

## Praxair Material Safety Data Sheet

### 1. Chemical Product and Company Identification

<b>Product Name:</b> Compressed gas, toxic, corrosive, n.o.s. (germanium tetrafluoride) (MSDS No. P-4822-A)	<b>Trade Name:</b> Germanium tetrafluoride
<b>Chemical Name:</b> Germanium tetrafluoride	<b>Synonyms:</b> Germanium fluoride, germanium (IV)fluoride, tetrafluorogermane
<b>Formula:</b> GeF <sub>4</sub>	<b>Chemical Family:</b> Inorganic halide
<b>Telephone:</b>	<b>Company Name:</b> Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113
<b>Emergencies:</b> 1-800-645-4633* <b>CHEMTREC:</b> 1-800-424-9300* <b>Routine:</b> 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 (2002)
Germanium tetrafluoride	7783-58-6	>99%*	None currently established	None currently established**

\*The symbol > means "greater than."

\*\* See section 3.

### 3. Hazards Identification



#### EMERGENCY OVERVIEW

**DANGER!** Toxic, corrosive high-pressure gas.  
Harmful or fatal if inhaled.

May cause eye, skin, and respiratory tract burns.  
Symptoms may be delayed.

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, garlic-like



**THRESHOLD LIMIT VALUE:** None currently established (ACGIH, 2002). Praxair recommends compliance with the OSHA and ACGIH (2002) limits of 3 ppm (ceiling) for hydrogen fluoride formed by the hydrolysis of germanium tetrafluoride. According to the manufacturer, the 2.5 mg/m<sup>3</sup> TLV-TWA for fluorides as F (ACGIH, 2002) translates into a TLV-TWA of 0.8 for germanium 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 conditions.

**EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:**

**INHALATION**—Harmful or fatal if inhaled. Extremely irritating to mucous membranes and respiratory tract. Causes throat irritation, coughing, shortness of breath, excessive salivation, headache, vertigo, chills, nausea, abdominal pain, and vomiting. May cause bronchial spasms, chemical pneumonia, and pulmonary edema (fluid in the lungs). May damage the lungs, liver, kidneys, heart, and blood. Symptoms may be delayed.

**SKIN CONTACT**—Germanium tetrafluoride causes chemical burns. Skin burns may result in absorption of potentially harmful amounts of material. Symptoms may be delayed

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

**EYE CONTACT**— Germanium tetrafluoride burns eye tissue.

**EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:** Prolonged or repeated exposure may decalcify the bones and cause nasal congestion, bronchitis, weight loss, anemia, weakness, and stiffness of joints. Dental fluorosis (mottling of the teeth) may occur. Repeated overexposure may also damage the lungs, liver, kidneys, heart, and blood.

**OTHER EFFECTS OF OVEREXPOSURE:** None known.

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** None known.

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

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

#### 4. First Aid Measures

**NOTE:** *In any case of exposure to germanium tetrafluoride, always assume that some inhalation has occurred. Seek immediate emergency medical assistance.*

**INHALATION:** Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Keep victim warm. Seek immediate emergency medical assistance.

**SKIN CONTACT:** Immediately flush affected area with large quantities of cool water while removing contaminated clothing and shoes. Seek immediate emergency medical assistance. Continue washing in cool water for at least 15 minutes or until medical assistance arrives. Discard contaminated clothing and shoes.

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

**EYE CONTACT:** Immediately flush eyes thoroughly with water until emergency medical assistance arrives, but for at least 30 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Seek immediate emergency medical assistance. See a physician, preferably an ophthalmologist.

**NOTES TO PHYSICIAN:** *Germanium tetrafluoride reacts with water or moist air to form germanium oxide and hydrofluoric and fluorogermanic acids. Composition of materials to which the patient has been*

*exposed depends on the conditions of release. Skin and eye contact should be treated as exposure to acid compounds of fluorine such as hydrofluoric acid. Consider use of benzalkonium chloride, magnesium sulfate, calcium gluconate, or similar agents. Monitor patient for hypocalcemia, hypomagnesia, and cardiac arrhythmias. Symptoms may be delayed up to 24 hours.*

## 5. Fire Fighting Measures

<b>FLASH POINT</b> (test method):	Not applicable
<b>AUTOIGNITION TEMPERATURE:</b>	Not applicable
<b>FLAMMABLE LIMITS IN AIR</b> , % by volume:	<b>LOWER:</b> Not applicable   <b>UPPER:</b> Not applicable
<b>EXTINGUISHING MEDIA:</b> Germanium tetrafluoride cannot catch fire. Use media appropriate for surrounding fire. Note that germanium tetrafluoride reacts with water. Note other incompatibilities in section 10.	

**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. 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:** 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). Germanium tetrafluoride cylinders are equipped with a pressure relief device designed to relieve pressure at elevated temperature. (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 cylinders may cause rupture. (See section 16.) Do not approach area without self-contained breathing apparatus and full protective clothing. Reduce vapors with fog or fine water spray. Shut off leak if without risk. Ventilate area of leak 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 germanium 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:** A positive-pressure, air-supplied, full-face, self-contained breathing apparatus is required for any work where exposure to product could occur. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

**PROTECTIVE GLOVES:** Wear work gloves for cylinder handling; neoprene, natural rubber, or nitrile gloves when changing out cylinders or wherever contact with product could occur.

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

**OTHER PROTECTIVE EQUIPMENT:** Metatarsal shoes for cylinder handling. 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**

<b>MOLECULAR WEIGHT:</b>	148.6
<b>VAPOR PRESSURE</b> at 5°F (-15°C):	58.6 psia (404.03 kPa abs)
<b>SOLUBILITY IN WATER:</b>	Reacts
<b>PERCENT VOLATILES BY VOLUME:</b>	100
<b>BOILING POINT</b> at 1 atm:	Sublimes at -34.6°F (-37°C)
<b>MELTING POINT</b> at 4 atm:	5°F (-15°C)
<b>APPEARANCE, ODOR, AND STATE:</b> Colorless gas at normal temperature and pressure; pungent, garlic-like odor.	

**10. Stability and Reactivity**

<b>STABILITY:</b>	<input type="checkbox"/> Unstable	<input checked="" type="checkbox"/> Stable
<b>INCOMPATIBILITY (materials to avoid):</b> Water; alkali metals, alkaline earth metals, calcium oxide; organic or silica materials.		
<b>HAZARDOUS DECOMPOSITION PRODUCTS:</b> Fluorogermanic acids, hydrogen fluoride.		
<b>HAZARDOUS POLYMERIZATION:</b>	<input type="checkbox"/> May Occur	<input checked="" type="checkbox"/> Will Not Occur
<b>CONDITIONS TO AVOID:</b> Exposure to air, moisture		

**11. Toxicological Information**

See section 3.

**12. Ecological Information**

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

**13. Disposal Considerations**

**WASTE DISPOSAL METHOD:** Keep waste away from surrounding environment. Keep personnel away. Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

**14. Transport Information**

<b>DOT/IMO SHIPPING NAME:</b>	Compressed gas, toxic, corrosive, n.o.s. (germanium tetrafluoride)	
<b>HAZARD CLASS:</b> 2.3	<b>IDENTIFICATION NUMBER:</b> UN 3304	<b>PRODUCT RQ:</b> None
<b>SHIPPING LABEL(s):</b>	POISON GAS, CORROSIVE*	
<b>PLACARD (when required):</b>	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 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)].

## 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.

Germanium 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.

Germanium tetrafluoride is not listed as a regulated substance.

**TSCA: TOXIC SUBSTANCES CONTROL ACT:** Germanium 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.

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

**STATE REGULATIONS:**

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

**PENNSYLVANIA:** Germanium 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.* Do not breathe gas. Do not get vapor 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. 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. *Store and use with adequate ventilation at all times.* Always secure cylinder prior to use. *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. *Follow safe practices when returning cylinder to supplier.* Be sure valve is closed; then tightly install valve outlet plug or cap. *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 = 4  
FLAMMABILITY = 0  
INSTABILITY = 1  
SPECIAL = None

**HMIS RATINGS:**

HEALTH = 4  
FLAMMABILITY = 0  
PHYSICAL HAZARD = 1

**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, 5<sup>th</sup> Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700.

- AV-1 *Safe Handling and Storage of Compressed Gases*
- 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.

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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.

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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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