

## Praxair Material Safety Data Sheet

### 1. Chemical Product and Company Identification

<b>Product Name:</b> Titanium tetrachloride (MSDS No. P-6249-B)			<b>Trade Name:</b> Titanium Tetrachloride		
<b>Chemical Name:</b> Titanium tetrachloride			<b>Synonyms:</b> Titanic chloride, tetrachloro-titanium, titanium chloride, titanium (IV) chloride		
<b>Formula:</b> TiCl <sub>4</sub>			<b>Chemical Family:</b> Inorganic halide		
<b>Telephone:</b>	<b>Emergencies:</b>	1-800-645-4633*	<b>Company Name:</b> Praxair, Inc. 39 Old Ridgebury Road Danbury, CT 06810-5113		
	<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 (2004)
Titanium tetrachloride	7550-45-0	>99%*	None currently established**	None currently established**

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

\*\* Praxair recommends the 2 ppm ceiling value established by the ACGIH for hydrogen chloride, CAS 7647-01-0, formed by the reaction of  $\text{TiCl}_4$  and moisture. OSHA PEL 5 ppm ceiling. Ceiling values are not time-weighted average.

### 3. Hazards Identification

#### EMERGENCY OVERVIEW



**DANGER! Corrosive, toxic liquid and vapor.**

**Reacts with water or moisture in the air to form toxic, corrosive gases.**

**Harmful or fatal if inhaled.**

**Harmful if swallowed.**

**Causes severe eye, skin, and respiratory tract burns.**

**Symptoms may be delayed.**

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

**Odor: Pungent, penetrating acid**



**THRESHOLD LIMIT VALUE:** TLV-TWA, none currently established (ACGIH, 2004).

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

**INHALATION**—Corrosive vapor. Destroys tissues of the mouth, nose, and throat. Symptoms include a burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Upper respiratory spasms and swelling of tissues in the larynx and bronchial passages may cut off the supply of oxygen to the lungs—lack of oxygen can kill. Death may also result from pulmonary edema (fluid in the lungs) and chemical pneumonia. Surviving victims of inhalation may suffer permanent lung damage.

**SKIN CONTACT**—Liquid spilled or splashed on the skin may cause painful irritation, blistering, and burns. Vapors may severely irritate the skin.

**SWALLOWING**—Corrosive liquid will burn the mouth, throat, and stomach, resulting in throat and abdominal pain, nausea, and vomiting. The liquid and hydrogen chloride gas formed by contact with moisture are poisons.

**EYE CONTACT**—Corrosive vapors irritate the eyes and may damage them. Contact with the liquid may cause severe burns resulting in permanent eye damage.

**EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE:** Repeated exposure may cause such respiratory conditions as chronic bronchitis and emphysema. Symptoms are coughing and shortness of breath. These conditions are more likely if irritation due to exposure is noticeable.

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

**MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:** Exposure may aggravate existing skin, eye, or respiratory problems.

**SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH**

**HAZARD EVALUATION:** Rats inhaling 0.04mg/l for 6 hours per day, 5 days per week, for 4 weeks showed decreased weight gain, respiratory tract inflammation, pulmonary fibrosis, and 8% mortality. Rats given similar treatment at 0.005mg/l showed no effects. A single dermal application in rabbits produced moderate to severe necrosis and edema but no symptoms of toxicity.

A lifetime inhalation test found microscopic lung tumors in 5 of 150 rats exposed to 10 mg/m<sup>3</sup> titanium tetrachloride. According to the authors, the relevance of tumors of this type to human lung cancer is highly questionable. A 1992 epidemiological study of exposed workers found no significantly higher risk of developing lung cancer than that of unexposed workers.

**CARCINOGENICITY:** This product is not listed by NTP, OSHA, or IARC.

**4. First Aid Measures**

**INHALATION:** Immediately remove victim to fresh air. If not breathing, give artificial respiration.

**WARNING:** Rescuer could receive chemical burns from giving mouth-to-mouth resuscitation. Avoid breathing air exhaled by victim.

If breathing is difficult, qualified personnel may give oxygen. Get immediate medical attention. Keep victim warm and at rest, and monitor breathing and pulse until medical assistance arrives.

**SKIN CONTACT:** Immediately wipe away as much material as possible using a clean, dry cloth, while removing all contaminated clothing and shoes. Flush exposed skin with plenty of water for at least 15 minutes. Do not apply chemical agents intended to neutralize titanium tetrachloride. Discard contaminated clothing and shoes. Get immediate medical attention.

**SWALLOWING:** If victim is conscious, immediately give several glasses of water. Never give anything by mouth to an unconscious or convulsive person. Do not induce vomiting. If vomiting occurs, give more water. Get immediate medical attention.

**EYE CONTACT:** Immediately flush eyes thoroughly with large quantities of running water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Do not apply chemical agents intended to neutralize titanium tetrachloride. Get immediate medical attention. Continue flushing the eyes with water until medical help arrives or for at least another 15 minutes. See a physician, preferably an ophthalmologist.

**NOTES TO PHYSICIAN:** *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient. Victim should be hospitalized and observed for 24 to 48 hours for possible delayed onset of pulmonary edema.*

## 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

**EXTINGUISHING MEDIA:** Titanium tetrachloride will not burn. Use dry chemical or CO<sub>2</sub> to extinguish fires. Do not use water except in flooding quantities for large fires. Titanium tetrachloride reacts violently with water. (See section 10.)

**SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Corrosive, toxic liquid and vapor. Reacts with water to form corrosive, toxic gases.** Evacuate all personnel from danger area. Do not reenter area without self-contained breathing apparatus and protective clothing and shoes. (See section 8.) Extinguish small fires with recommended media. Remove all containers from area of fire if without risk. Containers may be cooled with water spray, but avoid getting water into them; water reacts violently with titanium tetrachloride, forming noxious gases. If water must be used to scrub out vapors or wash away residue, large quantities are required for adequate dilution. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

**UNUSUAL FIRE AND EXPLOSION HAZARDS:** Heat of fire can build pressure in containers and cause rupture. No part of a container should be subjected to a temperature higher than 125°F (52°C).

**HAZARDOUS COMBUSTION PRODUCTS:** Not applicable. See section 10 for products of thermal decomposition.

## 6. Accidental Release Measures

**STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Corrosive, toxic liquid and vapor. Reacts with water to form corrosive, toxic gases.** Evacuate all personnel from danger area. Do not reenter area without self-contained breathing apparatus and protective clothing and shoes. (See section 8.) Shut off flow if you can do so without risk. Ventilate area or move container to a well-ventilated area. Remove all sources of ignition. Neutralize spill with lime or soda ash. Absorb liquids in vermiculate, dry sand, earth, or other dry material. Do not use water. Deposit absorbed material in sealed containers for disposal. After removing spilled material, flush area of spill with soap and water.

**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 away from flammable materials, oxidizers, heat, or flame. Do not store with foodstuffs or animal feed. Store in a cool, dry area only in the DOT-approved container in which product was received. Ensure containers are leak-free and keep them closed even when empty. Store only where temperature will not exceed 125°F (52°C). Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods.

**PRECAUTIONS TO BE TAKEN IN HANDLING:** Protect containers from damage. Use a suitable hand truck to move containers; do not drag, roll, slide, or drop. Open containers only in a dry atmosphere, e.g., nitrogen, while wearing adequate protective clothing and equipment. (See sections 8 and 16.) Empty containers may contain corrosive, toxic residues; handle as if they were full. For other precautions in using this product, see section 16.

## 8. Exposure Controls/Personal Protection

### VENTILATION/ENGINEERING CONTROLS:

**LOCAL EXHAUST**—A local exhaust system is preferred to keep hazardous fumes and gases below exposure limits in the worker's breathing zone. Work with samples should be conducted only in a dry atmosphere. (See section 7.)

**MECHANICAL (general)**—General exhaust ventilation may be acceptable if it can keep hazardous fumes and gases below exposure limits in the worker's breathing zone.

**SPECIAL**—None

**OTHER**—None

**RESPIRATORY PROTECTION:** Where ventilation is inadequate and/or exposure to titanium tetrachloride may occur, use an air-supplied respirator or a full-face, positive-pressure, self-contained breathing apparatus. Respirators must have a full facepiece, hood, or helmet. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134. Select per OSHA 29 CFR 1910.134 and ANSI Z88.2.

**SKIN PROTECTION:** Wear natural rubber or nitrile gloves and protective clothing (see Other Protective Equipment, below) where contact with liquid or vapor may occur.

**EYE PROTECTION:** Wear safety goggles and a full face shield where contact with liquid or vapor may occur.

**OTHER PROTECTIVE EQUIPMENT:** Wear acid-resistant clothing and impervious boots, apron, and coveralls as needed to prevent exposure of skin to liquid or vapor. Select in accordance with 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>	189.70
<b>SPECIFIC GRAVITY</b> (H <sub>2</sub> O = 1) at 68/68°F (20/20°C):	1.726
<b>SPECIFIC GRAVITY</b> (Air = 1):	6.6
<b>VAPOR PRESSURE</b> at 70°F (21.1°C):	0.2 psia (1.379 kPa abs)
at 77°F (25°C):	0.24 psia (1.65 kPa abs, 12.4 mm Hg)
<b>SOLUBILITY IN WATER:</b>	Reacts violently
<b>PERCENT VOLATILES BY VOLUME:</b>	100
<b>BOILING POINT</b> at 1 atm:	277.61°F (136.45°C)
<b>MELTING POINT</b> at 1 atm:	-13°F (-25°C)
<b>APPEARANCE, ODOR, AND STATE:</b> Colorless to pale yellow liquid; sharp, penetrating odor.	

**10. Stability and Reactivity**

**STABILITY:** ☐ Unstable ☒ Stable\*

\*Stable under ordinary conditions of storage and use if kept dry and free of atmospheric moisture.

**INCOMPATIBILITY (materials to avoid):** Moisture, water, alkali metals, hydrofluoric acid or hydrogen fluoride, oxidizing agents. Absorption of atmospheric moisture produces dense, white fumes.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Reacts violently with water or moisture to produce hydrogen chloride (hydrochloric acid gas). Thermal decomposition or burning may produce hydrogen chloride, chlorine gas, titanium oxychloride, and titanium oxides.

**HAZARDOUS POLYMERIZATION:** ☐ May Occur ☒ Will Not Occur

**CONDITIONS TO AVOID:** Moisture, including condensation in the container; other incompatibles

**11. Toxicological Information**

LC<sub>50</sub> = 0.4 mg/l, 4-hour, rat; cause of death from acute inhalation exposure appeared to be pulmonary edema.

LD<sub>50</sub> = <464 mg/kg, male rat. The acute dermal LD<sub>50</sub> is 3160 mg/kg in rabbits. A single dermal application did not produce symptoms of toxicity in rabbits; however, moderate to severe necrosis and edema were observed.

**12. Ecological Information**

TLm = 100-1000 ppm, 96 hr. Titanium tetrachloride does not contain any Class I or Class II ozone-depleting chemicals. Titanium tetrachloride is not listed as a marine pollutant by DOT.

**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:** Titanium tetrachloride

HAZARD CLASS:	PACKING GROUP/ZONE:	IDENTIFICATION NUMBER:	PRODUCT RQ:
8	II/B	UN 1838	1000 lb (454 kg)

**SHIPPING LABEL(s):** CORROSIVE, POISON INHALATION HAZARD\***PLACARD (when required):** CORROSIVE, POISON INHALATION HAZARD\**\*The words in the POISON INHALATION HAZARD 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:** 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):** 1000 lb (454 kg)

**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:** 100 lb (45.4 kg)

**EHS RQ:** 1000 lb (454 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

**DELAYED:** Yes

**PRESSURE:** No

**REACTIVITY:** Yes

**FIRE:** Yes

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

Titanium tetrachloride is 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.

Titanium tetrachloride is listed as a regulated substance in quantities of 2500 lb (1134 kg) or greater.

**TSCA: TOXIC SUBSTANCES CONTROL ACT:** Titanium tetrachloride 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.

Titanium tetrachloride is not listed in Appendix A as a highly hazardous chemical.

#### STATE REGULATIONS:

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

**PENNSYLVANIA:** Titanium tetrachloride 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:** *Corrosive, toxic liquid and vapor.* Harmful or fatal if inhaled. Do not breathe vapors. Use only with adequate ventilation or respiratory protection. (See section 8.) Do not get liquid or 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 with compatible materials and equipment. Use only in a closed system. **Can catch fire.** Keep away from heat, sparks, and open flame. Keep away from flammable materials and oxidizing agents. **Do not eat, drink, or smoke in areas where titanium tetrachloride is stored or used.** After working with this product, wash face and hands thoroughly with soap and water before eating drinking, smoking, applying cosmetics, or using the toilet.

**NOTE:** Prior to using any plastics, confirm their compatibility with titanium tetrachloride.

**MIXTURES:** When you mix two or more gases or liquids, 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	= 2
SPECIAL	= <del>W</del>

##### HMIS RATINGS:

HEALTH	= 3
FLAMMABILITY	= 0
PHYSICAL HAZARD	= 2

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, <http://www.cganet.com/Publication.asp>.

AV-1      *Safe Handling and Storage of Compressed Gases*  
P-1      *Safe Handling of Compressed Gases in Containers*  
—      *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, or download from [www.praxair.com](http://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 other countries.



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