofluoric acid.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Toxic, corrosive liquid and gas under pressure (see section 3). Immediately 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; then move them away from fire if without risk. If cylinders are leaking, reduce toxic vapors with water spray or fog. Shut off leak if without risk. Reverse flow into cylinders may cause rupture. (See section 16.) On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Nonflammable, toxic, corrosive liquid and gas. Vapors are extremely irritating. Contact may cause skin and eye burns (see section 4). Heat of fire can build pressure in cylinder and cause it to rupture. To provide maximum containment up to cylinder burst pressure, Sulfur tetrafluoride cylinders are not equipped with a pressure relief device. No part of cylinder should be subjected to a temperature higher than 125°F (52°C).

HAZARDOUS COMBUSTION PRODUCTS: None known.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Toxic, corrosive liquid and gas under pressure (see section 3). Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Reduce vapors with fog or fine water spray. Shut off flow if without risk. Sulfur tetrafluoride is much heavier than air and will accumulate in low-lying areas. Ventilate area or move cylinder to a well-ventilated area. Prevent runoff from contaminating surrounding environment. Toxic, corrosive vapors may spread from spill. Before entering area, especially a confined area, check atmosphere with an appropriate device. Reverse flow into cylinder may cause rupture.

WASTE DISPOSAL METHOD: Prevent waste from contaminating surrounding environment. Keep personnel away. Call your local Praxair supplier for disposal information or call one of the emergency numbers listed in section 1.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in a cool, dry, well-ventilated area, away from flammable materials. 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 sulfur 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—A corrosion-resistant system is acceptable.

MECHANICAL (general)—Inadequate. See SPECIAL, below.

SPECIAL—Use only in a closed system. Corrosion-resistant, forced-draft fume hood is preferred.

OTHER—See special.

RESPIRATORY PROTECTION: Select per OSHA 29 CFR 1910.134 and ANSI Z88.2. No NIOSH-approved respirator is available for this product. Praxair recommends a respirator with a dust filter when exposure to metal fluorides is possible. Where product concentration may exceed 0.1 ppm, Praxair recommends an SCBA or positive-pressure airline respirator with a full face mask and escape pack worn with a full-protection, chemical resistant suit.

PROTECTIVE GLOVES: Wear work gloves for cylinder handling; Neoprene when changing out cylinders.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield 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 and protective clothing where needed. Select per OSHA 29 CFR 1910.132 and 1910.133. Regardless of protective equipment, never touch live electrical parts.

9. Physical and Chemical Properties

MOLECULAR WEIGHT:	108.058
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	3.7
GAS DENSITY at 70°F (21°C) and 1 atm:	0.277 lb/ft ³ (4.437 kg/m ³)
VAPOR PRESSURE at 68°F (20°C):	140 psig (965.3 kPa)
SOLUBILITY IN WATER:	Reacts
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1):	High
BOILING POINT at 1 atm:	-40.7°F (-40.4°C)
FREEZING POINT at 1 atm:	-191°F (-124°C)

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

10. Stability and Reactivity

STABILITY: Unstable Stable

INCOMPATIBILITY (materials to avoid): Reacts with water and organics; highly reactive with most materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen fluoride, thionyl fluoride, and sulfur dioxide, when hydrolyzed. Pyrolyzation at 1112°F (600°C) yields sulfur and fluorine.

HAZARDOUS POLYMERIZATION: May Occur Will Not Occur

CONDITIONS TO AVOID: None known.

11. Toxicological Information

See section 3.

12. Ecological Information

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

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not dispose of unused quantities. Return cylinder to supplier. See section 6 for emergency leak or spill instructions.

14. Transport Information

DOT/IMO SHIPPING NAME: Sulfur tetrafluoride

HAZARD CLASS:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.3	UN 2418	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, upright 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 (40 CFR Part 355):

Threshold Planning Quantity (TPQ): 100 lb (45.4 kg)

Extremely Hazardous Substances (40 CFR 355): 100 lb (45.4 kg)

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.

Sulfur tetrafluoride 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.

Sulfur tetrafluoride is listed as a regulated substance in quantities of 2,500 lb (1134 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Sulfur 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.

Sulfur tetrafluoride is listed in Appendix A as a highly hazardous chemical in quantities of 250 pounds (113.4 kg) or greater.

STATE REGULATIONS:

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

PENNSYLVANIA: This product 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 liquid and gas under pressure (see section 3). Do not breathe gas. Do not get vapors or liquid in eyes,

on skin, or on clothing. (See section 3.) Have safety showers and eyewash fountains immediately available. **Use piping and equipment adequately designed to withstand pressures to be encountered.** Use only in a closed system constructed of corrosion-resistant materials. **Prevent reverse flow.** Reverse flow into cylinder may cause rupture. Always use a vacuum break or other protective device in any line or piping from the cylinder. **Store and use with adequate ventilation at all times.** Close valve after each use; keep closed even when empty. **Never work on a pressurized system.** If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws, inert the system; then repair the leak. **Never place a compressed gas cylinder where it may become part of an electrical circuit.**

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 = 3
SPECIAL = ~~W~~

HMIS RATINGS:

HEALTH = 3
FLAMMABILITY = 0
REACTIVITY = 3

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:

CGA-330 connection is standard.

PIN-INDEXED YOKE:

Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION: Not applicable

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), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

P-1 *Safe Handling of Compressed Gases in Containers*
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
— *Handbook of Compressed Gases, Fourth Edition*

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 14150-7891).

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