TRICHLOROSILANE
Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	TRICHLOROSILANE
Product Code(s)	G-81
UN-Number	UN1295
Recommended Use	Compressed gas.
Synonyms	Silicochloroform; Trichloromonosilane
Supplier Address*	Linde Gas North America LLC - Linde Merchant Production Inc. - Linde LLC 575 Mountain Ave. Murray Hill, NJ 07974 Phone: 908-464-8100 www.lindeus.com Linde Gas Puerto Rico, Inc. Las Palmas Village Road No. 869, Street No. 7 Catano, Puerto Rico 00962 Phone: 787-641-7445 www.pr.lindegas.com Linde Canada Limited 5860 Chedworth Way Mississauga, Ontario L5R 0A2 Phone: 905-501-1700 www.lindecanada.com * May include subsidiaries or affiliate companies / divisions. For additional product information contact your local customer service.
Chemical Emergency Phone Number	Chemtrec: 1-800-424-9300 for US / 703-527-3887 outside US

2. HAZARDS IDENTIFICATION

DANGER!

Emergency Overview

Dangerous when wet
Extremely flammable liquid and vapor
Toxic by inhalation
The product causes burns of eyes, skin and mucous membranes
Keep at temperatures below 52°C / 125°F

Appearance Colorless | Physical State Liquid. | Odor Sharp, Acidic

OSHA Regulatory Status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

Potential Health Effects

Principle Routes of Exposure	Inhalation. Eye contact. Skin contact. Ingestion.
Acute Toxicity	
Inhalation	Toxic by inhalation. Inhalation of corrosive fumes / gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Chemical pneumonitis and pulmonary edema result from exposure to the lower respiratory tract and deep lung. Residual pulmonary malfunction might occur.
Eyes	Corrosive to the eyes and may cause severe damage including blindness.
Skin	Contact causes severe skin irritation and possible burns.
Skin Absorption Hazard	No known hazard in contact with skin.
Ingestion	Ingestion causes burns of the upper digestive and respiratory tract.
Chronic Effects	None known
Aggravated Medical Conditions	Skin disorders. Respiratory disorders. Pre-existing eye disorders.
Environmental Hazard	See Section 12 for additional Ecological Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Trichlorosilane	10025-78-2	> 99	Cl_3HSi

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	Get medical attention if irritation persists. In case of contact with substance, immediately flush eyes with running water for at least 30 minutes. Keep eye wide open while rinsing.
Skin Contact	Immediate medical attention is required. Wash off immediately with soap and plenty of water for at least 15 minutes while removing all contaminated clothing and shoes.
Inhalation	PROMPT MEDICAL ATTENTION IS MANDATORY IN ALL CASES OF INHALATION OVEREXPOSURE. RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Conscious inhalation victims should be assisted to an uncontaminated area and inhale fresh air. If breathing is difficult, administer oxygen. Unconscious persons should be moved to an uncontaminated area and, as necessary, given artificial resuscitation and supplemental oxygen. Treatment should be symptomatic and supportive.
Ingestion	Immediate medical attention is required. Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Call a physician or Poison Control Center immediately.
Notes to Physician	Treat symptomatically.
Protection of First-aiders	Remove all sources of ignition. Use personal protective equipment. Avoid contact with skin, eyes and clothing.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Extremely flammable liquid and vapor
Suitable Extinguishing Media	DO NOT apply water to fire as water will intensify fire and cause corrosive hydrogen chloride fumes to be produced. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
Small Fires	Use medium expansion foam (>20:1 expansion ratio), carbon dioxide or dry chemical.
Large Fires	Use medium expansion foam (>20:1 expansion ratio) AFFF or alcohol compatible foam.
Unsuitable Extinguishing Media	DO NOT USE WATER. Do not use halogenated extinguishing agents or foam.
Hazardous Combustion Products	Hydrogen chloride. Hydrogen. Silicon dioxide. Chlorine compounds.

Explosion Data

Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	Yes.
Specific Hazards Arising from the Chemical	Low ignition energy. Water-reactive - Reacts vigorously with water or moisture in the air to form hydrogen chloride and hydrogen. The material can accumulate static charge and can therefore cause electrical ignition. Continue to cool fire exposed cylinders until flames are extinguished. Cylinders may rupture under extreme heat. Damaged cylinders should be handled only by specialists.
Protective Equipment and Precautions for Firefighters	Trichlorosilane fires are difficult to extinguish by conventional methods. In some instances, it may be better to allow the fire to burn itself out. DO NOT use water as an extinguishing agent OR allow water to contact spilled material or contents of container. Water spray may be used to knock down toxic combustion products and cool fire exposed containers and materials. Gently apply foam to surface of liquid. Avoid submersing foam streams beneath liquid surfaces. Initial foam application will generate significant amounts of flammable hydrogen gas and corrosive hydrogen chloride fumes. These fumes will reduce as the surface of the liquid becomes completely covered with foam. Hydrogen and hydrogen chloride gases produced can become trapped beneath foam blanket. Use extreme caution to eliminate all ignition sources. DO NOT allow any foam to enter containers. As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA / NIOSH (approved or equivalent) and full protective gear. Additional chemical protective clothing may be required to protect from toxic decomposition products.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Evacuate personnel to safe areas. Keep people away from and upwind of spill / leak. All equipment used when handling the product must be grounded. Use personal protective equipment. Do not touch or walk through spilled material. Stop leak if you can do it without risk.
Environmental Precautions	Beware of vapors accumulating to form explosive concentrations. Prevent spreading of vapors through sewers, ventilation systems and confined areas.
Methods for Containment	FOR CHLOROSILANES, use AFFF alcohol-resistant medium expansion foam to reduce vapors. Dike to collect large liquid spills. Absorb spilled material with an absorbent material such as clay, sawdust, or sand.

Methods for Cleaning Up	Minimize the amount spilled and supress resultant vapors Do not direct water at spill or source of leak. Use non-sparking tools and equipment. Return container to Linde or an authorized distributor.

7. HANDLING AND STORAGE

Handling	Ground and bond all lines and equipment associated with product system. All equipment should be non-sparking and explosion proof. Remove all sources of ignition. Use only in ventilated areas. "NO SMOKING" signs should be posted in storage and use areas. Any materials suitable for use with anhydous hydrogen chloride may be used. Systems and equipment must be scrupulously dry. Handle only in sealed, purged systems. Never attempt to lift a cylinder by its valve protection cap. Protect cylinders from physical damage; do not drag, roll, slide or drop. When moving cylinders, even for short distance, use a cart designed to transport cylinders. Use equipment rated for cylinder pressure. Use backflow preventive device in piping. Use an adjustable strap wrench to remove over-tight or rusted caps. Never insert an object (e.g. wrench, screwdriver, pry bar,etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Never put cylinders into trunks of cars or unventilated areas of passenger vehicles. Never attempt to refill a compressed gas cylinder without the owner's written consent. Never strike an arc on a compressed gas cylinder or make a cylinder a part of an electrical circuit.
Storage	Outside or detached storage is preferred. Protect from physical damage. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Store in cool, dry, well-ventilated area of non-combustible construction away from heavily trafficked areas and emergency exits. Keep at temperatures below 52°C / 125°F. Full and empty cylinders should be segregrated. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Always store and handle compressed gas cylinders in accordance with Compressed Gas Association, pamphlet CGA-P1, Safe Handling of Compressed Gases in Containers.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Other Exposure Guidelines	Linde recommends consideration a 2 ppm (ceiling) for hydrogen chloride (HCl), which forms by the hydrolysis of trichlorosilane. The American Industrial Hygiene Association (AIHA) has established a Workplace Environmental Exposure Level (WEEL) ceiling limit of 0.5 ppm for trichlorosilane.
Engineering Measures	Showers. Eyewash stations. Explosion proof ventilation systems. Exhaust gas should be vented to a gas treatment system.
Ventilation	Use ventilation adequate to keep exposures below recommended exposure limits.
Personal Protective Equipment	
Eye / Face Protection	Tightly fitting safety goggles. Face-shield.
Skin and Body Protection	Appropriate protective and chemical resistant gloves, clothing and splash protection, or fully encapsulating vapor protective clothing to prevent exposure. For materials of construction consult protective clothing manufacturer's specifications.
Respiratory Protection	

General Use	If exposure limits are exceeded or irritation is experienced, NIOSH / MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.
Emergency Use	Use positive pressure air line respirator or self-contained breathing apparatus for exposure over exposure limits or emergency use.
Hygiene Measures	When using, do not eat, drink or smoke. Remove and wash contaminated clothing before re-use. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Colorless.	Odor	Sharp, Acidic.
Odor Threshold	No information available	Physical State	Liquid
Flash Point	-18 °F / -28 °C	Flashpoint Method	Closed cup
Autoignition Temperature	182 °C / 360 °F	Decomposition Temperature	No information available.
Boiling Point / Boiling Range	32 °C / 90 °F	Freezing Point	-126.5 °C / -195.7 °F
Molecular Weight	135.45	Water Solubility	Hydrolyzes
Evaporation Rate	No information available	Vapor Pressure	493 mmHg @ 77 °F
Vapor Density	4.67 (air = 1)	VOC Content (%)	Not applicable.
Flammability Limits in Air			
Upper	83%		
Lower	7%		

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions.
Incompatible Products	Oxidizing agents. Water. Alcohols. Bases. Amines. Peroxides. Acids. Ammonia.
Conditions to Avoid	Heat, flames and sparks.
Hazardous Decomposition Products	Hydrogen gas. Silicon dioxide. Phosgene. Finely divided amorphous silica.
Hazardous Polymerization	Hazardous polymerization does not occur.

11. TOXICOLOGICAL INFORMATION

Acute Toxicity

LD50 Oral:	No information available.
LD50 Dermal:	No information available.
LC50 Inhalation:	Per CGA P-20: 1040 ppm / 1 hr. (Rat).
Inhalation	Inhalation may cause severe respiratory irritation and pulmonary edema.
Eye Contact	Instillation of trichlorosilane has caused severe injury to the rabbit eye (rated 9 on Carpenter-Smyth scale).
Skin Contact	Contact causes severe skin irritation and possible burns.

Ingestion	May cause corrosive burns to the mouth, throat, and digestive tract. The oral LD50 has been cited as between 0.19 and 2 g / kg.
Repeated Dose Toxicity	No information available.

Chronic Toxicity

Chronic Toxicity	None known.
Carcinogenicity	Contains no ingredient listed as a carcinogen.

Irritation	No information available.
Sensitization	No information available.
Mutagenic Effects	Trichlorosilane was negative in the Ames test in S. Typhimurium TA-98, TA-100, TA-1535, TA-1537 and TA-1538.
Reproductive Toxicity	No information available.
Developmental Toxicity	No information available.
Synergistic Materials	None known.
Target Organ Effects	None known.

12. ECOLOGICAL INFORMATION

Ecotoxicity

The environmental impact of this product has not been fully investigated.

Ozone depletion potential; ODP; (R-11 = 1): Does not contain ozone depleting chemical (40 CFR Part 82).

13. DISPOSAL CONSIDERATIONS

Waste Disposal Methods	Do not attempt to dispose of residual waste or unused quantities. Return in the shipping container PROPERLY LABELED WITH ANY VALVE OUTLET PLUGS OR CAPS SECURED AND VALVE PROTECTION CAP IN PLACE to Linde for proper disposal.
Contaminated Packaging	Do not re-use empty containers.

14. TRANSPORT INFORMATION

DOT

Proper shipping name	Trichlorosilane
Hazard Class	4.3
Subsidiary Class	3, 8
UN-Number	UN1295

Packing Group	I
Description	UN1295,Trichlorosilane,4.3,(3, 8),PG I
Emergency Response Guide Number	139

TDG

Proper Shipping Name	Trichlorosilane
Hazard Class	4.3
Subsidiary Class	(3), (8)
UN-Number	UN1295
Packing Group	I
Description	UN1295,TRICHLOROSILANE,4.3(3), (8),PG I

MEX

Proper Shipping Name	Trichlorosilane
Hazard Class	4.3
Subsidiary Class	3, 8
UN-Number	UN1295
Description	UN1295 Trichlorosilane,4.3, (3,8),I
Packing Group	I

IATA

UN-Number	UN1295
Proper Shipping Name	Trichlorosilane
Hazard Class	4.3
Subsidiary Class	3,8
ERG Code	4HW
Description	UN1295,Trichlorosilane,4.3(3,8)
Maximum Quantity for Passenger	Forbidden
Maximum Quantity for Cargo Only	Forbidden
Limited Quantity	No information available.

IMDG / IMO

Proper Shipping Name	Trichlorosilane
Hazard Class	4.3
Subsidiary Class	8, 3
UN-Number	UN1295
Packing Group	I
EmS No.	F-G, S-O
Description	UN1295, Trichlorosilane,4.3(8, 3),PG I, FP -28C

ADR

Proper Shipping Name	Trichlorosilane
Hazard Class	4.3
UN-Number	UN1295
Packing Group	I
Classification Code	WFC
Description	UN1295 Trichlorosilane,4.3,(3,8),I
ADR / RID-Labels	3, 8

15. REGULATORY INFORMATION

International Inventories

TSCA	Complies
DSL	Complies
EINECS / ELINCS	Complies

Legend

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL / NDSL - Canadian Domestic Substances List / Non-Domestic Substances List
EINECS / ELINCS - European Inventory of Existing Commercial Chemical Substances / EU List of Notified Chemical Substances

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311 / 312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	Yes

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

Risk and Process Safety Management Programs
This material, as supplied, contains one or more regulated substances with specified thresholds under 40 CFR Part 68 or regulated as a highly hazardous chemical pursuant to the 29 CFR Part 1910.110 with specified thresholds:

Chemical Name	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Toxic Substances	U.S. - CAA (Clean Air Act) - Accidental Release Prevention - Flammable Substances	U.S. - OSHA - Process Safety Management - Highly Hazardous Chemicals
Trichlorosilane		10000 lbs	5000 lb

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)
This product does not contain any substances regulated as hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act Amendments of 1990.

CERCLA / SARA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

U.S. State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Trichlorosilane	X	X	X		X

International Regulations

Mexico - Grade Severe risk, Grade 4

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class
B2 Flammable liquid
B6 Reactive flammable material
E Corrosive material
D1A Very toxic materials

Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501
Issuing Date	01-Jul-2010
Revision Date	27-Sep-2013
Revision Number	2
Revision Note	Not applicable.

NFPA	Health Hazard 3	Flammability 4	Stability 0	Physical and Chemical Hazards W2
HMIS	Health Hazard 3	Flammability 4	Physical Hazard 2	Personal Protection -

Note: Ratings were assigned in accordance with Compressed Gas Association (CGA) guidelines as published in CGA Pamphlet P-19-2009, CGA Recommended Hazard Ratings for Compressed Gases, 3rd Edition.

End of Safety Data Sheet