

THRESHOLD LIMIT VALUE: None currently established. Praxair recommends compliance with the OSHA PEL and ACGIH (TLV-TWA) limits of 5 ppm for silane, which is similar in structure and properties to methylsilane. 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—Harmful if inhaled. Suspected symptoms: headache, nausea.

SKIN CONTACT—Contact may irritate the skin and mucous membranes. Pyrophoric reaction (spontaneous ignition) from silane impurities could burn the skin and mucous membranes.

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

EYE CONTACT—Methylsilane may irritate the eyes. Pyrophoric reaction (spontaneous ignition) from silane impurities can cause thermal burns of eye tissue.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: None known.

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: Methylsilane is not listed by NTP, OSHA, and IARC.

4. First Aid Measures

INHALATION: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

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.

SWALLOWING: An 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: *The reaction product of methylsilane and air is silicon oxide (silica). Irrigate skin and eye burns as necessary to remove the silica, then treat burns as usual.*

5. Fire Fighting Measures

FLASH POINT (test method)	Not applicable	AUTOIGNITION TEMPERATURE	Unknown
FLAMMABLE LIMITS IN AIR, % by volume	LOWER	Unknown	UPPER Unknown

EXTINGUISHING MEDIA: Use medial appropriate for surrounding fire. Note that Methylsilane reacts with water and note other incompatibilities in section 10.

SPECIAL FIRE FIGHTING PROCEDURES:

DANGER! Flammable liquid and gas under pressure (see section 3). Reacts violently with oxidizers and halogens; may react with water. 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, taking care not to extinguish flames. Solid streams of water may be ineffective. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Stop flow of gas if without risk, while continuing cooling water spray. Remove all containers from area of fire if without risk. Allow fire to burn out. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Forms explosive mixtures with air and oxidizing agents. 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). Methylsilane 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 may burn the skin and eyes. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check with an appropriate device. To protect persons from cylinder fragments should a rupture occur, evacuate the area if the fire cannot be brought under immediate control.

HAZARDOUS COMBUSTION PRODUCTS: Reacts with water to produce silicon oxide and flammable methane.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Flammable liquid and gas under pressure (see section 3). Reacts violently with oxidizers and halogens; may react with water. Forms explosive mixtures with air (see Section 5). Immediately evacuate all personnel from danger area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. If leaking methylsilane catches fire, do not extinguish flames (see section 5). Before entering area, especially confined areas, check with an appropriate device. Do not approach area without self-contained breathing apparatus and full protective clothing. Shut off flow if without risk. Remove all sources of ignition if without risk. Ventilate area or move cylinder to a well-ventilated area. Reverse flow into cylinder may cause rupture.

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 methylsilane cylinders from oxygen and other oxidizers by at least 20 feet or use a barricade of noncombustible material. This barricade should be at least 5 feet 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. 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. 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.

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. 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 methylsilane, 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 an explosion-proof local exhaust system with sufficient air flow velocity to maintain the concentration of methylsilane below the TLV in the worker's breathing zone.

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

SPECIAL—None

OTHER—None

RESPIRATORY PROTECTION: Use air-supplied respirators for concentrations up to 10 times the applicable permissible exposure limit. For higher concentrations, a full-face, self-contained breathing apparatus is required. Respiratory protection must conform to OSHA rules as specified in 29 CFR 1910.134.

SKIN PROTECTION: Wear work gloves for cylinder handling; suitable chemical-resistant gloves during cylinder changeout or wherever contact with product is possible.

EYE PROTECTION: Wear safety glasses when handling cylinders; vapor-proof goggles or face mask during cylinder changeout or wherever contact with product is possible. 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

MOLECULAR WEIGHT: 46.145	EXPANSION RATIO: Not applicable
SPECIFIC GRAVITY (H₂O=1): At -72.4°F (-58°C) and 1 atm: 0.628	SOLUBILITY IN WATER: Reacts
SPECIFIC GRAVITY (Air=1): Not available	VAPOR PRESSURE: AT 70°F (21.1°C): 192 psig (1324 kPa)
PERCENT VOLATILES BY VOLUME: 100	EVAPORATION RATE (Butyl Acetate=1): Not applicable.
BOILING POINT (1 atm): -71°F (-57.2°C)	pH: Not applicable

FREEZING POINT (1 atm): -248.8°F (-156°C)

APPEARANCE, ODOR, AND STATE: Colorless gas at normal temperature and pressure; mildly repulsive odor.

10. Stability and Reactivity

STABILITY:	Unstable		Stable	X
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INCOMPATIBILITY (materials to avoid): Oxidizers, halogens

HAZARDOUS DECOMPOSITION PRODUCTS: Silicon oxide, hydrogen, methane

HAZARDOUS POLYMERIZATION:	May Occur		Will Not Occur	X
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CONDITIONS TO AVOID: Sources of ignition, exposure to air

11. Toxicological Information

See section 3.

12. Ecological Information

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

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: Compressed gases, flammable n.o.s. (methylsilane)	HAZARD CLASS: 2.1
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IDENTIFICATION NUMBER: UN 1954	PRODUCT RQ: None
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SHIPPING LABEL(s): FLAMMABLE GAS	PLACARD (When required): FLAMMABLE GAS
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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 (40 CFR Part 355):

Threshold Planning Quantity (TPQ): None

Extremely Hazardous Substances (40 CFR 355): None

- **SECTIONS 311/312:** Require submission of Material Safety Data Sheets (MSDSs) and chemical inventory reporting with identification of EPA hazard categories. The hazard categories for this products are as follows:

IMMEDIATE: Yes

PRESSURE: Yes

DELAYED: Yes

REACTIVITY: Yes

FIRE: Yes

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

Methylsilane 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.

Methylsilane is not listed.

TSCA: Toxic Substances Control Act: Methylsilane 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.

Methylsilane 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 lbs (4553 kg) or more is covered under this regulation unless the gas is used as fuel.

STATE REGULATIONS:

CALIFORNIA: This product is not listed by California under the Safe Drinking Water 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: DANGER!

Flammable, toxic liquid and gas under pressure (see section 3). Pyrophoric--may ignite spontaneously in air. Do not breathe gas. Do not get vapor or liquid 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 thoroughly purged with an inert gas prior to introduction of methylsilane 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. **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. **Never work on a pressurized system.** If there is a leak, close the cylinder valve. Blow down the system in an environmentally safe manner in compliance with all federal, state, and local laws, then repair the leak. **When returning cylinder to supplier,** be sure valve is closed, then install valve outlet plug tightly. **Never ground a compressed gas cylinder or allow it to 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 = 1
 FLAMMABILITY = 4
 REACTIVITY = 3
 SPECIAL = None

HMIS RATINGS:

HEALTH = 0
 FLAMMABILITY = 4
 REACTIVITY = 3

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	Not assigned, (CGA-350 may be used)
PIN-INDEXED YOKE:	None
ULTRA-HIGH-INTEGRITY CONNECTION:	Not assigned, (CGA-632 may be used)

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA Pamphlet V-1.

Ask your supplier about free Praxair safety literature as referenced on the label for this product; you may also obtain copies by calling 1-800-PRAXAIR. Further information about methylsilane can be found in the following pamphlets published by the Compressed Gas Association, Inc. (CGA), 1725 Jefferson Davis Highway, Arlington, VA 22202-4102, Telephone (703) 412-0900.

- 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, Third Edition

Praxair asks users of this product to study this Material Safety Data Sheet (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 on 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. 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 14150-7891).

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