Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Compressed gas, toxic, flammable, corrosive, n.o.s. (Silicon Tetrafluoride, Hydrogen) (MSDS No. P-19-6395)	**Trade Names:** Not applicable.
Chemical Name: Mixture of Silicon Tetrafluoride & Hydrogen	**Synonyms:** Mixture of Silicon Tetrafluoride & Hydrogen
Chemical Family: Not applicable.	**Product Grades:** None assigned.

Telephone: **Emergencies:** 1-800-645-4633* **Company Name:** Praxair, Inc.
CHEMTREC: 1-800-424-9300* 39 Old Ridgebury Road
Routine: 1-800-PRAXAIR Danbury, CT 06810-5113

**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. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Poisonous, 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.
Under ambient conditions, this is a colorless gas with a suffocating odor.

OSHA REGULATORY STATUS: The components of this mixture are considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

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. An unlikely route of exposure. 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.

CARCINOGENICITY: The components of this mixture are not listed by NTP, OSHA, and IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: None known. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Silicon Tetrafluoride	7783-61-1	80%
Hydrogen	1333-74-0	20%

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. **Warning: To avoid possible chemical burns, the rescuer should avoid breathing any exhaled air from the victim.** Qualified personnel should give oxygen at half-hour intervals for 3 to 4 hours. Immediately call a physician.

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. Discard contaminated shoes.

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

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

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.*

Contact the Poison Control Center in your area for additional information on patient management and follow-up.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Reacts with water to form hydrogen fluoride fumes. May form explosive mixtures with air and oxidizing agents.

SUITABLE EXTINGUISHING MEDIA: CO_2, dry chemical foam. Water may be ineffective. Use water spray or fog to reduce corrosive vapors.

PRODUCTS OF COMBUSTION: Water (H_2O). See section 10 for hazardous decomposition products.

PROTECTION OF FIREFIGHTERS: DANGER! Poisonous, corrosive, high-pressure gas. 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.

Specific Physical and Chemical Hazards. Heat of fire can build pressure in cylinder and cause it to rupture. Cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.) No part of a cylinder should be subjected to a temperature higher than 125°F (52°C). If venting or leaking gas catches fire, do not extinguish flames. Flammable gas may spread from leak, creating an explosive re-ignition hazard. Vapors can be irritating and may burn skin and eyes on contact.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Poisonous, corrosive, high-pressure gas.

Personal Precautions. May form explosive mixtures with air. 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.

Environmental Precautions. 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 HANDLING: Harmful if inhaled. Do not breathe gas. Do not get liquid or vapor in eyes, on skin, or on clothing. Have safety showers and eyewash fountains immediately available. Always secure cylinder before use. 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. Close cylinder valve after each use; keep closed even when empty. 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.

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.

RECOMMENDED PUBLICATIONS: For further information on storage, handling, and use, see Praxair publication P-14-153, *Guidelines for Handling Gas Cylinders and Containers*. Obtain from your local supplier.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2009)
Silicon Tetrafluoride	Not Established	Not Established.
Hydrogen	Not Established	Simple asphyxiant.

Praxair recommends compliance with the OSHA and ACGIH (2009) limits of 2 ppm (STEL ceiling) for hydrogen fluoride, formed by the hydrolysis of silicon tetrafluoride.

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = 30 ppm (hydrogen fluoride.)

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.

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves when handling cylinders; neoprene when changing them out. Use 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.

Eye/Face Protection. Wear safety glasses when handling cylinders. Select per OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Suffocating
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 1 atm**:**	-124.24°F (-86.8°C)**

BOILING POINT at 1 atm**:**	-138.6°F (-94.8°C)**
FLASH POINT (test method)**:**	Not available.
EVAPORATION RATE (Butyl Acetate = 1)**:**	Not applicable.
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR, % by volume**:**	**LOWER:** 4.0%* **UPPER:** 75.0%*
VAPOR PRESSURE at 10°F (-12.25°C)**:**	Not applicable.
VAPOR DENSITY at 70°F (21.1°C) and 1 atm**:**	0.269 lb/ft^3 (4.31 kg/m^3)**
SPECIFIC GRAVITY (H_2O = 1) at 19.4°F (-7°C)**:**	Not available.
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm**:**	3.594**
SOLUBILITY IN WATER 68°F (20°C)**:**	Reacts
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	932°F (500°C)*
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	Not available.
MOLECULAR FORMULA:	Mixture of SiF_4 & H_2

***For Hydrogen only
**For Silicon Tetrafluoride only

10. Stability and Reactivity

CHEMICAL STABILITY: ☐ Unstable ☒ Stable

CONDITIONS TO AVOID: None known.

INCOMPATIBLE MATERIALS: Water, trimethylamine, sodium, alkali metals

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may produce silicon and fluorine. Reacts with water to form hydrogen fluoride fumes.

POSSIBILITY OF HAZARDOUS REACTIONS: ☒ May Occur ☐ Will Not Occur

Thermal decomposition may produce silicon and fluorine. Reacts with water to form hydrogen fluoride fumes.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC_{50} for SiF_4, 1 hr, mouse = 450 ppm. Hydrogen is a simple asphyxiant.

STUDY RESULTS: None known about this mixture.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: No adverse ecological effects expected. The components of this mixture do not contain any Class I or Class II ozone-depleting chemicals.

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: Compressed gas, toxic, flammable, corrosive, n.o.s. (Silicon Tetrafluoride, Hydrogen)

HAZARD CLASS:	2.3	**PACKING GROUP/Zone:**	NA*/ B	**IDENTIFICATION NUMBER:**	UN3305	**PRODUCT RQ:**	None
SHIPPING LABEL(s):	POISON GAS**, FLAMMABLE GAS, CORROSIVE						
PLACARD (when required):	POISON GAS**, FLAMMABLE GAS, CORROSIVE						

**NA=Not applicable.*

***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 Requirement: 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)].

MARINE POLLUTANTS: The components of this mixture are not listed as marine pollutants by DOT.

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):

TPQ: 500 lb (226.8 kg) for BF_3
EHS RQ (40 CFR 355): 500 lb (226.8 kg) for BF_3

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
DELAYED: Yes
PRESSURE: Yes
REACTIVITY: Yes
FIRE: Yes

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

The components of this mixture are not subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA) and 40CFR Part 372.

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.

The components of this mixture are not listed as regulated substances.

TSCA: TOXIC SUBSTANCES CONTROL ACT: The components of this mixture are 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.

The components of this mixture are not listed in Appendix A as highly hazardous chemicals. However, any process that involves a flammable gas on site in one location in quantities of 10,000 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

STATE REGULATIONS:

CALIFORNIA: The components of this mixture are not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: The components of this mixture are subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: ***Poisonous, corrosive high-pressure gas***. Store and use with adequate ventilation at all times. Use piping and equipment adequately designed to withstand pressures to be encountered. Use a backflow prevention device in any piping. Use only in a closed system constructed of corrosion-resistant materials. 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, ensure that the valve is closed; then install valve outlet cap or plug, leak tight. Never place a compressed gas cylinder where it may become part of an electrical circuit.

Mixtures. When you mix two or more chemicals, 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. Chemicals have properties that can cause serious injury or death.

NOTE: *Before 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.

HAZARD RATING SYSTEMS:

NFPA RATINGS:		**HMIS RATINGS:**	
HEALTH	= 3	HEALTH	= 2
FLAMMABILITY	= 3	FLAMMABILITY	= 3
INSTABILITY	= 2	PHYSICAL HAZARD	= 3
SPECIAL	= ~~W~~		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-330.
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 can be found in the following materials published by the Compressed Gas Association, Inc. (CGA), 4221 Walney Road, 5th Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, http://www.cganet.com/Publication.asp.

AV-1	*Safe Handling and Storage of Compressed Gases*
P-1	*Safe Handling of Compressed Gases in Containers*
SB-2	*Oxygen-Deficient Atmospheres*
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 MSDSs for these products, contact your Praxair sales representative or local distributor or supplier, or download from www.praxair.com. 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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