

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Compressed gas, flammable, n.o.s. (methylsilane) (MSDS No. P-6211-B)	Trade Names: Methylsilane
Chemical Name: Methylsilane	Synonyms: Monomethylsilane, monosilylmethane, silylmethane
Chemical Family: Organic silanes	Product Grades: Not applicable.
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! Pyrophoric, flammable liquid and gas under pressure.

Can ignite on contact with air.

May form explosive mixtures with air.

Harmful if inhaled.

Can cause eye, skin, and respiratory tract burns.

Contact with oxidizers or halogens causes violent reaction.

Self-contained breathing apparatus and protective clothing

must be worn by rescue workers.

Under ambient conditions, this is a colorless gas with a mildly repulsive 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 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.

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Other Effects of Overexposure. None known.

Medical Conditions Aggravated by Overexposure. None known.

CARCINOGENICITY: Methylsilane is not listed by NTP, OSHA, and 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
Methylsilane	992-94-9	>99%*

*The symbol > means "greater than."

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

FLAMMABLE PROPERTIES: Forms explosive mixtures with air and oxidizing agents.

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

PRODUCTS OF COMBUSTION: Carbon dioxide, carbon monoxide, water, silicone dioxide. Reacts with water to produce silicon oxide and flammable methane.

PROTECTION OF FIREFIGHTERS: DANGER! Pyrophoric, flammable liquid and gas under pressure. 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.

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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). 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.

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! Pyrophoric, flammable liquid and gas under pressure.

Personal Precautions. Reacts violently with oxidizers and halogens; may react with water. Forms explosive mixtures with air. 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. 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.

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 or liquid in eyes, on skin, or on clothing. Have safety showers and eyewash fountains immediately available. Keep away from heat, sparks, and open flame. Use only spark-proof tools and explosion-proof equipment. Close cylinder valve after each use; keep closed even when empty. 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. Slowly open valve.. If valve is hard to open, discontinue use and contact your supplier. For other precautions in using methylsilane, see section 16.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store and use with adequate ventilation. Separate methylsilane cylinders from oxygen 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 (1.5 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. 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

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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.

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 (2009)
Methylsilane	N.E.*	5 ppm**

*N.E.—Not Established.

**Praxair recommends a TLV-TWA value of 5 ppm based on the TLV for silane (silicon tetrahydride).

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

Mechanical (General). Not recommended as a primary ventilation system to control worker's exposure.

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear work gloves for cylinder handling; suitable chemical-resistant gloves during cylinder changeout or wherever contact with product is possible. 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 is possible. Select per OSHA 29 CFR 1910.133.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	Colorless gas
ODOR:	Mildly repulsive
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Gas at normal temperature and pressure
pH:	Not applicable.
FREEZING POINT at 1 atm:	-248.8°F (-156°C)
BOILING POINT at 1 atm:	-71°F (-57.2°C)
FLASH POINT (test method):	Not applicable.
EVAPORATION RATE (Butyl Acetate = 1):	Not applicable.
FLAMMABILITY:	Flammable
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: 1.3% UPPER: 88.9%
VAPOR PRESSURE at 68°F (20°C):	192 psig (1324 kPa)
VAPOR DENSITY:	Not available.
SPECIFIC GRAVITY (H ₂ O = 1) at -72.4°F (-58°C) and 1 atm:	0.63
SPECIFIC GRAVITY (Air = 1):	1.60
SOLUBILITY IN WATER:	Reacts with water
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	320°F (160°C)
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	100
MOLECULAR WEIGHT:	46.145
MOLECULAR FORMULA:	CH ₃ SiH ₃

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

CONDITIONS TO AVOID: Sources of ignition, exposure to air

INCOMPATIBLE MATERIALS: Oxidizers, halogens

HAZARDOUS DECOMPOSITION PRODUCTS: Silicon oxide, hydrogen, methane, carbon dioxide, carbon monoxide

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

Reacts violently with oxidizers and halogens.

11. Toxicological Information

ACUTE DOSE EFFECTS: LC₅₀, 1 hr rat = 19200 ppm (Silane)

STUDY RESULTS: Hydrolysis of silanes in the body forms silicic acid or hydrated silica.

12. Ecological Information

ECOTOXICITY: No known effects.

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

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. (methylsilane)

HAZARD CLASS:	PACKING GROUP/Zone:	IDENTIFICATION NUMBER:	PRODUCT RQ:
2.1	NA*	UN3156	None

SHIPPING LABEL(s): FLAMMABLE GAS

PLACARD (when required): FLAMMABLE GAS

*NA- Not applicable.

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)].

MARINE POLLUTANTS: Methylsilane 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: No

PRESSURE: 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 is not subject to reporting under Section 313.

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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 as a regulated substance.

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 lb (4536 kg) or greater is covered under this regulation unless the gas is used as a fuel.

STATE REGULATIONS:

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

PENNSYLVANIA: Methylsilane is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Pyrophoric, flammable liquid and gas under pressure.* Store and use with adequate ventilation. Isolate from all other products. ***Use piping and equipment adequately designed to withstand pressures to be encountered.*** Use a backflow prevention device in any piping. Electrical equipment must be non-sparking or explosion-proof. Use only in a closed system thoroughly purged with an inert gas prior to introduction of methylsilane from cylinder. ***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. ***Follow safe practices when returning cylinder to supplier.*** Ensure that the 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. 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.

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HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH = 1
FLAMMABILITY = 4
INSTABILITY = 3
SPECIAL = None

HMIS RATINGS:

HEALTH = 1
FLAMMABILITY = 4
PHYSICAL HAZARD = 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED: Not assigned. (CGA-350 may be used.)

PIN-INDEXED YOKE: Not applicable.

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 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*

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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.

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