



CHLORINE

Material Safety Data Sheet

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name	CHLORINE
Product Code(s)	G-23, 1046
UN-Number	UN1017
Recommended Use	Compressed gas.
Synonyms	Bertholite; Molecular Chlorine
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.lindecana.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		
Fatal if inhaled		
Corrosive		
The product causes burns of eyes, skin and mucous membranes		
Accelerates combustion and increases risk of fire		
Contents under pressure		
Keep at temperatures below 52°C / 125°F		
Appearance	Greenish-yellow gas	Physical State
		Compressed gas.
		Odor Bleach

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	Eye contact. Skin contact. Inhalation.
Acute Toxicity	
Inhalation	Fatal if inhaled. 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	Gas can cause irritation. Contact with liquid causes severe corrosive action. Risk of serious damage to eyes.
Skin	Gas can cause irritation. Contact with liquid causes severe corrosive action. Reacts with water very rapidly yielding hydrochloric acid. Hydrogen chloride burns exhibit severe pain, redness, possible swelling and early necrosis.
Skin Absorption Hazard	No known hazard in contact with skin.
Ingestion	Not an expected route of exposure. Ingestion causes burns of the upper digestive and respiratory tract.
Chronic Effects	No known effect based on information supplied
Aggravated Medical Conditions	Skin disorders. Pre-existing eye disorders. Respiratory disorders.
Environmental Hazard	Very toxic to aquatic organisms. See Section 12 for additional Ecological Information.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS-No	Volume %	Chemical Formula
Chlorine	7782-50-5	> 99	Cl ₂

4. FIRST AID MEASURES

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye Contact	Immediate medical attention is required. 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 30 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	None under normal use. Call a POISON CENTER or doctor / physician if exposed or you feel unwell.
Notes to Physician	Treat symptomatically.
Protection of First-aiders	Use personal protective equipment. Avoid contact with skin, eyes and clothing.

5. FIRE-FIGHTING MEASURES

Flammable Properties	Oxidizer. May vigorously accelerate combustion.
Suitable Extinguishing Media	Use water spray or fog; do not use straight streams. DO NOT EXTINGUISH A LEAKING GAS FIRE UNLESS LEAK CAN BE STOPPED.
<u>Explosion Data</u>	
Sensitivity to Mechanical Impact	None
Sensitivity to Static Discharge	None
Specific Hazards Arising from the Chemical	Will ignite combustible materials (wood, paper, oil, debris, etc.). Flame impingement upon steel chlorine containers will result in iron / chlorine fire causing rupture of the container. Most combustible materials burn in chlorine as they do in oxygen producing irritating and poisonous gases. 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	As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA / NIOSH (approved or equivalent) and full protective gear. Corrosive hazard. Wear protective gloves / clothing and eye / face protection.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill / leak. Ensure adequate ventilation. Use personal protective equipment. Avoid contact with skin, eyes and clothing.
Environmental Precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas. Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.
Methods for Containment	Stop the flow of gas or remove cylinder to outdoor location if this can be done without risk. If leak is in container or container valve, contact the appropriate emergency telephone number in Section 1 or call your closest Linde location.
Methods for Cleaning Up	Return cylinder to Linde or an authorized distributor.
Other Information	Ventilate the area.

7. HANDLING AND STORAGE

Handling	Most metals corrode rapidly with wet chlorine. Systems must be kept dry. Lead, gold, tantalum and Hastelloy are most resistant to wet chlorine. Do not breathe gas. Avoid contact with skin, eyes and clothing. Use only in ventilated areas. 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. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve cap openings. Doing so may damage valve, causing leak to occur. "NO SMOKING" signs should be posted in storage and use areas.
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Use an adjustable strap wrench to remove over-tight or rusted caps. Close valve after each use and when empty. 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

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 segregated. 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.

For additional storage recommendations, consult the CHLORINE INSTITUTE PAMPHLET 1.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Chlorine 7782-50-5	STEL: 1 ppm TWA: 0.5 ppm	(vacated) TWA: 0.5 ppm (vacated) TWA: 1.5 mg / m ³ (vacated) STEL: 1 ppm (vacated) STEL: 3 mg / m ³ Ceiling: 1 ppm Ceiling: 3 mg / m ³	IDLH: 10 ppm Ceiling: 0.5 ppm 15 min Ceiling: 1.45 mg / m ³ 15 min

Immediately Dangerous to Life or Health.

Other Exposure Guidelines

Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992).

Engineering Measures

Showers. Eyewash stations. 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. (Butyl rubber, neoprene, and Teflon® provide adequate protection for exposures to chlorine >8 hours).

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. For exposures above IDLH, an additional escape bottle is required.

Hygiene Measures

When using, do not eat, drink or smoke. Provide regular cleaning of equipment, work area and clothing. Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product. Keep away from food, drink and animal feeding stuffs.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Greenish-yellow gas.	Odor	Bleach.
Odor Threshold	No information available	Physical State	Compressed gas
Flash Point	No information available.	Autoignition Temperature	No information available.
Decomposition Temperature	No information available.	Boiling Point / Boiling Range	-34.1 °C / -29.3 °F
Freezing Point	-101 °C / -149.8 °F	Molecular Weight	70.906
Water Solubility	Very soluble	Evaporation Rate	No information available
Vapor Pressure	100.2 PSIA @ 70°F	Vapor Density	2.47 (air = 1)
Gas Density	2.980 g / ltr @ 21°C, 1 atm	Liquid Density	2.473 (@ 20°C, 101.325 kPa)
VOC Content (%)	Not applicable.	Specific Vol. @ 21.1°C & 1 atm	337.1 dm ³ / kg (5.4 ft ³ / lb)
Critical Pressure	1118.4 psia	Critical Temperature	144°C (291.2°F)
Flammability Limits in Air			
Upper	Not applicable		
Lower	Not applicable		

10. STABILITY AND REACTIVITY

Stability	Stable under recommended storage conditions.
Incompatible Products	Strong oxidizing agents. Organic material. Combustible materials.
Conditions to Avoid	Chlorine reacts explosively or forms explosive compounds with many common substances including acetylene, ether, turpentine, ammonia, fuel gas, hydrogen and finely divided metals. Reacts with water to form hydrochloric acid.
Hazardous Decomposition Products	None known based on information supplied.
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: 293 ppm / 1hr. (Rat)
Inhalation	Inhalation of chlorine concentrations as low as 1 ppm may cause nose, throat and conjunctiva irritation. Irritation becomes more pronounced at concentrations of 1.3 ppm and above with coughing and labored breathing. Death may occur after a few breaths at 1000 ppm. Delayed effects following high exposure may include bronchitis, edema, and pneumonia.
Eye Contact	Causes burns.
Skin Contact	Causes burns. Prolonged exposure to low concentrations may cause chloracne.
Repeated Dose Toxicity	No information available.

Chronic Toxicity

Chronic Toxicity None known.

Carcinogenicity Equivocal evidence of carcinogenicity for chlorine was noted in an IARC review and a 2 year drinking water study in F344 / N and B6C3F1 mice by the NTP.

Irritation No information available.

Sensitization No information available.

Reproductive Toxicity No information available.

Developmental Toxicity No information available.

Synergistic Materials None known.

Target Organ Effects Eyes. Respiratory system. Skin.

12. ECOLOGICAL INFORMATION

This product contains a chemical which is listed as a marine pollutant according to DOT.

Ecotoxicity

Very toxic to aquatic organisms.

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

Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
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Chlorine		LC50 96 h: 0.104-0.168 mg/L static (Oncorhynchus mykiss) LC50 96 h: = 0.014 mg/L (Oncorhynchus mykiss) LC50 96 h: = 0.014 mg/L flow-through (Oncorhynchus mykiss) LC50 96 h: = 0.08 mg/L flow-through (Pimephales promelas) LC50 96 h: = 0.1 mg/L (Pimephales promelas) LC50 96 h: = 0.44 mg/L flow-through (Lepomis macrochirus)		LC50 48 h: = 0.017 mg/L (Daphnia magna)
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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	Chlorine
Hazard Class	2.3
Subsidiary Class	5.1, 8
UN-Number	UN1017
Marine Pollutant	This product contains a chemical which is listed as a marine pollutant according to DOT.
Description	UN1017,Chlorine,2.3,(5.1, 8),Marine Pollutant
Additional Description:	"Toxic-Inhalation Hazard Zone B". If net weight of product is greater than or equal to 10 lbs., the shipping description must also contain the letters "RQ".
Additional Marking Requirements:	"Inhalation Hazard". If net weight of product is greater than or equal to 10 lbs., the container must also be marked with the letters "RQ".
Emergency Response Guide Number	124

TDG

Proper Shipping Name	Chlorine
Hazard Class	2.3
Subsidiary Class	(8)
UN-Number	UN1017
Marine Pollutant	This product contains a chemical which is listed as a marine pollutant according to TDG.
Description	UN1017,CHLORINE,2.3(8),Marine Pollutant

MEX

Proper Shipping Name	Chloro
Hazard Class	2.3
Subsidiary Class	8

UN-Number UN1017
Description UN1017 Chloro,2.3

IATA

UN-Number UN1017
Proper Shipping Name Chlorine
Hazard Class 2.3
Subsidiary Class 5.1, 8
ERG Code 2CP
Description UN1017,Chlorine,2.3(5.1, 8)
Maximum Quantity for Passenger Forbidden
Maximum Quantity for Cargo Only Forbidden
Limited Quantity No information available.

IMDG / IMO

Proper Shipping Name Chlorine
Hazard Class 2.3
Subsidiary Class 5.1, 8, P
UN-Number UN1017
EmS No. F-C, S-U
Marine Pollutant This product contains a chemical which is listed as a marine pollutant according to IMDG / IMO
Description UN1017, Chlorine,2.3(5.1, 8, P),Marine Pollutant

ADR

Proper Shipping Name Chlorine
Hazard Class 2.3
UN-Number UN1017
Classification Code 2TOC
Description UN1017 Chlorine,2.3,
ADR / RID-Labels 5.1, 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 RegulationsSARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372:

Chemical Name	CAS-No	SARA 313 - Threshold Values %
Chlorine	7782-50-5	1.0

SARA 311 / 312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	Yes
Sudden Release of Pressure Hazard	Yes
Reactive Hazard	Yes

Clean Water Act

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42):

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Chlorine	10 lb			X

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
Chlorine	2500 lbs		1500 lb

Clean Air Act, Section 112 Hazardous Air Pollutants (HAPs) (see 40 CFR 61)

This product contains the following substances which are listed hazardous air pollutants (HAPS) under Section 112 of the Clean Air Act:

Chemical Name	CAS-No	HAPS data	VOC Chemicals	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Chlorine	7782-50-5				

CERCLA / SARA

This material, as supplied, contains one or more 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):

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	TPQ
Chlorine	10 lb	10 lb	100 lb TPQ

U.S. State RegulationsCalifornia 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
Chlorine	X	X	X	X	X

International Regulations

Chemical Name	Carcinogen Status	Exposure Limits
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Chlorine		Mexico: TWA 1 ppm Mexico: TWA 3 mg / m ³ Mexico: STEL 3 ppm Mexico: STEL 9 mg / m ³
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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

A Compressed gases

D1A Very toxic materials

E Corrosive material



Chemical Name	NPRI
Chlorine	X

Legend

NPRI - National Pollutant Release Inventory

Prepared By Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Issuing Date 14-Feb-2011

Revision Date 27-Sep-2013

Revision Number 1

Revision Note Not applicable.

NFPA

Health Hazard 4

Flammability 0

Stability 0

Physical and Chemical
Hazards OX

HMIS

Health Hazard 3

Flammability 0

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.

General Disclaimer

For terms and conditions, including limitation of liability, please refer to the purchase agreement in effect between Linde LLC, Linde Merchant Production, Inc. or Linde Gas North America LLC (or any of their affiliates and subsidiaries) and the purchaser.

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End of Safety Data Sheet