

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Compressed gas, toxic, corrosive, n.o.s. (germanium tetrafluoride) (MSDS No. P-4822-C)	Trade Names: Germanium tetrafluoride
Chemical Name: Germanium tetrafluoride	Synonyms: Germanium fluoride, germanium (IV) fluoride, tetrafluorogermane
Chemical Family: Inorganic halide	Product Grades: None assigned.
Telephone: Emergencies: 1-800-645-4633* CHEMTREC: 1-800-424-9300* Routine: 1-800-PRAXAIR	Company Name: Praxair, Inc. 39 Old Ridgebury Road 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! Toxic, corrosive high-pressure gas.
Harmful or fatal if inhaled.**



**May cause eye, skin, and respiratory tract burns.
May damage the lungs, liver, kidneys, heart, and blood.
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.**

Under ambient conditions, this a colorless gas with a pungent, garlic-like odor.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

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.

Product: Compressed gas, toxic, corrosive,
n.o.s. (Germanium Tetrafluoride)

P-4822-C

Date: January 2009

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.

CARCINOGENICITY: Germanium tetrafluoride is not listed by NTP, OSHA, or 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
Germanium tetrafluoride	7783-58-6	>99%*

*The symbol > means "greater than."

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.

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

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Germanium tetrafluoride cannot catch fire. However, contact with organic or silica materials may cause fire.

SUITABLE EXTINGUISHING MEDIA: Germanium tetrafluoride cannot catch fire. Use media appropriate for surrounding fire. Note that germanium tetrafluoride reacts with water. Note other incompatibilities in section 10.

PRODUCTS OF COMBUSTION: Not applicable. Decomposition due to heating may produce toxic fumes. (See section 10.)

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

Evacuate all personnel from danger area and keep personnel upwind. 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.

Specific Physical and Chemical 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). Reverse flow into cylinder may cause rupture. Vapors are extremely irritating; contact may burn the skin and eyes.

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! Toxic, corrosive high-pressure gas.

Personal Precautions. Evacuate all personnel from the danger area and keep personnel upwind. 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.

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: Do not breathe gas. Do not get vapor in eyes, on skin, or on clothing. Keep away from heat, sparks, and flame. Have safety showers and

eyewash fountains immediately available. 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. Close cylinder valve after each use; keep closed even when empty. For other precautions in using germanium 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 (2008)
Germanium tetrafluoride	Not established.	Not established.

IDLH = Not available.

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 for cylinder handling; neoprene, natural rubber, or nitrile gloves when changing out cylinders or wherever contact with product could occur. 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.

Eye/Face 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.

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.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Pungent, garlic-like
ODOR THRESHOLD:	Not available.

Product: Compressed gas, toxic, corrosive,
n.o.s. (Germanium Tetrafluoride)

P-4822-C

Date: January 2009

PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
MELTING POINT at 4 atm:	5°F (-15°C)
BOILING POINT at 1 atm:	Sublimes at -34.6°F (-37°C)
FLASH POINT (test method):	Not applicable.
EVAPORATION RATE (Butyl Acetate = 1):	Not applicable.
FLAMMABILITY:	Not applicable.
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: Not applicable. UPPER: Not applicable.
VAPOR PRESSURE at 5°F (-15°C):	58.6 psia (404.03 kPa abs)
VAPOR DENSITY at 70°F (21.1°C) and 1 atm:	0.3842 lb/ft ³ (6.154 kg/m ³)
SPECIFIC GRAVITY (H ₂ O = 1) at 19.4°F (-7°C):	Not available.
SPECIFIC GRAVITY (Air = 1) at 70°F (21.1°C) and 1 atm:	5.127 (Calculated)
SOLUBILITY IN WATER 68°F (20°C):	Reacts
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not applicable.
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	148.6
MOLECULAR FORMULA:	GeF ₄

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: Exposure to air, moisture. Contact with organic or silica materials may cause fire.

INCOMPATIBLE MATERIALS: Water; alkali metals, alkaline earth metals, calcium oxide; organic or silica materials.

HAZARDOUS DECOMPOSITION PRODUCTS: Germanium oxide, hydrogen fluoride.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Contact with organic or silica materials may cause fire.

Germanium tetrafluoride reacts with water or moist air to form germanium oxide and hydrofluoric and fluorogermanic acids.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC₅₀, 1 hr, rat = 280 ppmv

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

Product: Compressed gas, toxic, corrosive, P-4822-C
n.o.s. (Germanium Tetrafluoride)

Date: January 2009

OTHER ADVERSE EFFECTS: Germanium tetrafluoride does not contain any Class I or Class II ozone-depleting chemicals.

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

DOT/IMO SHIPPING NAME: Compressed gas, toxic, corrosive, n.o.s. (germanium tetrafluoride)

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.3	NA*/B	UN3304	None

SHIPPING LABEL(s): POISON GAS, CORROSIVE**

PLACARD (when required): POISON GAS, CORROSIVE**

*NA = Not available.

**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: Germanium tetrafluoride is not listed as a marine pollutant 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: None

EHS RQ (40 CFR 355): None

Product: Compressed gas, toxic, corrosive, n.o.s. (Germanium Tetrafluoride)

P-4822-C

Date: January 2009

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: No

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

Germanium tetrafluoride is not subject to 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. 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. Use a check valve or other protective devices 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 install valve outlet plug or cap, leak-tight. *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.

Product: Compressed gas, toxic, corrosive,
n.o.s. (Germanium Tetrafluoride)

P-4822-C

Date: January 2009

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 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*
V-1 *Compressed Gas Cylinder Valve Inlet and Outlet Connections*
— *Handbook of Compressed Gases, Fourth Edition*

Product: Compressed gas, toxic, corrosive,
n.o.s. (Germanium Tetrafluoride)

P-4822-C

Date: January 2009

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).

Praxair and the *Flowing Airstream* design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.



Praxair, Inc.
39 Old Ridgebury Road
Danbury, CT 06810-5113