



CHLORINE

Safety Data Sheet

1. IDENTIFICATION

Product identifier

Product Name CHLORINE

Other means of identification

Safety data sheet number LIND-P030

UN / ID no. UN1017

Synonyms Bertholite; Molecular Chlorine

Recommended use of the chemical and restrictions on use

Recommended Use Industrial and professional use.

Uses advised against Consumer use

Details of the supplier of the safety data sheet

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.

Road 869, Km 1.8

Barrio Palmas, Catano, PR 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.

Emergency telephone number

Company Phone Number 800-232-4726 (Linde National Operations Center, US)
905-501-0802 (Canada)

CHEMTREC: 1-800-424-9300 (North America) +1-703-527-3887 (International)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Acute toxicity - Inhalation (Gases)	Category 2
Skin corrosion / irritation	Category 1
Serious eye damage / eye irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Oxidizing gases	Category 1
Gases under pressure	Liquefied gas

Label elements

Signal word

Danger

Hazard Statements

May cause or intensify fire; oxidizer

Contains gas under pressure; may explode if heated

Fatal if inhaled

Causes severe skin burns and eye damage

Corrosive to the respiratory tract

Precautionary Statements - Prevention

Do not handle until all safety precautions have been read and understood

Keep valves and fittings free from oil and grease

Do not breathe gas.

Wash hands thoroughly after handling

Use and store only outdoors or in a well ventilated place

Wear protective gloves, protective clothing, eye protection, respiratory protection, and / or face protection

Use backflow preventive device in piping

Use only with equipment of compatible materials of construction and rated for cylinder pressure

Do not open valve until connected to equipment prepared for use

Close valve after each use and when empty

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

Precautionary Statements - Response

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor / physician.

IF ON SKIN (or hair): Remove / Take off immediately all contaminated clothing. Rinse skin with water / shower. Wash contaminated clothing before reuse. Immediately call a POISON CENTER or doctor / physician.

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

Immediately call a POISON CENTER or doctor / physician

In case of fire: Stop leak if safe to do so

Precautionary Statements - Storage

Store locked up

Protect from sunlight when ambient temperature exceeds 52°C / 125°F

Precautionary Statements - Disposal

Dispose of contents / containers in accordance with container supplier / owner instructions

Hazards not otherwise classified (HNOC)

Not applicable

Other Information

Very toxic to aquatic life

Avoid release to the environment

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Volume %	Chemical Formula
Chlorine	7782-50-5	100	Cl ₂

4. FIRST AID MEASURES

Description of first aid measures

General advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Inhalation	Remove to fresh air and keep comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. Get medical attention immediately.
Skin contact	Immediately flush skin with plenty of water for at least 30 minutes. Remove contaminated clothing and shoes. Immediate medical attention is required.
Eye contact	Immediately flush eyes with running water for at least 30 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Keep eye wide open while rinsing. Do not rub affected area. Immediate medical attention is required.
Ingestion	Not an expected route of exposure.
Self-protection of the first aider	RESCUE PERSONNEL SHOULD BE EQUIPPED WITH SELF-CONTAINED BREATHING APPARATUS. Use personal protective equipment. Avoid contact with skin, eyes and clothing. Ensure that medical personnel are aware of the material(s) involved and take precautions to protect themselves.

Most important symptoms and effects, both acute and delayed

Symptoms	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. May cause burns of eyes, skin and mucous membranes. Symptoms may be delayed.
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Indication of any immediate medical attention and special treatment needed

Note to physicians	Treat symptomatically.
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5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Specific extinguishing methods

Continue to cool fire exposed cylinders until flames are extinguished. Damaged cylinders should be handled only by specialists.

Specific hazards arising from the chemical

Non-flammable gas. May cause or intensify fire; oxidizer. Most combustible materials burn in chlorine as they do in oxygen producing irritating and poisonous gases. Will support and accelerate combustion of combustible materials (wood, paper, oil, debris, etc). The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating and toxic gases and vapors. Flame impingement upon steel chlorine containers will result in iron / chlorine fire causing rupture of the container. Cylinders may rupture under extreme heat.

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 chemically protective gloves / clothing and eye / face protection. Additional chemical protective clothing may be required to protect from toxic decomposition products.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions	Evacuate personnel to safe areas. Keep people away from and upwind of spill / leak. Ensure adequate ventilation, especially in confined areas. Monitor concentration of released product. Eliminate all ignition sources if safe to do so. Use personal protection recommended in Section 8. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.
Other Information	Gas / vapor is heavier than air. Prevent from entering sewers, basements and workpits, or any place where accumulation may be dangerous.

Environmental precautions

Environmental precautions	Prevent spreading of vapors through sewers, ventilation systems and confined areas. Do not allow into any sewer, on the ground or into any body of water. Prevent product from entering drains. See Section 12 for additional ecological information.
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Methods and material for containment and cleaning up

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.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on safe handling	Most metals corrode rapidly with wet chlorine. Systems must be kept dry. Lead, gold, tantalum and Hastelloy are most resistant to wet chlorine. Keep valves and fittings free from oil and grease. Use only equipment of compatible materials of construction. Open valve slowly. "NO SMOKING" signs should be posted in storage and use areas. Separate flammable gas cylinders from oxygen and other oxidizers by a minimum distance of 20 ft. or by a 5 ft. high barrier with a minimum fire resistance rating of a half an hour. 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. Never attempt to lift a cylinder by its valve protection cap. Never insert an object (e.g. wrench, screwdriver, pry bar, etc.) into valve
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cap openings. Doing so may damage valve, causing leak to occur. Use an adjustable strap wrench to remove over-tight or rusted caps. Use only with adequate ventilation. Use backflow preventive device in piping. Use only with equipment rated for cylinder pressure. Close valve after each use and when empty. If user experiences any difficulty operating cylinder valve discontinue use and contact supplier. Ensure the complete gas system has been checked for leaks before use.

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.

Only experienced and properly instructed persons should handle gases under pressure. 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.

Conditions for safe storage, including any incompatibilities

Storage Conditions 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. Cylinders should be stored upright with valve protection cap in place and firmly secured to prevent falling. Use a "first in-first out" inventory system to prevent full cylinders from being stored for excessive periods of time. Full and empty cylinders should be segregated. Stored containers should be periodically checked for general condition and leakage. Do not store near combustible materials

Incompatible materials Strong oxidizing agents. Combustible materials. Organic material.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

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

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health

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

Appropriate engineering controls

Engineering Controls Showers. Eyewash stations. Ventilation systems. Exhaust gas should be vented to a gas treatment system. Consider installation of leak detection systems in areas of use and storage. Systems under pressure should be regularly checked for leakages.

Individual protection measures, such as personal protective equipment

Eye / face protection Tightly fitting safety goggles. Face protection shield.

Skin and body protection Work gloves and safety shoes are recommended when handling cylinders. Gloves must be clean and free from grease or oil. 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	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.
General Hygiene Considerations	Handle in accordance with good industrial hygiene and safety practice. Do not get in eyes, on skin, or on clothing. Do not eat, drink or smoke when using this product. Wash hands before breaks and immediately after handling the product. Remove and wash contaminated clothing before re-use. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical state	Compressed gas
Appearance	Greenish-yellow gas.
Odor	Bleach.
Odor threshold	No information available
pH	No data available
Melting point	-101 °C / -149.8 °F
Evaporation rate	Not applicable
Fire Hazard	Yes
Lower flammability limit:	Not applicable
Upper flammability limit:	Not applicable
Flash point	Not applicable
Autoignition temperature	No data available
Decomposition temperature	No data available
Water solubility	Very soluble
Partition coefficient	No data available
Kinematic viscosity	Not applicable

Chemical Name	Molecular weight	Boiling point	Vapor Pressure	Vapor density (air =1)	Gas Density kg / m ³ @20°C	Critical Temperature
Chlorine	70.90	-33.97 °C	6384 hPa @ 20 °C	2.5	2.98	143.75 °C

10. STABILITY AND REACTIVITY

Reactivity

Not reactive under normal conditions

Chemical stability

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

Explosion data

Sensitivity to Mechanical Impact	None.
Sensitivity to Static Discharge	None.

Possibility of Hazardous Reactions

None under normal processing.

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. Heat, flames and sparks.

Incompatible materials

Strong oxidizing agents. Combustible materials. Organic material.

Hazardous Decomposition Products

None known.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

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. Corrosive to respiratory system.
Skin contact	Corrosive. Causes severe irritation and or burns. Reacts with water very rapidly yielding hydrochloric acid. Hydrogen chloride burns exhibit severe pain, redness, possible swelling and early necrosis. Prolonged exposure to low concentrations may cause chloracne. Contact with liquid causes severe corrosive action.
Eye contact	Corrosive to the eyes and may cause severe damage including blindness. Contact with liquid causes severe corrosive action.
Ingestion	Not an expected route of exposure.

Information on toxicological effects

Symptoms	May be 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. Symptoms may be delayed.
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Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion / irritation	Category 1.
Serious eye damage / eye irritation	Category 1.
Irritation	Causes severe irritation and or burns.
Corrosivity	Corrosive to living tissue.
Sensitization	Not classified.
Germ cell mutagenicity	Not classified.
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.
Reproductive toxicity	Not classified.
STOT - single exposure	Category 3. Respiratory system.
STOT - repeated exposure	Not classified.
Target Organ Effects	Respiratory system, Eyes, Skin.
Aspiration hazard	Not applicable.

Numerical measures of toxicity

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50	Inhalation LC50 (CGA P-20)
Chlorine 7782-50-5	-	-	-	293 ppm (Rat) 1hr

Product Information

Oral LD50	
Dermal LD50	No information available
Inhalation LC50	No information available
Inhalation LC50	No information available

12. ECOLOGICAL INFORMATIONEcotoxicity

Very toxic to aquatic organisms.

Chemical Name	Algae / aquatic plants	Fish	Crustacea
Chlorine 7782-50-5	-	0.44: 96 h <i>Lepomis macrochirus</i> mg / L LC50 flow-through 0.014: 96 h <i>Oncorhynchus mykiss</i> mg / L LC50 flow-through 0.014: 96 h <i>Oncorhynchus mykiss</i> mg / L LC50 0.104 - 0.168: 96 h <i>Oncorhynchus mykiss</i> mg / L LC50 static 0.08: 96 h <i>Pimephales</i> <i>promelas</i> mg / L LC50 flow-through 0.1: 96 h <i>Pimephales promelas</i> mg / L LC50	0.017: 48 h <i>Daphnia magna</i> mg / L LC50

Persistence and degradability

Not applicable.

Bioaccumulation

No information available.

13. DISPOSAL CONSIDERATIONSWaste treatment methods

Disposal of wastes

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.

14. TRANSPORT INFORMATIONDOT

UN / ID no. UN1017
 Proper shipping name Chlorine
 Hazard Class 2.3
 Special Provisions 2, B9, B14, N86, T50, TP19
 Description UN1017, Chlorine, 2.3 (5.1.8),
 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

UN / ID no. UN1017
 Proper shipping name Chlorine
 Hazard Class 2.3
 Subsidiary class 8
 Marine pollutant This product contains a chemical which is listed as a marine pollutant according to TDG.
 Description UN1017, Chlorine, 2.3 (8),

MEX

UN / ID no. UN1017
 Proper shipping name Chlorine
 Hazard Class 2.3
 Subsidiary class 5.1.8
 Description UN1017, Chlorine, 2.3 (5.1.8)

IATA

Forbidden

IMDG

UN / ID no.	UN1017
Proper shipping name	Chlorine
Hazard Class	2.3
Subsidiary hazard class	5.1 8 P
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

UN / ID no.	UN1017
Proper shipping name	Chlorine
Hazard Class	2.3 5.1 8
Classification code	2TOC
Tunnel restriction code	(C/D)
Description	UN1017, Chlorine, 2.3 5.1 8, (C/D)
Labels	2.3 + 5.1 + 8

15. REGULATORY INFORMATIONInternational 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 Chemical Substances / European List of Notified Chemical Substances

US 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	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

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302).

Chemical Name	Hazardous Substances RQs	CERCLA / SARA RQ	Reportable Quantity (RQ)
Chlorine 7782-50-5	10 lb	10 lb	10 lb 4.54 kg

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.	Hazardous air pollutants (HAPS) content	VOC Chemicals	Class 1	Class 2
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Chlorine	7782-50-5				
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CWA (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 7782-50-5	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 lb		1500 lb

US State RegulationsCalifornia Proposition 65

This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Chlorine 7782-50-5	X	X	X

International Regulations

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

Chemical Name	NPRI
Chlorine	X

Legend

Canada NPRI - National Pollutant Release Inventory

16. OTHER INFORMATION

NFPA	Health hazards 4	Flammability 0	Instability 0	Physical and Chemical Properties OX
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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.

Issue Date	27-Mar-2015
Revision Date	27-Mar-2015
Revision Note	Initial Release.

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.

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

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End of Safety Data Sheet