

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Silane	Trade Name: Silane
Product Use: Many.	
Chemical Name: Silane	Synonym: Silicon Tetrahydride, Silicane, Monosilane, Silicon Hydride
Chemical Formula: SiH ₄	Chemical Family: Metalloid Hydride
Telephone: Emergencies: * 1-800-363-0042	Supplier /Manufacture: Praxair Canada Inc. 1 City Centre Drive Suite 1200 Mississauga, ON L5B 1M2
	Phone: 905-803-1600
	Fax: 905-803-1682

**Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier or Praxair sales representative.*

2. Composition and Information on Ingredients

INGREDIENTS	% (VOL)	CAS NUMBER	LD ₅₀ (Species & Routes)	LC ₅₀ (Rat, 4 hrs.)	TLV-TWA (ACGIH)
Silane	100	7803-62-5	Not applicable.	9600 ppm	5 ppm

3. Hazards Identification

Emergency Overview

DANGER! Pyrophoric, flammable high-pressure gas. Can ignite on contact with air. May form explosive mixtures with air. Does not need a source of ignition. Respiratory irritant. May cause respiratory system damage. Self-contained breathing apparatus may be required by rescue workers.

ROUTES OF EXPOSURE: Inhalation.

EFFECTS OF A SINGLE (ACUTE) OVEREXPOSURE:

INHALATION: May cause headache, nausea, and irritation of the respiratory tract.

SKIN CONTACT: No information available.

SKIN ABSORPTION: No information available.

SWALLOWING: A highly unlikely route of exposure. This product is a gas at room temperature and pressure.

EYE CONTACT: No information available.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: Not available.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE:

A knowledge of the available toxicology information and of the physical and chemical properties of the material suggests that overexposure is unlikely to aggravate existing medical conditions.

SIGNIFICANT LABORATORY DATA WITH POSSIBLE RELEVANCE TO HUMAN HEALTH HAZARD EVALUATION:

None.

CARCINOGENICITY:

Not listed as carcinogen by OSHA, NTP or IARC.

4. First Aid Measures

INHALATION:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

SKIN CONTACT:

Wash with soap and water. If irritation persists, get medical attention.

SWALLOWING:

This product is a gas at normal temperature and pressure.

EYE CONTACT:

Flush with water. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. If irritation persists, get medical attention.

NOTES TO PHYSICIAN:

There is no specific antidote. Treatment of over-exposure should be directed at the control of symptoms and the clinical condition.

5. Fire Fighting Measures

FLAMMABLE : Yes.	IF YES, UNDER WHAT CONDITIONS?	Gas may ignite spontaneously. Forms explosive mixtures with air and oxidizing agents.
FLASH POINT (test method) Not applicable.	AUTOIGNITION TEMPERATURE	Not available.
FLAMMABLE LIMITS IN AIR, % by volume:	LOWER: 1.4	UPPER: 96

EXTINGUISHING MEDIA:

Gas may ignite spontaneously in air (fire cannot be extinguished).

SPECIAL FIRE FIGHTING PROCEDURES:

DANGER! 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 spray from maximum distance until cool. Reverse flow into cylinder may cause rupture. Stop gas flow if without risk, while continuing cooling water spray. If gas flow cannot be shut off, allow fire to burn out. Reduce combustion products with water spray or fog. If flames are accidentally extinguished, explosive re-ignition may occur.

UNUSUAL FIRE AND EXPLOSION HAZARD:

Gas may ignite spontaneously in air. At low ambient temperatures and high rates of flow, ignition may be delayed, and under sonic flow conditions, may not occur. Vapours form from this product and may spread. Flammable vapours form from this product can be ignited by pilot lights, other flames, smoking, sparks, heaters, electrical equipment, static discharges, or other ignition sources at locations distant from product handling point. Forms explosive mixture with air and oxidizing agents. Container may rupture due to heat of fire. No part of a container should be subjected to temperature higher than 52 C. Most containers are provided with a pressure relief device designed to vent contents when they are exposed to elevated temperature.

HAZARDOUS COMBUSTION PRODUCTS:

Silica dust.

SENSITIVITY TO IMPACT:

Avoid impact against container.

SENSITIVITY TO STATIC DISCHARGE:

Possible, ground container.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

DANGER! Flammable, high-pressure gas. Forms explosive mixtures with air. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if without risk. Reduce gas with fog or fine water spray. Shut off flow if without risk. Ventilate area or move cylinder to a well-ventilated area. Flammable gas may spread from leak. Before entering area, especially confined areas, check atmosphere with an appropriate device.

WASTE DISPOSAL METHOD:

EMERGENCY DISPOSAL: Silane, silane mixtures, and silane purge or vent gases can readily be treated to destroy the silane by several means as follows:

1. Burning the silane by slowly bleeding silane containing gases into a continuously burning pilot flame.
2. By venting the silane containing gases slowly to the air through a water seal and burning by self-ignition of the silane in an isolated area away from personnel.
3. Scrubbing the silane through a caustic bed or caustic solution (10% sodium hydroxide).
4. By reaction with aqueous mercuric chloride.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN STORAGE:

Store and use with adequate ventilation. Separate flammable cylinders from oxygen, chlorine, and other oxidizers by at least 6 m or use a barricade of non-combustible material. This barricade should be at least 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. 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 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. 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, 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.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE:

Spontaneously flammable, high-pressure gas. 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 material from the cylinder. Use only spark-proof tools and explosion-proof equipment. Keep away from heat, sparks, and open flame. Close 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 ventailation.** Isolate from all other products. **Never work on a pressurized system.** If there is a leak, close the cylinder valve. Vent the system down in a safe and environmentally sound manner in compliance with all federal, provincial, and local laws; then repair the leak. **Never place a compressed gas cylinder where it may become part of an electrical circuit.**

Recommended Equipment: 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.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST: An explosion-proof local exhaust system is acceptable. See SPECIAL.

MECHANICAL (general): Inadequate.

SPECIAL: Not applicable.

OTHER: Not applicable.

PERSONAL PROTECTION:

RESPIRATORY PROTECTION: Use an air-supplied respirator or a full-face, positive-pressure, self contained breathing apparatus. Select in accordance with the current CSA stanndard Z94.4. "Selection care and use of respirators". Respirators should be approved by NIOSH/MSHA.

SKIN PROTECTION: Wear work gloves when handling cylinders.

EYE PROTECTION: Wear safety glasses when handling cylinders.

Select in accordance with the current CSA standard Z94.3, "Industrial Eye and Face Protection", and any provincial regulations, local bylaws or guidelines.

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling. Protective clothing where needed. Cuffless trousers should be worn outside the shoes. Select in accordance with the current CSA standard Z195, "Protective Foot Wear", and any provincial regulations, local bylaws or guidelines.

9. Physical and Chemical Properties

PHYSICAL STATE: Gas. (Compressed Gas.)	FREEZING POINT: -184.7°C (-300.5°F)	pH: Not applicable.
BOILING POINT -112°C (-169.6°F)	VAPOUR PRESSURE Not applicable.	MOLECULAR WEIGHT: 32.112 g/mole
SPECIFIC GRAVITY: LIQUID (Water = 1) Not available.	SOLUBILITY IN WATER, Negligible.	

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Date: Oct. 15, 2013

SPECIFIC GRAVITY: VAPOUR (air = 1)	1.2 @ 21.1 C	EVAPORATION RATE (Butyl Acetate=1):	Not applicable.	COEFFICIENT OF WATER/OIL DISTRIBUTION:	Not applicable.
VAPOUR DENSITY:	0.00144 g/ml @ 0 C	% VOLATILES BY VOLUME:	100% (v/v).	ODOUR THRESHOLD:	Not available.

APPEARANCE & ODOUR: Colourless. Odour: Choking.

10. Stability and Reactivity

STABILITY:	The product is stable.
CONDITIONS OF CHEMICAL INSTABILITY:	Elevated temperatures (> 400 C).
INCOMPATIBILITY (materials to avoid):	Air, water, solutions of bases, oxidizing agents, chlorine, halogens. Will react violently with halocarbons.
HAZARDOUS DECOMPOSITION PRODUCTS:	Hydrogen, silica dust, amorphous dioxide. Powder produced by the decomposition of this product in the absence of air may be flammable. (Note: Minimum ignition energy may be less than 5 mJ, Kst may be greater than 400 bar meters-second-1)
HAZARDOUS POLYMERIZATION:	Will not occur.
CONDITIONS OF REACTIVITY:	None known.

11. Toxicological Information

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. The components of this mixture are not listed as marine pollutants by TDG Regulations.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return cylinder to supplier.

14. Transport Information

TDG/IMO SHIPPING NAME: Silane, Compressed

HAZARD CLASS:	CLASS 2.1: Flammable gas.	IDENTIFICATION #:	UN2203	PRODUCT RQ:	Any accidental release in a quantity that could pose a danger to public safety or any sustained release of 10 minutes or more
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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, non-ventilated compartment of a vehicle can present serious safety hazards.

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, provincial, and local regulations.

DSL (Canada)	This product is on the DSL list
WHMIS (Canada)	CLASS A: Compressed gas. CLASS B-1: Flammable gas. CLASS F: Dangerously reactive material. CLASS D-2B: Material causing other toxic effects (Toxic)

International Regulations

EINECS	Not available.
DSCL (EEC)	R20- Harmful by inhalation.

International Lists No products were found.

16. Other Information

MIXTURES:

When two or more gases, or liquefied gases are mixed, their hazardous properties may combine to 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 make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

HAZARD RATING SYSTEM:

HMIS RATINGS:

HEALTH 0
FLAMMABILITY 4
PHYSICAL HAZARD 3

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:	CGA-350
PIN-INDEXED YOKE:	Not available.
ULTRA-HIGH-INTEGRITY CONNECTION:	CGA-632

Use the proper CGA connections. **DO NOT USE ADAPTERS.** Additional limited-standard connections may apply. See CGA pamphlets V-1 and V-7 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, Fax (703) 961-1831, website: www.cganet.com.

AV-1	Safe Handling and Storage of Compressed Gas
P-1	Safe Handling of Compressed Gases in Containers
P-32	Safe Storage and Handling of Silane and Silane Mixtures
V-1	Compressed Gas Cylinder Valve Inlet and Outlet Connections
V-7	Standard Method of Determining Cylinder Valve Outlet Connections for Industrial Gas Mixtures
---	Handbook of Compressed Gases, Fifth Edition

PREPARATION INFORMATION:

Product Name: Silane

MSDS# E-4649-k

Date: Oct. 15, 2013

DATE: October 15, 2013

DEPARTMENT: Safety and Environmental Services

TELEPHONE: 905-803-1600

The opinions expressed herein are those of qualified experts within Praxair Canada 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 Canada Inc., it is the user's obligation to determine the conditions of safe use of the product.

Praxair Canada Inc. requests the users of this product to study this Material Data Sheet (MSDS) and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify its employees, agents and contractors of the information on this MSDS and any product hazards and safety information, (2) furnish this same information to each of its customers for the product, and (3) request such customers to notify their employees and customers for the product of the same product hazards and safety information.

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