

# Praxair Material Safety Data Sheet

## 1. Chemical Product and Company Identification

<b>Product Name:</b> Tungsten hexafluoride (MSDS No. P-4855-D)	<b>Trade Names:</b> Tungsten hexafluoride
<b>Chemical Name:</b> Tungsten hexafluoride	<b>Synonyms:</b> Tungsten fluoride
<b>Chemical Family:</b> Inorganic halide	<b>Product Grades:</b> 5.0 semiconductor process gas
<b>Telephone:</b>	<b>Company Name:</b> Praxair, Inc.
<b>Emergencies:</b> 1-800-645-4633*	39 Old Ridgebury Road
<b>CHEMTREC:</b> 1-800-424-9300*	Danbury, CT 06810-5113
<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. Hazards Identification

### EMERGENCY OVERVIEW



**DANGER! Poisonous, corrosive liquid and gas under pressure.  
May be fatal if inhaled.**



**Can cause eye, skin, and respiratory tract burns.  
Harmful if swallowed.**

**Symptoms may be delayed.**

**Contact with flammable materials may cause fire or explosion.**

**Self-contained breathing apparatus must be worn by rescue workers.**

**This material is a colorless, odorless gas at normal temperature and pressure;  
the liquid is pale yellow.**

**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.** Poison gas. Causes difficulty with breathing. Causes formation of methemoglobin in the blood and resultant cyanosis (a blue discoloration) particularly of the lips, fingernails, and ears. At high concentrations, irritates the eyes, throat, and respiratory tract, resulting in a burning sensation, cough, choking, tightness in the chest, nausea, and pulmonary edema. Odor and irritation cannot be used as warning signs of dangerous toxicity. Pulmonary edema may be delayed up to 24 hours.

**Skin Contact.** Corrosive. May produce painful chemical burns, deep local damage to underlying tissues, and local swelling. Severe local damage can occur without the immediate development of pain. Slow-healing skin ulcers may develop. If absorbed into

the skin, may cause severe deep tissue injury and delayed swelling in areas of exposed skin.

**Swallowing.** Highly toxic. Produces burns of the mouth, throat, esophagus, and stomach. Early signs and symptoms of poisoning may include severe chest and abdominal pain, nausea, diarrhea, vomiting of blood, weakness, dizziness, and collapse.

**Eye Contact.** Vapor irritates the eyes. Liquid causes severe chemical burns and possible permanent eye damage.

**Effects of Repeated (Chronic) Overexposure.** May cause lung congestion with hemorrhage and edema. Prolonged exposure by any route may lead to liver and kidney injury and to fluorosis (damage to bones and teeth).

**Other Effects of Overexposure.** None known.

**Medical Conditions Aggravated by Overexposure.** Breathing vapors from tungsten hexafluoride may exacerbate asthma and inflammatory or fibric pulmonary disease.

**CARCINOGENICITY:** Tungsten hexafluoride 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
Tungsten Hexafluoride	7783-82-6	>99%*

\*The symbol > means "greater than."

### 4. First Aid Measures

**INHALATION:** If inhaled or on suspicion of any exposure, remove to fresh air. If not breathing, give artificial respiration, preferably with simultaneous administration of oxygen by qualified personnel. **Warning: To avoid possible chemical burns, rescuer should avoid breathing any exhaled air from victim.** If breathing is difficult, qualified personnel may give oxygen. Keep warm and at rest. Call a physician.

**SKIN CONTACT:** Immediately flush with large quantities of water while removing contaminated clothing and shoes. Pay particular attention to skin under nails. Follow by applying iced saturation solution of epsom salts ( $MgSO_4$ ). If not available, continue washing in cool water until medical personnel arrive. Call a physician for all exposures. Discard contaminated clothing and shoes.

**SWALLOWING:** Do not induce vomiting. Give large quantities of milk if conscious. Call a physician immediately.

**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. Continue flushing with water until medical help arrives.

**NOTES TO PHYSICIAN:** Tungsten hexafluoride reacts on contact with water or moisture to form tungsten oxyfluoride and hydrogen fluoride (hydrofluoric acid). Systemic effects of overexposure are attributed primarily to hydrogen fluoride and should be treated as such. Local

*effects are due to the intensely irritating and corrosive nature of the material. For this reason, vomiting should not be induced if tungsten hexafluoride is swallowed, but careful gastric lavage should be performed. Complications of swallowing tungsten hexafluoride include mediastinitis, peritonitis, hematemesis, melema, disseminated intravascular coagulation syndrome, dysphagia, and chemical pneumonitis.*

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

## 5. Fire Fighting Measures

**FLAMMABLE PROPERTIES:** May accelerate combustion.

**SUITABLE EXTINGUISHING MEDIA:** Use media appropriate for surrounding fire.

**PRODUCTS OF COMBUSTION:** Not applicable. Thermal decomposition may produce fluorine and/or toxic fumes of fluorides.

**PROTECTION OF FIREFIGHTERS: DANGER! Poisonous, corrosive liquid and gas under pressure.** May accelerate combustion. 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. Move cylinders away from fire if without risk. Reverse flow into cylinder may cause explosion. (See section 16.) On-site fire brigades must comply with OSHA 29 CFR 1910.156.

**Specific Physical and Chemical Hazards.** May accelerate combustion. Contact with flammable materials may cause fire or explosion. 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). Tungsten hexafluoride cylinders are not equipped with a pressure relief device.

**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 liquid and gas under pressure.**

**Personal Precautions.** May accelerate combustion. 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. Prevent runoff from contaminating surrounding environment. Reverse flow into cylinder may cause rupture. (See section 16.) Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area.

**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. (See section 16.) If necessary, call your local supplier for assistance.

## 7. Handling and Storage

**PRECAUTIONS TO BE TAKEN IN HANDLING: *Poisonous, corrosive liquid and gas.*** Do not breathe gas. Do not get liquid or vapor in eyes, on skin, or on clothing. (See section 2.) 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.***

**PRECAUTIONS TO BE TAKEN IN STORAGE: *Store and use with adequate ventilation,*** away from oil, grease, and other combustibles. Store only where temperature will not exceed 125°F (52°C). ***Firmly secure cylinders upright to keep them from falling or being knocked over.*** Screw valve protection cap firmly in place by hand. ***Store full and empty cylinders separately.*** Use a first-in, first-out inventory system to prevent storing full cylinders for long periods. For other precautions in using tungsten hexafluoride, see section 16.

**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 (2007)
Tungsten Hexafluoride Fluorides as F	Not established. 2.5 mg/m <sup>3</sup> *	Not established. 2.5 mg/m <sup>3</sup> *

\* Praxair recommends the values used for fluorides as F.

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 = Not available.

### ENGINEERING CONTROLS:

**Local Exhaust.** A corrosion-resistant system is acceptable.

**Mechanical (General).** Inadequate.

**Special.** Use only in a closed system. A corrosion-resistant, canopy-type forced-draft fume hood is preferred.

**Other.** None

### PERSONAL PROTECTIVE EQUIPMENT:

**Skin Protection.** Wear work gloves and metatarsal shoes for cylinder handling; appropriate chemical gloves (e.g., nitrile) where contact with product is possible. Wear 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 and a face shield during cylinder changeout or wherever contact with product is possible. Select in accordance with OSHA 29 CFR 1910.133.

**Respiratory Protection.** Use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respiratory protection must conform to OSHA 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

### 9. Physical and Chemical Properties

<b>APPEARANCE:</b>	Colorless gas
<b>ODOR:</b>	None
<b>ODOR THRESHOLD:</b>	Not applicable.
<b>PHYSICAL STATE:</b>	Gas at normal temperature and pressure
<b>pH:</b>	Not applicable.
<b>MELTING POINT</b> at 1 atm:	31.1°F (-0.5°C)
<b>BOILING POINT</b> at 1 atm:	63.14°F (17.3°C)
<b>FLASH POINT</b> (test method):	Not applicable.
<b>EVAPORATION RATE</b> (Butyl Acetate = 1):	High
<b>FLAMMABILITY:</b>	Nonflammable
<b>FLAMMABLE LIMITS IN AIR</b> , % by volume:	<b>LOWER:</b> Not applicable. <b>UPPER:</b> Not applicable.
<b>VAPOR PRESSURE</b> at 70°F (21.1°C):	17.07 psia (117.7 kPa abs)
<b>LIQUID DENSITY</b> at 77°F (25°C):	211.44 lb/ft <sup>3</sup> (3387 kg/m <sup>3</sup> )
<b>VAPOR DENSITY</b> at 70°F (21.1°C) and 1 atm:	0.7701 lb/ft <sup>3</sup> (12.334 kg/m <sup>3</sup> )
<b>SPECIFIC GRAVITY</b> (H <sub>2</sub> O = 1):	Not available.
<b>SPECIFIC GRAVITY</b> (Air = 1) at 70°F (21.1°C) and 1 atm:	10.284
<b>SOLUBILITY IN WATER:</b>	Reacts violently with water.
<b>PARTITION COEFFICIENT: n-octanol/water:</b>	Not available.
<b>AUTOIGNITION TEMPERATURE:</b>	Not applicable.
<b>DECOMPOSITION TEMPERATURE:</b>	Not available.
<b>PERCENT VOLATILES BY VOLUME:</b>	100
<b>MOLECULAR WEIGHT:</b>	297.83
<b>MOLECULAR FORMULA:</b>	WF <sub>6</sub>

### 10. Stability and Reactivity

**CHEMICAL STABILITY:**     Unstable     Stable

This material is stable as shipped and stored under normal conditions, i.e., 70°F (21.1°C) so long as exposure to air, water, moisture, and other incompatible materials is avoided.

**CONDITIONS TO AVOID:** Temperatures approaching 900°F (482.22°C). Contact with incompatible materials.

**INCOMPATIBLE MATERIALS:** Water, glass, flammable materials, oil, grease.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Contact with oil or moisture will produce tungsten oxyfluoride and hydrofluoric acid. Thermal decomposition may produce fluorine and/or toxic fumes of fluorides.

**POSSIBILITY OF HAZARDOUS REACTIONS:**       May Occur     Will Not Occur

See Hazardous Decomposition Products.

### 11. Toxicological Information

**ACUTE DOSE EFFECTS:** LC<sub>50</sub>, 1 hr, rat = 213 ppm (based on 1/6 HF)

**STUDY RESULTS:** None known.

### 12. Ecological Information

**ECOTOXICITY:** No known effects.

**OTHER ADVERSE EFFECTS:** None known. Tungsten hexafluoride does not contain any Class I or Class II ozone-depleting chemicals.

### 13. Disposal Considerations

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

### 14. Transport Information

**DOT/IMO SHIPPING NAME:** Tungsten hexafluoride

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.3	NA*/B	UN2196	None

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

**PLACARD (when required):** POISON 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:** Tungsten hexafluoride 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

**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:** No

**REACTIVITY:** Yes

**FIRE:** No

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

Tungsten hexafluoride 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.

Tungsten hexafluoride is not listed as a regulated substance.

**TSCA: TOXIC SUBSTANCES CONTROL ACT:** Tungsten hexafluoride 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.

Tungsten hexafluoride is not listed in Appendix A as a highly hazardous chemical.

**STATE REGULATIONS:**

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

**PENNSYLVANIA:** Tungsten hexafluoride 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:** *Poisonous, corrosive liquid and gas under pressure.* Store and use with adequate ventilation at all times. *Use piping and equipment conditioned for tungsten hexafluoride service and adequately designed to withstand pressures to be encountered.* Use only in a closed system constructed of corrosion-resistant materials. *All materials and components must be free of oil, grease, and other contaminants.* Clean them thoroughly with a solvent, and purge them dry with an inert gas prior to use. Contact with combustible materials may cause fire or explosion. *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. **Follow safe practices when returning cylinder to supplier.** Be sure 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 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.

**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:

HEALTH = 4  
FLAMMABILITY = 0  
INSTABILITY = 1  
SPECIAL = None

##### HMIS RATINGS:

HEALTH = 3  
FLAMMABILITY = 0  
PHYSICAL HAZARD = 2

#### STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

**THREADED:** CGA-670  
**PIN-INDEXED YOKE:** Not applicable.  
**ULTRA-HIGH-INTEGRITY CONNECTION:** CGA-638

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, 5<sup>th</sup> Floor, Chantilly, VA 20151-2923, Telephone (703) 788-2700, <http://www.cganet.com/Publication.asp>.

- AV-1 *Safe Handling and Storage of Compressed Gases*
- G-4.1 *Cleaning Equipment for Oxygen Service*
- 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.

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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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