

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Trichlorosilane (MSDS No. P-4823-F)		Trade Name: Praxair® Chlorosilane A-19	
Chemical Name: Trichlorosilane		Synonyms: Silicochloroform, silicon trichloride, trichloromonosilane	
Formula: HSiCl ₃		Chemical Family: Silicon halide	
Telephone:	Emergencies: 1-800-645-4633*	Company Name:	Praxair, Inc.
	CHEMTREC: 1-800-424-9300*		39 Old Ridgebury Road
	Routine: 1-800-PRAXAIR		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	CONCENTRATION	OSHA PEL	ACGIH TLV-TWA (2001)
Trichlorosilane	10025-78-2	>99%*	None currently established.	None currently established.
Hydrogen chloride	7647-01-0	Trace	5 ppm ceiling**	5 ppm ceiling**

*The symbol > means "greater than"; the symbol <, "less than."

** Ceiling values are not time-weighted average.

3. Hazards Identification

EMERGENCY OVERVIEW

**DANGER! Flammable, corrosive liquid and vapor.
Harmful or fatal if inhaled.**

Can cause eye, skin, and respiratory tract burns.

Can form explosive mixtures with air.

Water can cause violent reaction.

Contact with water or moist air liberates irritating gas.

**Self-contained breathing apparatus and protective clothing
must be worn by rescue workers.**

Odor: Irritating, choking.

THRESHOLD LIMIT VALUE: TLV-TWA, none currently established (ACGIH, 2001). 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—Low vapor concentrations will irritate the nose, throat, and chest, causing discomfort or pain with coughing, excess sputum, runny nose, and difficulty with breathing. Higher concentrations may result in inhalation of harmful and, because of injury to the nasal passages, larynx, and lungs, potentially lethal, amounts of material.

SKIN CONTACT—Brief contact will cause itching or discomfort, with the development of local redness and possibly swelling. Sustained contact will cause pain, local redness, swelling, ulceration, and possibly bleeding into the inflamed site. Prolonged or widespread skin contact may result in absorption of potentially harmful amounts of material.

SWALLOWING—Highly to severely toxic. May cause severe burns of the mouth, throat, esophagus, and stomach. There may be pain in the mouth, throat, chest, and abdomen and possible swelling of the tissues in the mouth and throat. Effects may include nausea, vomiting, diarrhea, dizziness, drowsiness, faintness, weakness, thirst, circulatory collapse, and coma.

EYE CONTACT—Vapor causes discomfort or pain in the eye, with excess tear production and blinking, and excess redness and possibly swelling of the conjunctiva (the connective tissues surrounding the eye). If high concentrations of hydrogen chloride are formed, then injury to the cornea may develop. Liquid splashed into the eye will cause pain with excess blinking and tear production. There will be marked excess redness and swelling of the conjunctiva and corneal injury, which if not treated promptly and adequately could lead to permanent impairment of vision.

EFFECTS OF REPEATED (CHRONIC) OVEREXPOSURE: May discolor or erode the teeth, cause the nose and gums to bleed, and ulcerate the nasal mucosa.

OTHER EFFECTS OF OVEREXPOSURE: None known.

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: Inhalation may aggravate asthma and inflammatory or fibrotic lung disease. Skin irritation may aggravate an existing dermatitis.

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

CARCINOGENICITY: Trichlorosilane 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. Call a physician.

SKIN CONTACT: Remove contaminated clothing and wash skin with soap and water. Wash clothing before reuse. If irritation persists, see a physician.

SWALLOWING: If patient is fully conscious, give two glasses of water or milk at once. Do not induce vomiting. Get medical attention without delay. Never give anything by mouth to an unconscious person.

EYE CONTACT: Immediately flush eyes thoroughly with warm water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. See a physician, preferably an ophthalmologist, immediately.

NOTES TO PHYSICIAN:

- *Most of the effects from overexposure to trichlorosilane are due to liberation of hydrogen chloride.*
- *Trichlorosilane is highly irritant to skin and mucosal surfaces.*
- *Swallowed trichlorosilane may produce ulceration and possibly perforation in the upper alimentary tract. Mediastinitis or peritonitis and the complications thereof may develop.*
- *With massive overexposure to the vapor, delayed onset pulmonary edema may develop. Secondary infection may develop in the inflamed respiratory tract. Individuals having significant overexposure to the vapor should be kept under observation.*
- *Aspirated material may produce lung injury. Emesis should not be induced mechanically or pharmacologically. If it is considered that gastric lavage is necessary, then it should be carried out in a manner least likely to result in aspiration, e.g., in the presence of airway intubation. Caution should be taken to avoid perforation of an acutely inflamed or ulcerated area of the alimentary tract.*

Contact the Poison Control Center in your area for additional information on patient management and follow-up.

5. Fire Fighting Measures

FLASH POINT (test method):	-18°F (-27.8°C) TCC, ASTM D56; 7°F(-13.9°C), TOC, ASTM 1310	
AUTOIGNITION TEMPERATURE:	Vapor has relatively low autoignition temperature of 360 ±4°F (182 ± 2°C) in dry air.	
FLAMMABLE LIMITS IN AIR , % by volume:	LOWER: 6.9-7.1%	UPPER: 80.0-86.0%

EXTINGUISHING MEDIA: For small fires, use copious quantities of water spray to react with the chlorosilane, which reacts violently with water to form hydrogen chloride fumes. Despite the reaction with water, trichlorosilane fires can be extinguished with a 6% solution in water of medium-expansion Hazmat II foam.

SPECIAL FIRE FIGHTING PROCEDURES: DANGER! Flammable, corrosive liquid and vapor. 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. Remove ignition sources if without risk. If flames are accidentally extinguished, explosive reignition may occur. Take appropriate measures, e.g., total evacuation. Reapproach with extreme caution. Use remote spray monitors or fight fire from behind shields. Reduce corrosive vapors with coarse water spray. Hydrolysis will overcome combustion. Stop flow of gas if without risk, while continuing cooling water spray. Remove all containers from area of fire if without risk. 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. Trichlorosilane cylinders are not equipped with a pressure relief device. No part of cylinder should be subjected to a temperature higher than 125°F (52°C). If leaking or spilled trichlorosilane catches fire, do not extinguish flames. Vapors may spread from leak and could explode if reignited by sparks, flames, or other sources of ignition including imperceptible static sparks. Explosive atmospheres may linger. Before entering area, especially confined areas, check with an appropriate device. To protect persons from cylinder fragments and toxic fumes should a rupture occur, evacuate the area if the fire cannot be brought under immediate control.

This product has a low autoignition temperature. Exposure to heat from a fire or from the water-trichlorosilane reaction can cause the trichlorosilane to autoignite. The acidic decomposition products formed by burning trichlorosilane from leaks may rapidly attack the metal at the leak area, especially if the metal is hot. Use proper bonding and grounding during liquid transfer as described in National Fire Protection Association document NFPA 77.

Vapor is extremely easy to ignite. Minimum ignition energy—0.017 millijoules (similar to hydrogen). Quenching distance—0.005 inch (less than hydrogen). (ASTM E582-76.) Vapor may require special precautions beyond Group A of Article 500-2 of National Electrical Code. Vapor has a relatively low autoignition temperature of $182 \pm 2^\circ\text{C}$ (ASTM E659-78). May ignite on hot surfaces at about this temperature or greater. Vapor burns rapidly in air. Explosibility indices are $P_{\text{max}} = 136$ psia and $KG = 544$ bar-m/s in a 20-liter vessel. Use of the Coke Gas or Hydrogen Deflagration Nomograph for venting is recommended (see NFPA document 68 "Venting of Deflagrations" Guidelines).

HAZARDOUS COMBUSTION PRODUCTS: See section 10.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED: DANGER! Flammable, corrosive liquid and vapor. Immediately evacuate all personnel from danger area. Do not approach area without self-contained breathing apparatus and protective clothing. Vapor forms explosive mixtures with air (see section 5). Before entering area, especially a confined area, check atmosphere with an appropriate device. Remove all sources of ignition if without risk. Reduce vapors with coarse water spray. Reverse flow into cylinder may cause rupture. (See section 16.) Shut off flow if without risk. Ventilate area or move cylinder to well-ventilated area. Prevent runoff from contaminating surrounding environment. Toxic, flammable, corrosive vapors may spread from spill. Do not turn on any ignition source until the area is determined to be free of fire or explosion hazard.

Small spills may be absorbed on an acid spill pillow or hydrolyzed with large quantities of water. If the product is absorbed on an acid spill pillow, place the pillow in a large quantity of water and allow it to dissolve (hydrolyze). In either case, assure that the hydrolyzed product can be safely vented.

EMERGENCY DISPOSAL: Do not discharge chlorosilanes directly to surface waters or sewer systems. Instead, try to dike or contain any spilled liquid. To diminish fumes either 1) gently cap the liquid surface with No. 6 fuel oil or 2) apply an appropriate solution of vapor-suppression foam expanded per manufacturer's instructions. Periodic reapplication of the foam may be necessary.

Trichlorosilane can be disposed of by first reacting it with water (hydrolysis), then neutralizing the acid (HCl) formed by the reaction. These processes will produce corrosive hydrochloric acid and may produce flammable hydrogen gas and other toxic, corrosive gases. Wear suitable protective equipment (section 8) and observe all other precautions set forth in this MSDS. First, add the chlorosilane to water, always using more than 5 parts water to one part chlorosilane. The exothermic reaction produces hydrochloric acid and either an insoluble liquid or a solid. Next, neutralize the acid by reacting it with an alkali base to adjust the pH of the solution to approximately 7. (Neutralization is an exothermic reaction and should be carried out only after technical consultation.) Dispose of the neutralized solution in accordance with federal, state, and local regulations. Skim off and collect the insoluble liquid and dispose of it in suitable incineration facilities. Incineration will form fumed silica (SiO_2), which, upon burning, produces a white smoke. If this is objectionable, use an incineration facility capable of handling silicon dioxide particulates. The solids, once neutralized, are non-hazardous and can be disposed of in a landfill.

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. 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. For other precautions in using trichlorosilane, see section 16.

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 trichlorosilane, see section 16.

8. Exposure Controls/Personal Protection

VENTILATION/ENGINEERING CONTROLS:

LOCAL EXHAUST—Use corrosion-resistant, explosion-proof local exhaust ventilation with sufficient airflow to keep the trichlorosilane concentration below the TLV in the worker's breathing zone.

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

SPECIAL—A canopy type of forced-air fume hood equipped with an explosion-proof device may be more desirable for certain applications.

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 when handling cylinders; neoprene when changing them out.

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

OTHER PROTECTIVE EQUIPMENT: Metatarsal shoes for cylinder handling and protective clothing where needed. 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:	135.45
SPECIFIC GRAVITY (H ₂ O = 1) at 77/77°F (25/25°C) and 1 atm:	1.33
SPECIFIC GRAVITY (Air = 1):	4.7 (calculated)
VAPOR PRESSURE at 68°F (20°C):	9.67 psia (66.67 kPa, abs)
SOLUBILITY IN WATER:	Reacts violently.
PERCENT VOLATILES BY VOLUME:	100
EVAPORATION RATE (Butyl Acetate = 1):	40 (estimated)
BOILING POINT at 1 atm:	89.6°F (32°C)
FREEZING POINT at 1 atm:	-196.6°F (-127°C)

APPEARANCE, ODOR, AND STATE: Colorless liquid at normal temperature and pressure; irritating, choking odor of hydrochloric acid.

10. Stability and Reactivity

STABILITY: ☐ Unstable ☒ Stable

INCOMPATIBILITY (materials to avoid): Water, oxidizing agents, bases, organic materials, aqueous acids, alkalis, ketones, and aldehydes. Reacts very rapidly with alcohols, amines, acetone, and ammonia.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition or burning can produce chlorine, hydrogen chloride, hydrogen, and oxides of silicon. Acute overexposure to the products of combustion may irritate the respiratory tract. Trichlorosilane reacts violently with water to form hydrogen chloride fumes. Halocarbons react strongly with it, and the mixture may explode given a source of ignition. Under some conditions, the reaction of this product with acids or alkalis can release flammable hydrogen gas. Trichlorosilane is also a reducing agent that may react explosively with some oxidizing agents. Under the influence of heat or catalysts, such as amines, rust, or aluminum chloride, trichlorosilane may redistribute to form mixtures of silane, monochlorosilane, dichlorosilane, and silicon tetrachloride. These mixtures may be pyrophoric.

HAZARDOUS POLYMERIZATION: ☐ May Occur ☒ Will Not Occur

CONDITIONS TO AVOID: 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. Trichlorosilane 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:** Trichlorosilane

HAZARD CLASS: 4.3	PACKING GROUP: I	IDENTIFICATION NUMBER: UN 1295	PRODUCT RQ: None
SHIPPING LABEL(s): DANGEROUS WHEN WET, FLAMMABLE LIQUID, CORROSIVE			
PLACARD (when required): DANGEROUS WHEN WET, FLAMMABLE LIQUID, CORROSIVE			

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):

Threshold Planning Quantity (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: Yes

PRESSURE: No

REACTIVITY: Yes

FIRE: Yes

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

Trichlorosilane is not reportable 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.

Trichlorosilane is listed as a regulated substance in quantities of 10,000 lb (4536 kg) or greater.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Trichlorosilane 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.

Trichlorosilane is listed in Appendix A as a highly hazardous chemical in quantities of 5,000 lb (2268 kg) or greater.

STATE REGULATIONS:

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

PENNSYLVANIA: Trichlorosilane 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, corrosive liquid and vapor.* Vapors may cause flash fire. Do not breathe vapor. Do not swallow liquid. Do not get vapors or liquid in eyes or on skin or clothing (see section 3). Harmful if inhaled or absorbed through the skin. May be fatal if swallowed. Aspiration may cause lung damage; do not induce vomiting. *Causes eye and skin burns.* Have safety showers and eyewash fountains immediately available. Use piping and equipment adequately designed to withstand pressures to be encountered. *May form explosive mixtures with air.* Keep away from heat, sparks, or open flame. Ground all equipment. Use only spark-proof tools and explosion-proof equipment. Static ignition hazard can result from handling and use. *Store and use in a dry environment with adequate ventilation at all times.* Use only in a closed system constructed of corrosion-resistant materials. 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. Be sure to read and understand all labels and instructions supplied with all containers of this product. Wash thoroughly after handling. *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. *When returning cylinder to supplier,* be sure valve is closed; then install valve outlet plug tightly. *Never place a compressed gas cylinder where it may become part of an electrical circuit.*

Trichlorosilane vapors react with moisture in air to produce dense white clouds of silica and hydrogen chloride. Therefore, this product should be confined within enclosed equipment and should not be vented directly to the air. Where venting is necessary, trichlorosilane should be vented through a scrubber system equipped to handle hydrogen chloride.

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.

WARNING: Hot organic chemical vapors or mists are susceptible to sudden spontaneous combustion when mixed with air. Ignition may occur at temperatures below those published in the literature as "autoignition" or "ignition" temperatures. Ignition temperatures decrease with increasing vapor volume and vapor/air contact time, and are influenced by pressure changes.

Ignition may occur at typical elevated-temperature process conditions, especially in processes operating under vacuum if subjected to sudden ingress of air, or outside process equipment operating under elevated pressure if sudden escape of vapors or mists to the atmosphere occurs.

Any proposed use of this product in elevated-temperature processes should be thoroughly evaluated to assure that safe operating conditions are established and maintained.

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	= 3
FLAMMABILITY	= 4
REACTIVITY	= 2
SPECIAL	= W

HMIS RATINGS:

HEALTH	= 3
FLAMMABILITY	= 4
REACTIVITY	= 2

STANDARD VALVE CONNECTIONS FOR U.S. AND CANADA:

THREADED:

CGA-678 and VCR type fittings are used; however, there is no standard or limited standard CGA conventional threaded connection assignments as such.

PIN-INDEXED YOKE:

Not applicable

ULTRA-HIGH-INTEGRITY CONNECTION:

CGA-636

Use the proper CGA connections. **DO NOT USE ADAPTERS.** 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.

AV-1	<i>Safe Handling and Storage of Compressed Gases</i>
P-1	<i>Safe Handling of Compressed Gases in Containers</i>
V-1	<i>Compressed Gas Cylinder Valve Inlet and Outlet Connections</i>
—	<i>Handbook of Compressed Gases, Fourth Edition</i>

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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