

SECTION 1: Product and company identification

1.1. Product identifier

Product form : Substance
 Name : Silane
 CAS No : 7803-62-5
 Formula : SiH₄
 Other means of identification : Monosilane, silicon hydride, silicon tetrahydride, silicane

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture : Industrial use. Use as directed.

1.3. Details of the supplier of the safety data sheet

Praxair, Inc.
 10 Riverview Drive
 Danbury, CT 06810-6268 - USA
 T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146
www.praxair.com

1.4. Emergency telephone number

Emergency number : Onsite Emergency: 1-800-645-4633

CHEMTREC, 24hr/day 7days/week
 — Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887
 (collect calls accepted, Contract 17729)

SECTION 2: Hazard identification

2.1. Classification of the substance or mixture

GHS-US classification

Flam. Gas 1 H220
 Liquefied gas H280
 Acute Tox. 4 (Inhalation:gas) H332

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



GHS02

GHS04

GHS07

Signal word (GHS-US) :

DANGER

Hazard statements (GHS-US) :

H220 - **EXTREMELY FLAMMABLE GAS**
 H250 - **CATCHES FIRE SPONTANEOUSLY IF EXPOSED TO AIR**
 H280 - **CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED**
 H332 - **HARMFUL IF INHALED**

Precautionary statements (GHS-US) :

P202 - Do not handle until all safety precautions have been read and understood
 P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces. - No smoking
 P222 - Do not allow contact with air
 P261 - Avoid breathing gas
 P271+P403 - Use and store only outdoors or in a well-ventilated place
 P377 - Leaking gas fire: Do not extinguish, unless leak can be stopped safely
 P381 - Eliminate all ignition sources if safe to do so
 CGA-PG05 - Use a back flow preventive device in the piping
 CGA-PG06 - Close valve after each use and when empty
 CGA-PG10 - Use only with equipment rated for cylinder pressure

CGA-PG17 - Use only with equipment purged with inert gas or evacuated prior to discharge from cylinder

CGA-PG12 - Do not open valve until connected to equipment prepared for use

CGA-PG18 - When returning cylinder, install leak tight valve outlet cap or plug

CGA-PG02 - Protect from sunlight when ambient temperature exceeds 52°C (125°F)

2.3. Other hazards

Other hazards not contributing to the classification : Spontaneously flammable in air
May ignite spontaneously in contact with air.

2.4. Unknown acute toxicity (GHS US)

No data available

SECTION 3: Composition/Information on ingredients

3.1. Substance

| Name | Product identifier | % |
|------------------------------|--------------------|-----|
| Silane (Main constituent) | (CAS No) 7803-62-5 | 100 |

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures after inhalation : Remove to fresh air and keep at rest in a position comfortable for breathing. If not breathing, give artificial respiration. If breathing is difficult, trained personnel should give oxygen. Call a physician.

First-aid measures after skin contact : Wash with plenty of soap and water. If irritation persists, consult a doctor.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Contact an ophthalmologist immediately.

First-aid measures after ingestion : Ingestion is not considered a potential route of exposure.

4.2. Most important symptoms and effects, both acute and delayed

No additional information available

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Escaping gas cannot be extinguished.

Unsuitable extinguishing media : **Do not use halon fire extinguisher..**

5.2. Special hazards arising from the substance or mixture

Fire hazard : **DANGER! Pyrophoric, FLAMMABLE, high pressure gas..** If venting or leaking gas catches fire, do not extinguish flames. Flammable vapors may spread from leak, creating an explosive reignition hazard. 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. Explosive atmospheres may linger. Before entering an area, especially a confined area, check the atmosphere with an appropriate device.

Explosion hazard : **MAY FORM EXPLOSIVE MIXTURES WITH AIR.**

Reactivity : **The substance may spontaneously ignite on contact with air.**

5.3. Advice for firefighters

- Firefighting instructions : **DANGER! Pyrophoric, FLAMMABLE, high pressure gas.**
- Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.
- Special protective equipment for fire fighters : Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
- Other information : Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

- General measures : **DANGER! Pyrophoric, FLAMMABLE, high pressure gas.** May ignite spontaneously in contact with air.. May form explosive mixtures with air. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. 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 atmosphere with an appropriate device.

6.1.1. For non-emergency personnel

No additional information available

6.1.2. For emergency responders

No additional information available

6.2. Environmental precautions

Try to stop release. Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution. Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.

6.3. Methods and material for containment and cleaning up

No additional information available

6.4. Reference to other sections

See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

- Precautions for safe handling : Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment
- Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. 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 the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.

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7.2. Conditions for safe storage, including any incompatibilities

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post “No Smoking/No Open Flames” signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16

OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may become part of an electrical circuit.

7.3. Specific end use(s)

None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

| Silane (7803-62-5) | | |
|--------------------|---------------------|-------|
| ACGIH | ACGIH TLV-TWA (ppm) | 5 ppm |
| USA OSHA | Not established | |

8.2. Exposure controls

Appropriate engineering controls : Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. **MECHANICAL (GENERAL): Inadequate - Use only in a closed system.** Use explosion proof equipment and lighting.

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.

Eye protection : Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133.

Skin and body protection : Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

Respiratory protection : When workplace conditions warrant respirator use, follow a respiratory protection program that meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). 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. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA). None necessary.

Thermal hazard protection : Wear cold insulating gloves when transfilling or breaking transfer connections.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Gas
 Molecular mass : 32 g/mol
 Color : Colorless.

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| | |
|---|---|
| Odor | : choking |
| Odor threshold | : Odor threshold is subjective and inadequate to warn for overexposure. |
| pH | : Not applicable. |
| Relative evaporation rate (butyl acetate=1) | : No data available |
| Relative evaporation rate (ether=1) | : Not applicable. |
| Melting point | : -186 °C |
| Freezing point | : No data available |
| Boiling point | : -111.5 °C |
| Flash point | : Not applicable. |
| Critical temperature | : -3.4 °C |
| Auto-ignition temperature | : No data available |
| Decomposition temperature | : No data available |
| Flammability (solid, gas) | : 1.4 - 96 vol % |
| Vapor pressure | : Not applicable. |
| Critical pressure | : 4840 kPa |
| Relative vapor density at 20 °C | : No data available |
| Relative density | : 0.55 |
| Relative gas density | : 1.1 |
| Solubility | : Water: No data available |
| Log Pow | : Not applicable. |
| Log Kow | : Not applicable. |
| Viscosity, kinematic | : Not applicable. |
| Viscosity, dynamic | : Not applicable. |
| Explosive properties | : MAY FORM EXPLOSIVE MIXTURES WITH AIR. |
| Oxidizing properties | : None. |
| Explosion limits | : 1 - 100 vol % Pyrophoric. |

9.2. Other information

| | |
|------------------------|--|
| Gas group | : Liquefied gas |
| Additional information | : Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level |

SECTION 10: Stability and reactivity

10.1. Reactivity

The substance may spontaneously ignite on contact with air.

10.2. Chemical stability

Stable under recommended handling and storage conditions (see section 7).

10.3. Possibility of hazardous reactions

May occur.

10.4. Conditions to avoid

Air contact. Moisture. Temperatures in excess of 400°C (752°F).

10.5. Incompatible materials

Air. Water, humidity. Bases. Oxidizing agents. Halogens. Chlorine. Halocarbons.

10.6. Hazardous decomposition products

Hydrogen. Silica dust. Silicon dioxide. **Powder produced in the absence of air may be flammable..**

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Inhalation:gas: HARMFUL IF INHALED.

| Silane (f)7803-62-5 | |
|---------------------------|------------------|
| LC50 inhalation rat (ppm) | 9500 ppm/4h |
| ATE US (gases) | 9500.000 ppmV/4h |

Skin corrosion/irritation : Not classified
pH: Not applicable.

Serious eye damage/irritation : Not classified
pH: Not applicable.

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

Specific target organ toxicity (single exposure) : Not classified

Specific target organ toxicity (repeated exposure) : Not classified

Aspiration hazard : Not classified

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : No known ecological damage caused by this product.

12.2. Persistence and degradability

| Silane (7803-62-5) | |
|-------------------------------|-------------------------------------|
| Persistence and degradability | Not applicable for inorganic gases. |

12.3. Bioaccumulative potential

| Silane (7803-62-5) | |
|---------------------------|--------------------|
| Log Pow | Not applicable. |
| Log Kow | Not applicable. |
| Bioaccumulative potential | No data available. |

12.4. Mobility in soil

| Silane (7803-62-5) | |
|--------------------|---|
| Mobility in soil | No data available. |
| Ecology - soil | Because of its high volatility, the product is unlikely to cause ground or water pollution. |

12.5. Other adverse effects

Effect on ozone layer : None

Effect on the global warming : No known effects from this product

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Do not attempt to dispose of residual or unused quantities. Return container to supplier.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN2203 Silane, 2.1

UN-No.(DOT) : UN2203

Proper Shipping Name (DOT) : Silane

Class (DOT) : 2.1 - Class 2.1 - Flammable gas 49 CFR 173.115

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Hazard labels (DOT) : 2.1 - Flammable gas



Additional information

Emergency Response Guide (ERG) Number : 116

Other information : No supplementary information available.

Special transport precautions : Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers:
 - Ensure there is adequate ventilation. - Ensure that containers are firmly secured. - Ensure cylinder valve is closed and not leaking. - Ensure valve outlet cap nut or plug (where provided) is correctly fitted. - Ensure valve protection device (where provided) is correctly fitted.

Transport by sea

UN-No. (IMDG) : 2203
 Proper Shipping Name (IMDG) : SILANE
 Class (IMDG) : 2 - Gases
 MFAG-No : 116

Air transport

UN-No. (IATA) : 2203
 Proper Shipping Name (IATA) : Silane
 Class (IATA) : 2
 Civil Aeronautics Law : Gases under pressure/Gases flammable under pressure

SECTION 15: Regulatory information

15.1. US Federal regulations

| Silane (7803-62-5) | |
|---|--|
| Listed on the United States TSCA (Toxic Substances Control Act) inventory | |
| SARA Section 311/312 Hazard Classes | Fire hazard Immediate (acute) health hazard Reactive hazard Sudden release of pressure hazard |

15.2. International regulations

CANADA

| Silane (7803-62-5) |
|---|
| Listed on the Canadian DSL (Domestic Substances List) |

EU-Regulations

| Silane (7803-62-5) |
|--|
| Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances) |

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15.2.2. National regulations

Silane (7803-62-5)

Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Listed on the Canadian IDL (Ingredient Disclosure List)
Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Silane(7803-62-5)

| | |
|---|---|
| U.S. - California - Proposition 65 - Carcinogens List | No |
| U.S. - California - Proposition 65 - Developmental Toxicity | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Female | No |
| U.S. - California - Proposition 65 - Reproductive Toxicity - Male | No |
| State or local regulations | U.S. - Massachusetts - Right To Know List U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - Pennsylvania - RTK (Right to Know) List |

SECTION 16: Other information

Other information

: When you mix two or more chemicals, 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. Before using any plastics, confirm their compatibility with this product

Praxair asks users of this product to study this SDS and become aware of the 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 SDS 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 Safety Data Sheet. Since the use of this information and the conditions of use 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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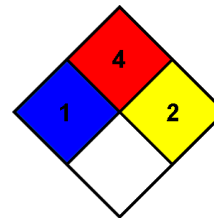
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| | |
|--------------------|--|
| NFPA health hazard | : 1 - Exposure could cause irritation but only minor residual injury even if no treatment is given. |
| NFPA fire hazard | : 4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily. |
| NFPA reactivity | : 2 - Normally unstable and readily undergo violent decomposition but do not detonate. Also: may react violently with water or may form potentially explosive mixtures with water. |



HMIS III Rating

| | |
|--------------|--|
| Health | : 0 Minimal Hazard - No significant risk to health |
| Flammability | : 4 Severe Hazard |
| Physical | : 3 Serious Hazard |

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.