Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Liquefied gas, flammable, n.o.s. (trimethylsilane) (MSDS No. P-6301)	**Trade Name:** Trimethylsilane
Chemical Name: Trimethylsilane	**Synonyms:** Trimethyl silane, trimethylsilyhydride
Formula: $C_3H_{10}Si$	**Chemical Family:** Organosilane
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. Composition/Information on Ingredients

See section 16 for important information about mixtures.

INGREDIENT	CAS NUMBER	CONCEN-TRATION	OSHA PEL	ACGIH TLV-TWA (2004)
Trimethylsilane	993-07-7	>99%*	None currently established	None currently established**

** The symbol > means "greater than."*

*** Praxair recommends use of the 5 ppm TLV for silane (silicon tetrahydride), CAS 7803-62-5 (ACGIH, 2004).*

3. Hazards Identification

EMERGENCY OVERVIEW

DANGER! Flammable liquid and gas under pressure.
May form explosive mixtures with air.
Liquid may cause frostbite.
May cause eye, skin, and respiratory tract irritation.
Reacts with halogens and oxidizers; may react with water.
May cause dizziness and drowsiness.
Self-contained breathing apparatus and protective clothing must be worn by rescue workers.
Odor: Slightly repulsive

THRESHOLD LIMIT VALUE: TLV-TWA, none currently established (ACGIH, 2004). Praxair recommends use of the 5 ppm TLV for silane (silicon tetrahydride), CAS 7803-62-5 (ACGIH, 2004). TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION–Effects unknown. Expected to be similar to those of silane—headache, nausea, and irritation of the respiratory tract.

SKIN CONTACT–May cause irritation. Contact with the liquid may cause frostbite.

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

EYE CONTACT–May cause irritation. Contact with liquid may cause frostbite.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: No information available.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Irritating effects may aggravate existing conditions of the eyes, skin and respiratory tract.

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

CARCINOGENICITY: Trimethylsilane is not listed by NTP, OSHA, or IARC.

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. In all cases where trimethylsilane is inhaled, seek immediate medical attention.

SKIN CONTACT: Flush affected areas with plenty of water while removing contaminated clothing and shoes. Continue for at least 15 minutes. Use lukewarm water if frostbite is indicated. Flush thermal burns with cool water and apply sterile dressings. In case of frostbite or thermal burns, seek immediate medical attention.

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

EYE CONTACT: Flush eyes with plenty of lukewarm water for at least 30 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Seek immediate medical attention. See a physician, preferably an ophthalmologist.

NOTES TO PHYSICIAN: *Trimethylsilane reacts with air to produce silicon oxide(silica) dust. Skin and eye burns should be irrigated as necessary to remove the silicon oxide to the extent deemed necessary. Thereafter, treatment of burns should proceed as usual. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

5. Fire Fighting Measures

FLASH POINT (test method):	-4°F (-20°C)	
AUTOIGNITION TEMPERATURE:	608°F (320°C)	
FLAMMABLE LIMITS IN AIR, % by volume:	**LOWER:** 1.3%	**UPPER:** 44%

EXTINGUISHING MEDIA: CO_2, foam, or dry chemical

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Flammable liquid and gas under pressure. Evacuate all personnel from danger area. Do not use halon fire extinguisher. Do not approach

area without self-contained breathing apparatus and protective clothing. Immediately spray cylinders with water from maximum distance until cool. Avoid direct contact of water with trimethylsilane.

Reverse flow into cylinder may cause rupture. (See section 16.) Stop flow of gas if without risk, while continuing cooling water spray. If flow of gas cannot be shut off, allow fire to burn out. Reduce combustion products with water spray or fog. Remove all cylinders from area if without risk. If fire is extinguished while gas is present, explosive reignition may occur. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Highly flammable gas. May form explosive mixtures with air. Heat of fire can build pressure in cylinder and cause it to rupture. No part of a cylinder should be subjected to a temperature higher than 125°F (52°C). Trimethylsilane cylinders are equipped with a pressure relief device. (Exceptions may exist where authorized be DOT.) Vapors may spread. Flammable vapors can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharge, or other ignition sources at locations distant from product handling point.

HAZARDOUS COMBUSTION PRODUCTS: Silicon dioxide (silica dust). Flammable hydrogen is a product of thermal decomposition; reaction with water may produce flammable methane. See section 10.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Flammable liquid and gas under pressure. Forms explosive mixtures with air. (See section 5.) Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Reduce combustion products with fog or fine water spray. Avoid direct contact of water with trimethylsilane; water reaction may produce flammable methane gas. 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.

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. Separate cylinders containing this product from oxygen, chlorine, and other oxidizers by at least 20 ft (6.1 m) or use a barricade of noncombustible material. This barricade should be at least 5 ft (1.53 m) high and have a fire resistance rating of at least ½ hour. Firmly secure cylinders upright to keep them from falling or being knocked over. Screw valve protection cap firmly in place by hand. Post “No Smoking or Open Flames” signs in storage and use areas. There must be no sources of ignition. All electrical equipment in storage areas must be explosion-proof. Storage areas must meet national electric codes for Class 1 hazardous areas. 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. All piped trimethylsilane systems and associated equipment must be grounded. Electrical equipment must be non-sparking or explosion-proof. 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 trimethylsilane, see section 16.
For further information on storage, handling, and use of this product, see *NFPA 55: Standard for the Storage, Use, and Handling of Compressed and Liquefied Gases in Portable Cylinders*, published by the National Fire Protection Association.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST–Use an explosion-proof local exhaust system with sufficient airflow velocity to prevent oxygen deficiency and keep hazardous fumes and gases below applicable TLVs in the worker's breathing zone.

MECHANICAL (general)–Not recommended as a primary ventilation system to control worker's exposure.

SPECIAL–Use only in a closed system.

OTHER–See SPECIAL.

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.in 29 CFR 1910.134.

SKIN PROTECTION: Wear work gloves when handling cylinders.

EYE PROTECTION: Wear safety glasses when handling cylinders. Select eye protection in accordance with OSHA 29 CFR 1910.133.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Select in accordance with OSHA 29 CFR 1910.132 and 1910.133. Fire-resistant clothing, ear protection, and face shields are recommended when connecting or disconnecting transfer lines. 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

MOLECULAR WEIGHT:	74.2
SPECIFIC GRAVITY (H_2O = 1)@ 44°F (6.7°C)**:**	0.638
SPECIFIC GRAVITY (Air = 1)**:**	2.6
VAPOR PRESSURE at 32°F (0°C)**:**	11.5 psi (79.2 kPa, 594 mm Hg))
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1)**:**	High
BOILING POINT at 1 atm**:**	44°F (6.7°C)
FREEZING POINT at 1 atm**:**	-212.6°F (-135.9°C)

APPEARANCE, ODOR, AND STATE: Colorless liquid and gas; slight, repulsive odor.

10. Stability and Reactivity

STABILITY: ☐ Unstable ☒ Stable

INCOMPATIBILITY (materials to avoid): Halogens, oxidizers, acids, alkalis. Liberates flammable hydrogen gas on contact with acids, alcohols, alkalis, and metals or metallic compounds.

HAZARDOUS DECOMPOSITION PRODUCTS: Hydrogen, methane, silicon oxide. Decomposition at temperatures above 932°F (500°C) may release silicon carbonate and hydrogen.

HAZARDOUS POLYMERIZATION: ☐ May Occur ☒ Will Not Occur

CONDITIONS TO AVOID: Sources of ignition, exposure to air and incompatible materials

11. Toxicological Information

LC_{50} = >5,000 ppm, 1hr, rat. See section 3

12. Ecological Information

No adverse ecological effects expected. This product does not contain any Class I or Class II ozone-depleting chemicals. This product 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: Liquefied gas, flammable, n.o.s. (trimethylsilane)

HAZARD CLASS: 2.1	**IDENTIFICATION NUMBER:** UN 3161	**PRODUCT RQ:** None

SHIPPING LABEL(s): FLAMMABLE GAS

PLACARD (when required): FLAMMABLE GAS

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.

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):

TPQ: None
EHS RQ: 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: No	**REACTIVITY:** Yes
	FIRE: Yes

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

This product 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.

Trimethylsilane is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: This product 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.

Trimethylsilane is not listed in Appendix A as a highly hazardous chemical. 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: This product is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: This product 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: ***Flammable liquid and gas under pressure.*** Use piping and equipment adequately designed to withstand pressures to be encountered. Use only in a closed system thoroughly purged with an inert gas prior to introduction of trimethylsilane from cylinder. Use only spark-proof tools and explosion-proof equipment. Keep away from heat, sparks, and open flame. Close cylinder valve after each use; keep closed even when empty. ***Material may accumulate behind valve outlet cap or plug.*** Don appropriate protective equipment, and face the outlet away from you before removing the cap or plug. ***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.*** Isolate from all other products. ***Follow safe practices when returning cylinder to supplier.*** Be sure valve is closed; then tightly install valve outlet cap or plug. ***Never work on a pressurized system.*** If there is a leak, close the cylinder valve. Blow the system down in an environmentally safe manner in compliance with all federal, state, and local laws; then repair the leak. ***Never place a compressed gas cylinder where it may become part of an electrical circuit.***

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

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:		**HMIS RATINGS:**	
HEALTH	= 2	HEALTH	= 1
FLAMMABILITY	= 4	FLAMMABILITY	= 4
INSTABILITY	= 1	PHYSICAL HAZARD	= 1
SPECIAL	= None		

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-350
PIN-INDEXED YOKE:	CGA-None
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-632

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, 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.

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