

SAFETY DATA SHEET



CHLORINE (LIQUEFIED GAS UNDER PRESSURE) (PESTICIDE)

North America EN
SDS No.: M30816

Rev. Date: 04-Dec-2025
Rev. Num. 06

SECTION 1. CHEMICAL PRODUCT / COMPANY IDENTIFICATION

Company Identification:	Occidental Chemical Corporation 14555 Dallas Parkway, Suite 400 Dallas, Texas 75254-4300
24-Hour Emergency Telephone Number:	1-800-733-3665 (USA); CANUTEC (Canada): 1-613-996-6666; CHEMTREC (within USA and Canada): 1-800-424-9300; CHEMTREC (outside USA and Canada): +1 703-527-3887; CHEMTREC Contract No: CCN16186
To Request an SDS:	MSDS@oxy.com or 1-972-404-3245
Customer Service:	1-800-752-5151 or 1-972-404-3700
Product Identifier:	CHLORINE, LIQUID (PESTICIDE)
Synonyms:	Chlorine; Chlorine - liquefied gas; Chlorine gas; Chlorine (Liquid or Gas); Elemental Chlorine
Product Use:	Water chlorination; Water treatment chemicals; Chemical synthesis; This product is a registered pesticide in the United States (US): US EPA Registration Number 935-8
Uses Advised Against:	- NOT FOR USE IN COMMERCIAL/INDUSTRIAL APPLICATIONS NOT PROPERLY DESIGNED TO ACCOMMODATE THE SAFE USE OF THIS CHEMICAL*
<p>*NOTE: REFER TO THE CHLORINE INSTITUTE INFORMATIONAL PAMPLETS FOR ADDITIONAL INFORMATION ON SAFE HANDLING, STORAGE, SHIPPING, AND EMERGENCY RESPONSE PROCEDURES (https://bookstore.chlorineinstitute.org/).</p>	
Restrictions on Use (United States):	This is a pesticide product, do not use it in an application that is not included on its label.

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Other Global Restrictions on Use: This product is not registered as a pesticide in Canada; however, this product can be sold into Canada for drinking water and wastewater treatment uses. Other restrictions on use based on local, regional, or national regulations may exist and must be determined on a case-by-case basis.

Chemical Family: Halogens

SECTION 2. HAZARDS IDENTIFICATION

OSHA REGULATORY STATUS: Health hazard classifications were performed using OSHA Hazard Communication 2024 (1910.1200) Appendix A and/or UN GHS Rev. 8 (2019). This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

HEALTH CANADA HPR REGULATORY STATUS: This material is considered hazardous by the Health Canada Hazardous Products Act's Hazardous Products Regulations (HPR) (SOR/2015-17).

EMERGENCY OVERVIEW:

Color: Green to yellow gas; Amber liquid
Physical State: Liquefied gas
Appearance: Liquefied gas under pressure
Odor: Pungent, irritating; Odor like concentrated bleach

Signal Word: **DANGER**

MAJOR HEALTH HAZARDS: CAUSES SEVERE SKIN BURNS AND EYE DAMAGE. FATAL IF INHALED. MAY CAUSE RESPIRATORY TRACT IRRITATION. CAUSES DAMAGE TO RESPIRATORY SYSTEM BY INHALATION.

PHYSICAL HAZARDS: MAY CAUSE OR INTENSIFY FIRE; OXIDIZER. CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED.

ECOLOGICAL HAZARDS: VERY TOXIC TO AQUATIC LIFE.

PRECAUTIONARY STATEMENTS: Keep away from combustible materials. Keep reduction valves free from grease and oil. Do not breathe gas or vapors. Wash hands and exposed skin and clothing thoroughly after handling. Do not touch eyes. Do not eat, drink, or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves, protective clothing, eye, and face protection. In case of inadequate ventilation, wear respiratory protection. Avoid release to the environment.

ADDITIONAL HAZARD INFORMATION: ACUTE EXPOSURE MAY CAUSE DELAYED PULMONARY EDEMA. Direct contact with liquid or rapidly expanding gas may cause frostbite to contacted tissue (eyes, skin, etc.). Hazardous gas under pressure. May ignite or explode on contact with combustible materials. May react explosively

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with many incompatible materials, (see information below in this Section). Corrosive to most metals in the presence of moisture.

HAZARD CLASSIFICATION:

GHS: PHYSICAL HAZARDS:	- Gas Under Pressure - Liquefied Gas - [Contains gas under pressure; may explode if heated] - Oxidizing Gas - Category 1 [May cause or intensify fire; Oxidizer]
GHS: CONTACT HAZARD - SKIN:	Category 1 - Causes severe skin burns and eye damage
GHS: CONTACT HAZARD - EYE:	Category 1 - Causes serious eye damage
GHS: ACUTE TOXICITY - INHALATION:	Category 2 - Fatal if inhaled
SPECIFIC TARGET ORGAN TOXICITY (STOT) - SINGLE EXPOSURE (SE):	- Category 1 - Causes damage to: Respiratory System - Category 3 - May cause respiratory irritation
HAZARDS NOT OTHERWISE CLASSIFIED (HNOC):	- Hazardous to Aquatic Environment (Acute Hazard): Category 1 - Very toxic to aquatic life

UNKNOWN ACUTE TOXICITY:**Unknown Acute Oral Toxicity:**

100% of this product consists of ingredient(s) of known acute oral toxicity.

Unknown Acute Dermal Toxicity:

There is no acute dermal toxicity data available for this material.

Unknown Acute Inhalation Toxicity:

100% of this product consists of ingredient(s) of known acute inhalation toxicity.

GHS SYMBOL: Gas cylinder, Oxidizer, Skull and Crossbones, Corrosive, Health hazards, Environmental hazard



GHS SIGNAL WORD: DANGER

GHS HAZARD STATEMENTS:**GHS - Physical Hazard Statement(s)**

- May cause or intensify fire; oxidizer
- Contains gas under pressure; may explode if heated

GHS - Health Hazard Statement(s)

- Causes severe skin burns and eye damage
- Fatal if inhaled
- May cause respiratory irritation
- Causes damage to respiratory system by inhalation

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Additional Hazards - GHS Hazards Not Otherwise Classified (HNOC):

- ACUTE AQUATIC HAZARD - CATEGORY 1: Very toxic to aquatic life

GHS - Precautionary Statement(s) - Prevention

- Keep away from combustible materials
- Keep reduction valves free from grease and oil
- Do not breathe gas or vapors
- Wash hands and exposed skin thoroughly after handling. Do not touch eyes
- Do not eat, drink, or smoke when using this product
- Use only outdoors or in a well-ventilated area
- Wear protective gloves, protective clothing, eye, and face protection
- In case of inadequate ventilation, wear respiratory protection
- Avoid release to the environment

GHS - Precautionary Statement(s) - Response

- IF SWALLOWED: Rinse mouth. Do NOT induce vomiting
- IF INHALED: Remove person to fresh air and keep comfortable for breathing
- IF INHALED: Get emergency medical help immediately
- Specific treatment is urgent if inhaled (see First Aid information on product label and/or Section 4 of the SDS)
- IF ON SKIN: Take off immediately all contaminated clothing. Immediately rinse with water for several minutes
- IF ON SKIN: Get emergency medical help immediately
- Wash contaminated clothing before reuse
- Specific treatment for skin contact (see First Aid information on product label and/or Section 4 of the SDS)
- IF IN EYES: Immediately rinse with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
- IF IN EYES: Get medical help
- IF exposed or concerned: Get emergency medical help immediately
- Specific treatment (see "Notes to Physician" in Section 4 of the SDS)
- In case of fire: Stop leak if safe to do so
- Contain release

GHS - Precautionary Statement(s) - Storage

- Store in a well-ventilated place. Keep container tightly closed
- Store locked up
- Protect from sunlight

GHS - Precautionary Statement(s) - Disposal

- Dispose of contents and container in accordance with applicable local, regional, national, and/or international regulations

Physical Hazards Not Mentioned in GHS Classification

- Hazardous gas under pressure
- May ignite or explode on contact with combustible materials
- May react explosively with many incompatible materials, (see information below in this Section)
- Corrosive to most metals in the presence of moisture

Health Hazards Not Mentioned in GHS Classification

- ACUTE EXPOSURE MAY CAUSE DELAYED PULMONARY EDEMA
- Direct contact with liquid or rapidly expanding gas may cause frostbite to contacted tissue (eyes, skin, etc.)

Persistent, Bioaccumulative, and Toxic (PBT) and Very Persistent and Very Bioaccumulative (vPvB)

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Assessment:

This product does not fulfill the criteria for persistence, bioaccumulation, and toxicity. Therefore, this substance is not considered a PBT or a vPvB substance.

Endocrine Disruptor Assessment:

Chlorine is not currently listed as an endocrine disruptor on the various governmental agencies and/or regulatory lists. In addition, there is no significant evidence of endocrine-disrupting activity or adverse effects from active chlorine based on both systematic literature review and in silico assessment, though EATS-related modalities remain under-researched. In addition, the current research highlights the practical limitations of evaluating unstable and inorganic chemicals like chlorine with standard in vitro methodologies.

Component	Endocrine Screening List	EU - REACH (1907/2006) - Article 59(1) - Candidate List of Substances of Very High Concern (SVHC) for Authorisation
Chlorine	Not listed	Not Listed as SVHC

See Section 11: TOXICOLOGICAL INFORMATION

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Component	Systematic Chemical Name	Common name	CAS Number	Percent [%]
Chlorine 7782-50-5	Chlorine	Chlorine	7782-50-5	99.5 - 100

SECTION 4. FIRST AID MEASURES

General Advice: IF exposed or concerned: Get emergency medical help immediately.

EYE CONTACT: IF IN EYES: Immediately rinse with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. IF IN EYES: Get medical help.

SKIN CONTACT: IF ON SKIN: Take off immediately all contaminated clothing. Immediately rinse with water for several minutes. IF ON SKIN: Get emergency medical help immediately. Wash contaminated clothing before reuse. See specific treatment for skin contact below in this Section Under "Notes to Physicians".

INHALATION: IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF INHALED: Get emergency medical help immediately. Specific treatment is urgent if inhaled (see "Notes to Physician" in Section 4 of the SDS).

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INGESTION: IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. If exposed or concerned after ingestion: Get medical advice/attention. Specific treatment (see "Notes to Physician" in Section 4 of the SDS below).

MOST IMPORTANT SYMPTOMS/EFFECTS (ACUTE AND CHRONIC [DELAYED]):

Effects on respiratory system: It can be fatal if inhaled.

Skin effects: May cause skin burns.

Eye effects: May cause severe burns.

Acute Symptoms/Effects:

Eye: Low concentrations in air can cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, conjunctivitis, and tearing. Corneal burns may occur at high concentrations.

Skin: Chlorine irritates the skin and can cause burning pain, inflammation, and blisters. Exposure to liquefied chlorine can result in frostbite injury.

Inhalation (Breathing): Chlorine is water soluble and therefore, primarily removed by the upper airways. Exposure to low concentrations of chlorine (1 to 10 ppm) may cause eye and nasal irritation, sore throat, and coughing. Inhalation of higher concentrations of chlorine gas (>15 ppm) can rapidly lead to respiratory distress with airway constriction and accumulation of fluid in the lungs (pulmonary edema). Patients may have immediate onset of rapid breathing, blue discoloration of the skin, wheezing, rales or hemoptysis. In symptomatic patients, pulmonary injury may progress over several hours. Lung collapse may occur. The lowest lethal concentration for a 30-minute exposure has been estimated as 430 ppm. Exposure to chlorine can lead to reactive airways dysfunction syndrome (RADS), a chemical irritant-induced type of asthma.

Ingestion (Swallowing): Ingestion is unlikely to occur because chlorine is a gas at room temperature. Solutions that are able to generate chlorine (e.g., sodium hypochlorite solutions) may cause corrosive injury if ingested.

Other Health Effects: Cardiovascular: Tachycardia and initial hypertension followed by hypotension may occur. After severe exposure, cardiovascular collapse may occur from lack of oxygen. Metabolic: Acidosis may result from insufficient oxygenation of tissues. An unusual complication of massive chlorine inhalation is an excess of chloride ions in the blood, causing an acid-base imbalance.

Chronic (Delayed) Symptoms/Effects: Repeated exposures in workers have been associated with decreases in pulmonary functions, decreases in diffusing capacity, reactive airways, and hyper-responsiveness to methacholine challenge. Prolonged frequently repeated skin contact may cause allergic reactions in some individuals.

Target Organ Effects: Respiratory system

Protection of First-Aid Responders: Stay out of areas where there is liquid or gaseous chlorine. Use personal protective equipment (PPE). Refer to Section 8 for specific PPE recommendations. Remove contaminated clothing and wash before reuse. Remove affected individuals from exposure. At minimum, treating personnel should utilize PPE sufficient for prevention of bloodborne pathogen transmission.

Notes to Physician: Symptomatic individuals without hypoxia may benefit from humidified air. Delayed pulmonary edema may occur in the context of severe and symptomatic airway exposure. There is no specific antidote. Treat symptoms with supportive care. Follow normal parameters for airway, breathing, and circulation. Probable mucosal damage may contraindicate the use of gastric lavage.

Interaction with Other Chemicals Which Enhance Toxicity: No interaction with other chemicals which enhance toxicity are known.

Medical Conditions Aggravated by Exposure: Individuals with a previous history of asthma, or chronic or

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concurrent cardiopulmonary disorders (including smoking-induced respiratory disease) may experience more severe symptoms than non-predisposed individuals. Pulmonary diseases such as hyperactive airways, restrictive and obstructive pulmonary diseases such as COPD, bronchitis, emphysema, interstitial pulmonary disease. Skin disorders that compromise the integrity of the skin. Eye disorders that decrease tear production or have reduced integrity.

SECTION 5. FIRE FIGHTING MEASURES

Fire Hazard: Chlorine itself will not burn; however, it does act as an oxidizer and supports combustion even in the absence of oxygen. Most combustibles will burn in this material producing irritating, corrosive, and/or toxic gases. In water, chlorine is a strong acid, corrosive, and an oxidizer. Run-off from fire control may cause pollution. If the situation allows, control and properly dispose of run-off (effluent). May ignite or explode on contact with combustible materials. May react explosively with organic materials. Pressurized containers may vent or explode when exposed to high temperatures.

Explosive properties: Closed containers may explode or rupture when exposed to extreme heat (fire).

Extinguishing Media: Use extinguishing agents appropriate for surrounding fire.

Unsuitable Extinguishing Media: Do not direct water at source of leak or safety devices; icing may occur. Do not direct water at the source of the leak, because chlorine and water react to form acids and the leak will get worse.

Specific Hazards: STRONG OXIDIZING AGENT. This material increases the risk of fire and may aid combustion. Contact with combustible material may cause fire. CONTAINS GAS UNDER PRESSURE, MAY EXPLODE IF HEATED. VERY TOXIC TO AQUATIC LIFE. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Unusual Hazards: The quantity of escaping chlorine from a liquid chlorine leak is significantly more than from a gas chlorine leak, since one volume of liquid is equal to ~ 460 volumes of gas. If a container is leaking chlorine position the container so the liquid remains inside and allows the gas to vent. Contact with liquid may cause frostbite.

Fire Fighting: Do not direct water at the source of the leak or at safety devices; icing may occur. Flame impingement on steel chlorine container can result in over pressurization or iron/chlorine fire causing rupture of the container. Do not get water inside containers. Move containers from the fire area if it is possible to do so without risk to personnel. Damaged cylinders should be handled only by specialists trained and properly protected by PPE as described in Section 8. For large fires and fires involving tanks or tank cars, fight the fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at the source of the leak, because chlorine and water react to form acids and the leak will get worse. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tanks. Always stay away from tanks engulfed in fire, withdraw from the area and let the fire burn.

Advice for Firefighters: Wear NIOSH approved positive-pressure self-contained breathing apparatus operated in pressure demand mode. Avoid inhalation of material or combustion by-products. Keep unnecessary people away, isolate hazard areas and deny entry. Stay upwind and keep out of low areas.

Component	Immediately Dangerous to Life/ Health (IDLH)
Chlorine	10 ppm IDLH

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7782-50-5

Above are IDLHs (immediately dangerous to life or health concentrations) for those substances designated by United States (US) National Institute of Occupational Safety and Health (NIOSH). The IDLH is considered a maximum concentration above which only a highly reliable breathing apparatus providing maximum worker protection should be permitted.

Hazardous Combustion Products: Not combustible; however, if involved in a fire may produce hydrogen chloride gas, hydrochloric acid and/or hypochlorous acid

Sensitivity to Mechanical Impact: Not sensitive.

Sensitivity to Static Discharge: Not sensitive.

Lower Flammability Level (air): Not applicable

Upper Flammability Level (air): Not applicable

Flash point: Not flammable

Auto-ignition Temperature: Not flammable

GHS: PHYSICAL HAZARDS:

- Gas Under Pressure - Liquefied Gas - [Contains gas under pressure; may explode if heated]
- Oxidizing Gas - Category 1 [May cause or intensify fire; Oxidizer]

Physical Hazards Not Mentioned in GHS Classification

- Hazardous gas under pressure
- May ignite or explode on contact with combustible materials
- May react explosively with many incompatible materials, (see information below in this Section)
- Corrosive to most metals in the presence of moisture

SECTION 6. ACCIDENTAL RELEASE MEASURES

Occupational Release: General Precautions: Because gaseous chlorine is approximately two-and-one-half times as heavy as air, it is slow to diffuse into the air. It tends to accumulate in low places.

Personal Precautions: Evacuate unprotected personnel upwind or crosswind for at least 100 feet (800 feet for large spills) out of danger area. Isolate area. Keep unnecessary and unprotected personnel from entering the area. Vapors tend to accumulate in low areas. Use appropriate safety equipment. For additional information, refer to Section 8, Exposure Controls and Personal Protection. Refer to Section 7, Handling and Storage, for additional precautionary measures.

Personal Protective Equipment: Exposure to chlorine may occur wherever chlorine is handled or used. Therefore, self-contained positive pressure breathing apparatus, approved for emergency chlorine use, should be located strategically outside chlorine work areas, near entrances and away from contamination. Such equipment shall have a rating of at least 30 minute use, and be equipped with a low-pressure warning alarm. Any person entering a chlorine emergency area must be protected by this respiratory protective equipment and trained to properly wear / use

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the equipment.

Emergency Procedures: Every site using chlorine should have an emergency response plan in place that protects both the employees and the community. All employees should receive training on the emergency response plan. For chlorine leaks, immediately implement pre-determined emergency response plan. Pre-determined emergency response plan should identify where the specific chlorine emergency kits are located for handling any site emergency involving chlorine cylinders, ton containers, tank cars or barges. Chlorine emergency kits are maintained by producers and are located strategically throughout the United States and Canada. In addition, kits can be borrowed in an emergency situation from other chlorine users, distributors and some fire departments. If an emergency kit is not readily available, contact CHEMTREC or a CHLOREP team to facilitate locating a kit and to provide support for the emergency response.

Environmental Precautions: Keep out of water supplies and sewers. See Section 12 for additional ecological information. Call supplier, CHLOREP team, or CHEMTREC when help is needed. Releases should be reported, if required, to appropriate agencies.

Methods and Materials for Containment, Confinement, and/or Abatement: Remove sources of ignition. Stop leak, if possible, without personal risk. If a chlorine container is leaking, try to position it so that gas rather than liquid leaks. Apply emergency kit device if possible. For other than minor leaks, immediately implement predetermined emergency plan. Do not apply water directly to a leak. Reacts with water to form corrosive acid (hydrochloric acid). No one should respond to a chlorine emergency or leak if they are not a trained responder or they do not have all of the necessary tools, equipment, and PPE to respond safely. Call supplier, CHLOREP team, or CHEMTREC when help is needed.

Methods and Materials for Clean-up

Recovery: In case of spill or leak, stop the leak as soon as possible. Do not apply water directly to a leak. Moisture hydrolyzes chlorine, forming hydrochloric acid and attacks the metal, thus enlarging the leak. If a container is leaking chlorine, position the container so the liquid remains inside and allows the gas to vent. The quantity of escaping chlorine is significantly less from a gas than a liquid leak, since one volume of liquid is equal to approximately 460 volumes of gas.

Neutralization: Absorb chlorine in an alkaline solution (caustic soda, soda ash or hydrated lime) while maintaining an excess of base at all times. Refer to p. 15 of the OxyChem Chlorine Handbook for the recommended alkaline solutions for absorbing chlorine. Destroy resulting hypochlorite by adding sodium bisulfite or treating the basic hypochlorite at 122-158 F in the presence of copper, nickel, or iron. Control pH at the discharge to sewer or the receiving water and comply with all federal, state, and local regulations.

Final Disposal: Runoff may pollute waterways. Control pH at the discharge to sewer or the receiving water and comply with all federal, state, and local regulations.

Additional Disaster Prevention Measures: Vapors are heavier than air and will tend to collect in low areas. Reduce vapors with water spray. Evacuation of surrounding area may be necessary for large spills. Keep unnecessary people away, isolate hazard areas and deny entry.

SECTION 7. HANDLING AND STORAGE

General: Do not attempt to store, handle or use without complete review of The Chlorine Institute Chlorine Manual (Phone: (703) 894-4140).

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Handling:

Precautions for Safe Handling:

Only properly trained personnel wearing approved personal protective equipment should handle chlorine equipment, piping, and containers. Handling should only be performed by competent personnel trained in handling hazardous chemicals and the specific hazards associated with this product.

Technical measures/precautions: Use product only in closed system. Chlorine will react violently with many different chemicals and materials. It is essential that all equipment, piping, and valves be properly cleaned and dried for chlorine service before introducing any chlorine into the system. Dry chlorine will react violently with titanium. Systems must be in place to protect titanium equipment from exposure to dry chlorine and ensure titanium is not used in dry chlorine service. Many grades of carbon steel can become brittle when exposed to temperatures below -20F. It is essential that low-temperature carbon steel or a suitable alloy is used for continuous chlorine operations below -20F. Moisture in dry chlorine systems will rapidly increase carbon steel corrosion rates to dangerous levels. The possibility of generating hydrogen also exists. Moisture concentrations must be continuously monitored and controlled using moisture analyzers and drying systems.

Other precautions: Every site handling chlorine in bulk containers should have a Risk Management Plan (RMP) and Process Safety Management (PSM) programs. See Section 15 for related threshold quantities for RMP and PSM programs.

Prevention of contact: Do not breathe gas or vapors. Wash hands and exposed skin thoroughly after handling. Do not touch eyes. Do not eat, drink, or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves, protective clothing, eye, and face protection. In case of inadequate ventilation, wear respiratory protection. Avoid release to the environment.

Storage:

Safe Storage Conditions: Store and handle in accordance with all current regulations and standards. Keep container tightly closed. Store in a well-ventilated area. Protect from sunlight. Do not apply heat. Keep away from heat, sparks and open flames. Keep separated from incompatible substances (see below or Section 10 of the Safety Data Sheet). Avoid contact with water or moisture. Reacts with water to form a corrosive acid. The vapor is heavier than air. Most vapors that are heavier than air will spread along ground and collect in low or confined areas (drains, basements, tanks). Store away from basements, pits or other confined spaces. Make daily inspections for leaks. Protect from physical damage.

Technical measures: Valves used in chlorine service should be manufactured specifically for use with chlorine. For additional information, consult The Chlorine Institute, Inc., Pamphlet #6 [<https://bookstore.chlorineinstitute.org/safe-production-handling-packaging.html>]. Liquid chlorine has a high coefficient of thermal expansion. If liquid chlorine is trapped between two valves, high hydraulic pressure may develop and lead to a rupture of the line or its fittings. Expansion chambers should be installed any place liquid chlorine can be trapped between two valves. Expansion chambers are fabricated from extra heavy pipe and have a capacity equal to at least 20 volume percent of the protected section of pipe.

Incompatible Materials: Chlorine is incompatible with: Ammonia, Acetylene, Butadiene, Butane, Propane, and other petroleum gases, Hydrogen, Sodium carbide, Turpentine, Benzene, finely divided metals (elemental metals and metal hydrides), Methane, Unstable and Reactive compounds, Organic Compounds (e.g. petrochemicals, oils, and greases), Carbides, Nitrides, Oxides, Phosphides, Sulfides, and other easily oxidized materials. Substances not listed must be evaluated for compatibility prior to use.

Packaging or Materials of Construction: Chlorine will react with many metals, especially at elevated temperatures.

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It is critical that the materials of construction be consistent with the operational conditions and that excessive external heat is not applied to chlorine containing systems. Chlorine can be transported via pipeline, rail cars, tank trucks, barges, ton containers and cylinders. Please contact OxyChem Technical Services or the Chlorine Institute for information on the proper handling and use of these containers.

Additional Information:

GHS: PHYSICAL HAZARDS:

- Gas Under Pressure - Liquefied Gas - [Contains gas under pressure; may explode if heated]
- Oxidizing Gas - Category 1 [May cause or intensify fire; Oxidizer]

Physical Hazards Not Mentioned in GHS Classification

- Hazardous gas under pressure
- May ignite or explode on contact with combustible materials
- May react explosively with many incompatible materials, (see information below in this Section)
- Corrosive to most metals in the presence of moisture

SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

REGULATORY EXPOSURE LIMIT(S):

Listed below for the product components that have regulatory occupational exposure limits (OEL's).

Component	OSHA Final PEL TWA	OSHA Final PEL STEL	OSHA Final PEL Ceiling
Chlorine 7782-50-5 (99.5 - 100 %)	-----	-----	1 ppm { Ceiling} 3 mg/m ³ { Ceiling}

OEL: Occupational Exposure Limit; OSHA: United States Occupational Safety and Health Administration; PEL: Permissible Exposure Limit; TWA: Time Weighted Average; STEL: Short Term Exposure Limit
 OSHA Ceiling values indicate the exposure limit, which at no time shall be exceeded. Instantaneous monitoring is the preferred method to determine compliance with OSHA Ceiling values. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure which shall not be exceeded at any time during the working day [29 CFR § 1910.1000(a)(1)]

Component	Canada - TWAs	Canada - STELs	Canada - Ceilings
Chlorine 7782-50-5 (99.5 - 100 %)	Ontario - 0.5 ppm (TWA) Alberta - 0.5 ppm (TWA) Alberta - 1.5 mg/m ³ (TWA) British Columbia - 0.1 ppm (TWA)	Ontario - 1 ppm (STEL)	-----

NON-REGULATORY EXPOSURE LIMIT(S):

Listed below are the product components that have advisory (non-regulatory) occupational exposure limits (OEL's) established.

Component	ACGIH TWA	ACGIH STEL	ACGIH Ceiling	Skin Absorptio	NIOSH RELs	AIHA WEELs	OSHA TWA	OSHA STEL	OSHA Ceiling

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				n - ACGIH			(Vacated)	(Vacated)	(Vacated)
Chlorine 7782-50-5 (99.5 - 100 %)	0.1ppm TWA	0.4 ppm (STEL)	-----	-----	0.5 ppm (Ceiling) 15 min 1.45 mg/m ³ (Ceiling) 15 min	-----	0.5 ppm 1.5 mg/m ³	1 ppm 3 mg/m ³	-----

- The Non-Regulatory United States Occupational Safety and Health Administration (OSHA) limits, if shown, are the Vacated 1989 PEL's (vacated by 58 FR 35338, June 30, 1993).

- The American Conference of Governmental Industrial Hygienists (ACGIH) is a voluntary organization of professional industrial hygiene personnel in government or educational institutions in the United States. The ACGIH develops and publishes recommended occupational exposure limits each year called Threshold Limit Values (TLVs) for hundreds of chemicals, physical agents, and biological exposure indices. ACGIH TLV Ceiling (C) limits are airborne concentrations that should not be exceeded in the workplace under any circumstances. Ceiling limits can supplement other limits or stand alone.

ACGIH and/or Recommended Exposure Level (REL) Ceiling values indicate the exposure limit, which at no time shall be exceeded. Instantaneous monitoring is the preferred method to determine compliance with Ceiling values. If instantaneous monitoring is not feasible, then the ceiling shall be assessed as a 15-minute time weighted average exposure, which shall not be exceeded at any time during the working day.

ENGINEERING CONTROLS: Do not use in poorly ventilated or confined spaces. Use closed systems when possible. Provide local exhaust ventilation where vapor or mist may be generated. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT:

Eye Protection: Wear chemical safety goggles with a face shield to protect against eye and skin contact when appropriate. Provide an emergency eyewash fountain and quick drench shower in the immediate work area.

Skin and Body Protection: Wear appropriate chemical resistant clothing. When responding to accidental release of unknown concentrations, wear one-piece, total encapsulating suit of Butyl coated nylon or equivalent.

Hand Protection: Wear chemical resistant, insulated gloves such as Perfect Fit NL-56(TM) or Best 6781R(TM). Consult a glove supplier for assistance in selecting an appropriate chemical resistant glove.

Protective Material Types: Perfect Fit NL-56(TM), Best 6781R(TM), Best Nitri Solve 727(TM), Tychem 10000 (TM).

Respiratory Protection: Where vapor concentration exceeds or is likely to exceed applicable exposure limits, a NIOSH approved respirator is required. The added protection of a full face-piece respirator is required when the possibility for vapor, spray, mist, or splash conditions are encountered and eye irritation may occur. When an air-purifying respirator is not adequate for spills and/or emergencies of unknown concentrations, an approved self-contained breathing apparatus operated in the pressure demand mode is required. A respiratory protection program that meets 29 CFR 1910.134 must be followed whenever workplace conditions warrant use of a respirator.

Component	Immediately Dangerous to Life/ Health (IDLH)
Chlorine	10 ppm IDLH

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7782-50-5 (99.5 - 100 %)

Above are IDLHs (immediately dangerous to life or health concentrations) for those substances designated by United States (US) National Institute of Occupational Safety and Health (NIOSH). The IDLH is considered a maximum concentration above which only a highly reliable breathing apparatus providing maximum worker protection should be permitted.

HYGIENE MEASURES: An emergency eyewash fountain and quick drench shower should be provided in the immediate work area. Personnel should test equipment on a routine basis to ensure adequate water flow and temperature.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Liquefied gas under pressure
Physical State:	Liquefied gas
Color:	Green to yellow gas; Amber liquid
Odor:	Pungent, irritating; Odor like concentrated bleach
Odor Threshold [ppm]:	Odor Threshold Low: 0.2 [ppm], Odor Threshold High: 0.4 [ppm], Mean detection odor threshold = 0.080 ppm
Melting Point/Range:	-100.98° (°C)
Freezing Point/Range:	-100.98°C (-149.76°F)
Boiling Point °C	-34.05°C (-29.29°F)
Evaporation Rate (ether=1):	No data available
Flammability (solid, gas):	Not flammable
Lower Flammability Level (air):	Not applicable
Upper Flammability Level (air):	Not applicable
Explosion limits:	Not applicable
Flash point:	Not flammable
Auto-ignition Temperature:	Not flammable
Decomposition Temperature:	No information available.
pH:	Not applicable
Viscosity:	0.134 mPa.sec at 20 °C (gas); 0.346 mPa.sec at 20 °C (liquid)
Kinematic Viscosity:	No data available
Water Solubility:	0.7% @ 20 C
Partition Coefficient (n-octanol/water):	-0.85
Vapor Pressure:	678.0 kPa (5085 mm Hg) @ 20°C 778.7 kPa (5841 mm Hg) @ 25°C
Density:	11.7 lbs/gal @ 15.6 °C
Relative Density:	No data available
Relative Density/Specific Gravity (water=1):	1.467
Vapor Density (air=1):	2.47
Particle Size Distribution:	Not applicable
Other Information	
Molecular Formula:	Cl ₂
Chemical Family:	Halogens

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Molecular Weight:	70.91
Explosive properties:	Not applicable
Oxidizing properties:	Strong oxidizing agent
Volatility:	100%
Surface Tension:	18.4 dynes/cm at 20 °C in contact with vapor
Hygroscopic:	Not applicable
Critical Temperature:	144.0°C (291.2°F)
Critical Pressure:	7711 kPa (76.1 atm, 1118 psi)
Critical Volume:	1.745x10 ⁻³ m ³ /kg (0.02796 ft ³ /lb.)

SECTION 10. STABILITY AND REACTIVITY

Chemical Stability: Stable at normal temperatures and pressures.

Reactivity: Oxidizer.

Possibility of Hazardous Reactions: Dry material is highly reactive with titanium and tin. Reacts with most metals at high temperatures or in the presence of moisture. Avoid contact with water. Reacts with water to form corrosive acid (hydrochloric acid). May react explosively with many incompatible materials, (see information below in this Section). Chlorine reacts explosively or forms explosive compounds with many common substances such as acetylene, ether, turpentine, ammonia, fuel gas, hydrogen, and finely divided metals. All fluorinated refrigerants containing hydrogen have the potential to react exothermically with chlorine to produce a chloro-fluorocarbon. Additional information on reactivity potential between chlorine and several refrigerants is available from the Chlorine Institute or from OxyChem® Technical Service.

Conditions to Avoid (e.g., static discharge, shock, or vibration): No information available.

Incompatible Materials: Chlorine is incompatible with: Ammonia, Acetylene, Butadiene, Butane, Propane, and other petroleum gases, Hydrogen, Sodium carbide, Turpentine, Benzene, finely divided metals (elemental metals and metal hydrides), Methane, Unstable and Reactive compounds, Organic Compounds (e.g. petrochemicals, oils, and greases), Carbides, Nitrides, Oxides, Phosphides, Sulfides, and other easily oxidized materials. Substances not listed must be evaluated for compatibility prior to use.

Hazardous Decomposition Products: None known.

Hazardous Polymerization: Will not occur.

SECTION 11. TOXICOLOGICAL INFORMATION

POTENTIAL HEALTH EFFECTS:

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ACUTE TOXICITY:

The acute toxic effects of chlorine are primarily due to its corrosive properties. The action of chlorine is due to its strong oxidizing capability, in which chlorine splits hydrogen from water in moist tissue, causing the release of nascent oxygen and hydrogen chloride which produce major tissue damage. Alternatively, chlorine may be converted to hypochlorous acid which can penetrate cells and react with cytoplasmic proteins to form N-chloro derivatives that destroy cell structure. Symptoms may be apparent immediately or delayed for a few hours.

Eye contact: Causes serious eye damage. Liquid exposure may cause frostbite.

Skin contact: Causes skin burns. Liquid exposure may cause frostbite.

Inhalation: Inhalation may result in severe irritation, chemical burns, spasm, inflammation, and edema of the larynx and bronchi, as well as chemical pneumonitis and pulmonary edema. Significant exposure can be fatal.

Ingestion: Ingestion of product may cause irritation and burns to the contacted tissue.

CHRONIC TOXICITY:

Prolonged frequently repeated skin contact may cause allergic reactions in some individuals. Repeat exposures in workers have been associated with decreases in pulmonary functions, decreases in diffusing capacity, reactive airways, and hyper-responsiveness to methacholine challenge. Long term overexposure may produce upper airway changes leading to an increased prevalence of colds, shortness of breath, and reactive airway dysfunction syndrome.

ADDITIONAL DATA: Odor does not provide an adequate warning of exposure. In workers exposed to chlorine for a 2 to 5 year period, all had some degree of olfactory impairment. Sensory irritation tolerance developed in rats when they were pretreated with 1 ppm chlorine.

Chronic Effects: Chronic exposure to chlorine may cause corrosion of the teeth. Multiple exposures to chlorine have produced flu-like symptoms and a high risk of developing reactive airways dysfunction syndrome (RADS).

SIGNS AND SYMPTOMS OF EXPOSURE:

Inhalation (Breathing): Chlorine is water soluble and therefore, primarily removed by the upper airways. Exposure to low concentrations of chlorine (1 to 10 ppm) may cause eye and nasal irritation, sore throat, and coughing. Inhalation of higher concentrations of chlorine gas (>15 ppm) can rapidly lead to respiratory distress with airway constriction and accumulation of fluid in the lungs (pulmonary edema). Patients may have immediate onset of rapid breathing, blue discoloration of the skin, wheezing, rales or hemoptysis. In symptomatic patients, pulmonary injury may progress over several hours. Lung collapse may occur. The lowest lethal concentration for a 30-minute exposure has been estimated as 430 ppm. Exposure to chlorine can lead to reactive airways dysfunction syndrome (RADS), a chemical irritant-induced type of asthma.

Skin: Chlorine irritates the skin and can cause burning pain, inflammation, and blisters. Exposure to liquefied chlorine can result in frostbite injury.

Eye: Low concentrations in air can cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, conjunctivitis, and tearing. Corneal burns may occur at high concentrations.

Ingestion (Swallowing): Ingestion is unlikely to occur because chlorine is a gas at room temperature. Solutions that are able to generate chlorine (e.g., sodium hypochlorite solutions) may cause corrosive injury if ingested.

Other Health Effects:

Cardiovascular: Tachycardia and initial hypertension followed by hypotension may occur. After severe exposure, cardiovascular collapse may occur from lack of oxygen.

Metabolic: Acidosis may result from insufficient oxygenation of tissues. An unusual complication of massive chlorine inhalation is an excess of chloride ions in the blood, causing an acid-base imbalance.

Interaction with Other Chemicals Which Enhance Toxicity: No interaction with other chemicals which enhance toxicity are known.

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GHS HEALTH HAZARDS:

GHS: CONTACT HAZARD - SKIN: Category 1 - Causes severe skin burns and eye damage

GHS: CONTACT HAZARD - EYE: Category 1 - Causes serious eye damage

GHS: ACUTE TOXICITY - INHALATION: Category 2 - Fatal if inhaled

SPECIFIC TARGET ORGAN TOXICITY (STOT) - SINGLE EXPOSURE (SE):

Category 1 - Causes damage to: Respiratory System

Category 3 - May cause respiratory irritation

TOXICITY DATA:

PRODUCT TOXICITY DATA: See component data below.

LD50 Oral:	LD50 Dermal:	LC50 Inhalation:
No data is available on the product itself	No data is available on the product itself	No data is available on the product itself

The component toxicity data is populated by the LOLI database and may differ from the product toxicity data given.

Component	Oral LD50	Dermal LD50	Inhalation LC50
Chlorine 7782-50-5	5800 mg/kg (Rat) 6800 mg/kg (Rat)	No data available	No data available

EYE IRRITATION/CORROSION: Moisture in the eyes can react with chlorine to form hydrochloric acid and nascent oxygen, which damage cells. It can also penetrate cells and react with proteins, destroying cell structure. Corrosive to the eyes and may cause severe damage including blindness. Contact with liquid or rapidly expanding gas may cause frostbite to contacted tissue (eyes, skin, etc.). Low concentrations in air may cause burning discomfort, spasmodic blinking or involuntary closing of the eyelids, redness, conjunctivitis, and tearing.

SKIN IRRITATION/CORROSION: Chlorine gas is irritating and can be corrosive to the eyes, skin, and mucous membranes. Liquid chlorine may cause cutaneous burns; gaseous chlorine will irritate the skin and may cause burns in high concentrations. Exposure can cause complete destruction of skin or mucous membrane and may result in partial or total thickness burns. Symptoms of skin exposure include irritation with sensations of burning or prickling, inflammation or blister formation.

SKIN ABSORBENT/DERMAL ROUTE: NO.

Skin absorption is unlikely because chlorine is a gas above -34.1 C. Currently, no data are available regarding the kinetic behavior of chlorine gas following dermal exposure. It is therefore assumed that systemic absorption does not occur after dermal contact, and dermal absorption is not considered relevant.

RESPIRATORY OR SKIN SENSITIZATION: Sodium hypochlorite, as a test surrogate for chlorine, has not been classified as a skin sensitization hazard, and there are no documented human case reports indicating that chlorine possesses sensitization potential. Consequently, chlorine is regarded as presenting no risk for skin or respiratory sensitization. Furthermore, specific animal studies investigating the sensitization potential of chlorine are lacking. Isolated human cases of hyper-reactivity or hypersensitivity following exposure to chlorine gas are considered pseudo-allergic reactions, which are not immune-mediated and may vary according to individual characteristics. Not classified as a skin or respiratory sensitizer per GHS and/or CLP criteria.

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CARCINOGENICITY: Chlorine reacts with water in aqueous solutions to form hypochlorous acid and/or hypochlorite. The toxicity of sodium hypochlorite following repeated or continuous administration has been extensively studied in a number of species following exposure through chlorinated water. Thus, for oral and dermal application a read across from sodium hypochlorite is scientifically justified. Extensive research into the carcinogenicity of sodium hypochlorite has been conducted through oral, inhalation, and skin application studies in several rodent models. Oral administration of sodium hypochlorite in drinking water did not result in statistically significant increases in tumor incidence in rats or mice, with only slight and equivocal evidence of increased leukemia rates in some female rats. Inhalation studies similarly showed no increase in neoplasia, indicating that inhaled chlorine acts as a respiratory tract irritant but not as a carcinogen. Human data on sodium hypochlorite are restricted to its use in chlorinated drinking water, with epidemiological studies revealing only weak or inconsistent associations between long-term consumption and certain cancers, such as bladder and colon cancer. However, these studies are compromised by methodological limitations and confounding variables, making it impossible to establish a clear causal relationship. Not classified as a carcinogen per GHS and/or CLP criteria.

SPECIFIC TARGET ORGAN TOXICITY (Single Exposure): Reactive Airways Dysfunction Symptom (RADS) has been related to acute chlorine exposure. This syndrome is a sudden onset type of asthmatic illness occurring in responsive subjects, with normal pulmonary physiology and with no bronchial hyper-reactivity, following acute inhalation of high-dose irritant gases. Several cases of respiratory hyper-responsiveness following acute exposure to high concentration of chlorine have been reported in the literature. In addition, pulp mill workers who reported transient exposure to high levels of chlorine gas showed increased airflow obstruction on pulmonary function tests compared to controls.

SPECIFIC TARGET ORGAN TOXICITY (Repeated or Prolonged Exposure): No systemic effects were observed in repeated dose exposure studies in rats, mice, and monkeys with chlorine gas. Additionally, chlorine was discussed by the European Union's Scientific Committee on Occupational Exposure Limits (SCOEL) and an OEL of 0.5 ppm (1.5 mg/m³) was agreed based on these studies, with removal of the 8-hour TWA. The justification was that the effects appear to be related to concentration in the air and not to duration of exposure.

INHALATION HAZARD: Clinical and morphological observations together with lung function tests confirm that exposure to chlorine results in effects on lung function and histological integrity of the respiratory system. A reliable study with human volunteers showed that an exposure to chlorine up to 0.5 ppm (1.5 mg/m³) during a few days did not result in an inflammatory effect in the nose nor shows changes in the respiratory function (No Observed Adverse Effect Level (NOAEL)). Based on a selected set of animal experiments an LC50 value of 300-400 ppm (900-1200 mg/m³) was reported for an exposure of 30 minutes. Concentrations higher than 1000 ppm (3000 mg/m³) may be lethal at shorter exposure periods (about 10 minutes). Majority of effects of chlorine occur in the alveoli. Exposure to chlorine resulted additionally in changes in the conductive airways in some animals. LC50 value for 30 minute exposure was derived at 1.462 mg/L.

Chlorine is an irritant gas that can cause damage to moist tissues. It is a gas of intermediate solubility, and reacts with water to form hydrochloric and hypochlorous acids. Hypochlorous acid rapidly breaks down to hydrochloric acid and nascent oxygen, which can generate oxygen free radicals. The latter can disrupt cellular proteins and cause cytotoxic damage to the cells of the respiratory tract. The chlorine-containing acids can also combine with sulfhydryl groups and disulfur bonds, which may contribute to disruption of protein structure. The formation of hydrochloric acid may also contribute to localized tissue irritation, and possibly necrosis (though experimentally, chlorine gas is up to 30 times more destructive). Due to the small molecular size and only moderate water solubility of chlorine, a significant amount may escape dissolution in the moisture of the upper airways, and the entire respiratory tract can be affected. Pulmonary changes include necrosis and sloughing of respiratory epithelium with ulcerative tracheobronchitis, as well as alveolar exudates and hyaline membrane formation consistent with acute respiratory distress syndrome. Experimental evidence suggests increased microvascular permeability contributes along with the epithelial injury to alveolar edema. Due to the impaired oxygen delivery to the alveoli and their impaired structure, integrity and function,

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arterial deoxygenation occurs, with decreased cardiac performance further reducing oxygen delivery and compounding tissue hypoxia. Bronchospasm (if not pulmonary edema) may be more severe in asthmatic subjects. Profound hypoxia can lead to cardiac failure or arrest.

INGESTION HAZARD: No specific studies are available with chlorine gas. Read across from sodium hypochlorite is performed instead. The acute toxicity of marketed hypochlorite solutions by the oral route is low. The LD50 values for solutions containing active chlorine concentrations up to 12.5 % are greater than 5.8 g/kg.

GERM CELL/IN-VITRO MUTAGENICITY: Chlorine lacks direct mutagenicity studies, so sodium hypochlorite data were used instead (e.g., read across). Although some laboratory tests showed mixed or positive results, all animal studies were negative. The overall evidence, including findings from carcinogenicity and reproductive toxicity studies, indicates that sodium hypochlorite—and by extension chlorine—is not considered genotoxic, mutagenic or clastogenic and is not classified as mutagenic under GHS guidelines.

REPRODUCTIVE TOXICITY: Animal studies, using sodium hypochlorite as a read-across for chlorine, indicate that sodium hypochlorite does not cause adverse effects on development or fertility, with no treatment-related changes observed in viability, fetal weights, or external appearances across test groups. Skeletal and soft tissue abnormalities remained within normal ranges at all tested doses, with a NOAEL (No Observed Adverse Effect Level) established at greater than 5.7 mg available chlorine per kg body weight per day. Epidemiological studies of populations consuming chlorinated drinking water similarly do not provide evidence of reproductive toxicity. The scientific justification for extrapolating findings from aqueous chlorine (sodium hypochlorite) is supported, and overall, there is no indication that exposure to sodium hypochlorite or chlorine adversely affects development or fertility. Not classified as a reproductive toxin according to GHS criteria.

DEVELOPMENTAL TOXICITY: Not classified as a developmental or reproductive toxin per GHS criteria.

ASPIRATION HAZARD: Not classified as an aspiration hazard per GHS criteria.

TOXICOKINETICS: Chlorine exerts its primary effect at the site of contact by disrupting organic molecules present, which prevents its absorption into the bloodstream. Although moderately soluble in epithelial lining fluid, its rapid interaction with surface material and respiratory tract tissue renders it a potentially hazardous gas. Due to their obligatory nasal breathing and more complex nasal anatomy, mice and rats exhibit more pronounced nasal responses to inhaled toxicants compared to humans. However, available evidence suggests that in both species, at low concentrations (below 2.5 ppm, 7.5 mg/m³), nearly all chlorine is absorbed in the upper airways, preventing it from reaching the lower respiratory tract. Following oral administration of hypochlorous acid solution in rats, chlorine ions are rapidly absorbed and distributed in the blood, with peak concentrations occurring between 2 and 4 hours, and a half-life ranging from 2 to 4 days. Interactions between chlorine and gastric contents may lead to the formation of chlorinated organic compounds, such as chloroform, DCAN, DCA, TCA, and chlorinated amino acids.

METABOLISM: Metabolism and excretion of exogenous chlorine is determined by products of the reactions between hypochlorous acid/hypochlorite and biomolecules in vivo. The majority of chlorine joins the chloride pool in the body and is excreted accordingly.

BIOLOGICAL DISTRIBUTION: Available data indicate that in both humans and rodents at low concentrations (below 2.5 ppm, 7.5 mg/m³) almost all chlorine is absorbed in the upper airways and does not reach the lower airways. Greater than 95% of inhaled chlorine (over the 1 to 5 ppm range) reacts in the upper respiratory tract. Oral administration of a hypochlorous acid solution in rats resulted in a quick uptake and distribution of the chlorine-ion in the blood, with a peak concentration between 2 and 4 hours and a half-life between 2 and 4 days. Interaction of chlorine and stomach can result in the possible formation of chlorinated organic compounds as chloroform, dichloroacetonitriles (DCAN), dichloroacetic acid (DCA), trichloroacetic acid (TCA), and chlorinated amino acids. There are no data on kinetic behavior of chlorine gas upon dermal exposure. It can be assumed that no systemic

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exposure to chlorine will occur after dermal absorption. Therefore, dermal absorption is not considered.

PATHOGENICITY AND ACUTE INFECTIOUSNESS (ORAL, DERMAL, AND INHALATION): Not applicable.

ENDOCRINE DISRUPTOR: Chlorine is not currently listed as an endocrine disruptor on the various governmental agencies and/or regulatory lists. In addition, there is no significant evidence of endocrine-disrupting activity or adverse effects from active chlorine based on both systematic literature review and in silico assessment, though EATS-related modalities remain under-researched. In addition, the current research highlights the practical limitations of evaluating unstable and inorganic chemicals like chlorine with standard in vitro methodologies.

NEUROTOXICITY: There is very limited evidence in the literature for chronic adverse neurological effects following acute chlorine exposure. However, according to a series of studies by Kilburn (1995, 2000, 2003b), brief exposures to high concentrations of chlorine gas may lead to lasting neurological changes in humans, but these findings have not been replicated or confirmed by other research using neurobehavioral testing. Animal studies and research involving hypochlorite bleach have shown no evidence of neurological effects, suggesting the nervous system is not a sensitive target for oral chlorine exposure.

IMMUNOTOXICITY: There is limited information on the immunotoxicity of chlorine in humans following oral exposure. Animal studies have produced mixed results: one study in rats found changes in some immune parameters after eight weeks of drinking water containing chlorine, but the toxicological significance is unclear and lacks support from further research. Other studies in rats and mice exposed to higher chlorine doses did not show notable changes in lymphoreticular organs, although they did not directly assess immune function. Replicating earlier findings and challenging protocols with microorganisms may help clarify whether reported alterations indicate reduced immunity. Male Sprague-Dawley rats were exposed to the chlorine-based disinfectant, sodium hypochlorite (5, 15 and 30 ppm), in the drinking water from weaning to 12 weeks of age, at which time they were terminated and assessed for immune competence. Parameters of immunity measured were spleen and thymus weights, antibody production, delayed type hypersensitivity reactions, natural killer cell cytotoxicity, oxidative metabolism response (i.e. chemiluminescence - CL) and phagocytosis by macrophages, and production of 2 immunoregulatory cytokines, interleukin 2 and prostaglandin E2. Significant ($p < 0.05$) reductions of spleen weight. Delayed type hypersensitivity reactions, and oxidative metabolism by macrophages were observed only in groups of rats exposed to high levels (30 ppm) of sodium hypochlorite while prostaglandin E2 production was elevated.

Health Hazards Not Mentioned in GHS Classification

- ACUTE EXPOSURE MAY CAUSE DELAYED PULMONARY EDEMA
- Direct contact with liquid or rapidly expanding gas may cause frostbite to contacted tissue (eyes, skin, etc.)

SECTION 12. ECOLOGICAL INFORMATION

ECOTOXICITY (EC, IC, and LC):

Component:	Freshwater Fish:	Invertebrate Toxicity:	Algae Toxicity:	Other Toxicity:
Chlorine 7782-50-5 (99.5 - 100 %)	*LC50 <i>Lepomis macrochirus</i> : 0.44 mg/L 96h flow-through *LC50 <i>Oncorhynchus mykiss</i> : 0.014 mg/L	*LC50 <i>Daphnia magna</i> : 0.017 mg/L 48h	No data available	No data available

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	<p>96h flow-through *LC50 Oncorhynchus mykiss: 0.014 mg/L 96h *LC50 Oncorhynchus mykiss: 0.104 - 0.168 mg/L 96h static *LC50 Pimephales promelas: 0.08 mg/L 96h flow-through *LC50 Pimephales promelas: 0.1 mg/L 96h</p>			
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Aquatic Toxicity:

Very toxic to aquatic organisms.

Fish Toxicity:

LC50 Fathead minnow: 0.07 to 0.15 (96 hour)

LC50 Bluegill: 0.44 mg/l (96 hour).

Invertebrate Toxicity:

LC50 Daphnia: 30 to 150 ug/L (48 hour).

FATE AND TRANSPORT:

PERSISTENCE: In natural water, the Cl₂ molecule as well as hypochlorite ions are not stable due to the presence of organic and inorganic matter. The half-life of hypochlorite is estimated to be less than 2 hours due to reduction and photolysis. The free available chlorine reacts to form various chlorinated by-products, e. g. chloramines and chloromethanes. In the atmosphere, chlorine mainly undergoes photolysis. The half-lifetime for that process has been estimated to be in the order of 1–4 hours, depending on the time of the day.

BIODEGRADATION: This material is an element and not subject to biodegradation.

BIOCONCENTRATION: This material is not expected to bioconcentrate in organisms.

BIOACCUMULATIVE POTENTIAL: Chlorine does not bioaccumulate or bioconcentrate because of its water solubility and high reactivity.

MOBILITY IN SOIL: Chlorine will react with water to form hydrogen chloride. The high-water solubility of chlorine can lead to a high mobility in soil, although chlorine as vapor or as aqueous solution is normally irreversibly bound to soil organics within the first few millimeters or centimeters of the soil surface.

ADDITIONAL ECOLOGICAL INFORMATION: This material has exhibited toxicity to terrestrial organisms.

Persistent, Bioaccumulative, and Toxic (PBT) and Very Persistent and Very Bioaccumulative (vPvB) Assessment:

This product does not fulfill the criteria for persistence, bioaccumulation, and toxicity. Therefore, this substance is not considered a PBT or a vPvB substance.

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SECTION 13. DISPOSAL CONSIDERATIONS

Waste from material:

Use or process if possible. Chlorine may be absorbed into an alkaline solution such as caustic soda, soda ash or hydrated lime. Dispose in accordance with all applicable regulations.

Container Management:

Return empty chlorine tankcars and cargo tanks containing residual gas and/or liquid to supplier in compliance with applicable DOT regulations. See product label for container disposal information.

Contaminated Material:

Dispose according to appropriate regulations.

SECTION 14. TRANSPORT INFORMATION

LAND TRANSPORT

U.S. DOT 49 CFR 172.101:

UN NUMBER: UN1017
PROPER SHIPPING NAME: Chlorine
HAZARD CLASS/ DIVISION: 2.3 (5.1, 8)
LABELING REQUIREMENTS: 2.3, 5.1, 8
MARINE POLLUTANT: Yes (Marine Pollutant)

RQ (Lbs.): RQ 10 Lbs. (Chlorine)

Special provisions for transport: 2, B9, B14, N86, T50, TP19.

ADDITIONAL INFORMATION: Toxic-Inhalation Hazard Zone B. An Emergency Kit "C" must be on chlorine tank cars and trucks. Proper training on the use of emergency equipment is required (OSHA 29CFR 1910.134).

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:

* **NOTE:** Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code. Consult regulations before transporting via ocean bulk.

UN NUMBER: UN1017
SHIPPING NAME: Chlorine
CLASS OR DIVISION: 2.3, 5.1, 8
LABELING REQUIREMENTS: 2.3, 5.1, 8
CAN. MARINE POLLUTANT: Yes (Marine Pollutant)
OTHER INFORMATION: Emergency Response Assistance Plan (ERAP) may be required

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MARITIME TRANSPORT (IMO / IMDG)

* **NOTE:** Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code:. Consult regulations before transporting via ocean bulk.

UN NUMBER: 1017
PROPER SHIPPING NAME: Chlorine
HAZARD CLASS / DIVISION: 2.3 (5.1, 8)
Packing Group: Not applicable
LABELING REQUIREMENTS: 2.3, 5.1, 8, Environmental hazard
MARINE POLLUTANT: Yes (Marine Pollutant)

AIR TRANSPORT (ICAO / IATA)

Status - ICAO/IATA: Transport by passenger and cargo aircraft is forbidden

Special Instructions CAO: IATA Certificate for shipping personnel is required

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: The product is considered to be dangerous, by IMDG code. Consult regulations before transporting via ocean bulk.

SECTION 15. REGULATORY INFORMATION**U.S. REGULATIONS****OSHA REGULATORY STATUS:**

Health hazard classifications were performed using OSHA Hazard Communication 2024 (1910.1200) Appendix A and/or UN GHS Rev. 8 (2019). This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).

CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):

If a release is reportable under CERCLA section 103, notify the state emergency response commission and local emergency planning committee. In addition, notify the National Response Center at (800) 424-8802 or (202) 426-2675.

Component	U.S. DOT Hazardous Substances/ RQs	CERCLA Hazardous Substances / RQs	CERCLA Section 302 EHS EPCRA RQs	Section 302 Threshold Planning Quantity (TPQ)
Chlorine 7782-50-5 (99.5 - 100 %)	10 lbs(RQ) lbs. (RQ)	10 lbs. (RQ)	10 lbs. (EPCRA RQ)	100 lb TPQ lbs. TPQ

SARA EHS Chemical (40 CFR 355.30)

If a release is reportable under EPCRA, notify the state emergency response commission and local emergency planning committee. If the TPQ is met, facilities are subject to reporting requirements under EPCRA Sections 311 and 312.

SARA HAZARD CATEGORIES ALIGNED WITH GHS (2018):

Physical Hazard - Gas Under Pressure
Physical Hazard - Oxidizer (liquid, solid or gas)

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Health Hazard - Acute Toxin (any route of exposure)
 Health Hazard - Skin Corrosion or Irritation
 Health Hazard - Serious eye damage or eye irritation
 Health Hazard - Specific Target Organ Toxicity (STOT) Single Exposure (SE)

EPCRA SECTION 313 (40 CFR 372.65):

The following chemicals are listed in 40 CFR 372.65 and may be subject to Community Right-to Know Reporting requirements.

Component	SARA 313 - Emission Reporting	SARA 313 PBT
Chlorine 7782-50-5 (99.5 - 100)	0.1% (de minimis concentration)	Not Listed

DEPARTMENT OF HOMELAND SECURITY (DHS)- Chemical Facility Anti-Terrorism Standards (6 CFR 27):

This product is regulated under the U.S. Department of Homeland Security (DHS) Chemical Facility Anti-Terrorism Standards (CFATS) as follows:

Component	DHS - Security Issues	DHS-Sabotage Screening Threshold Qty.	DHS-Sabotage Min. Conc.	DHS-Theft Screening Threshold Qty.	DHS-Theft Min. Conc.	DHS-Release Screening Threshold Qty.	DHS-Release Min. Conc.	CWC Toxic Chemicals:
Chlorine 7782-50-5 (99.5 - 100)	Release - Toxic; Theft – Weapons of Mass Effect	Not Listed	Not Listed	500 lbs. TPQ	9.77% Maximum Concentration	2500 lbs. STQ	1.0% Minimum Concentration	Not Listed

OSHA PROCESS SAFETY (PSM) (29 CFR 1910.119):

CHLORINE: 1500 LBS TQ.

Component	EPA RMP Toxic or Flammable TPQ	PSM - Highly Hazardous Substances, Toxics and Reactives	Flash Point
Chlorine 7782-50-5 (99.5 - 100)	Toxic (2500 lbs. threshold quantity)	1500 lbs. TQ	

FIFRA REGULATIONS: Registered pesticide under 40 CFR 152.10, Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). EPA Reg. No. 935-8 (Chlorine Liquefied Gas).

FIFRA LABELING REQUIREMENTS: - This chemical is a pesticide product registered by the United States Environmental Protection Agency (EPA) and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets (SDS), and for workplace labels of non-pesticide chemicals. The hazard information required on the pesticide label is reproduced below. The pesticide label also includes other important information, including directions for use.

- FIFRA Signal Word - DANGER - POISON
- FIFRA Symbol - Skull and Crossbones
- Fatal if inhaled
- Liquid causes severe burns
- Fatal if inhaled or absorbed through skin
- Corrosive
- Causes irreversible eye damage and skin burns
- Prolonged frequently repeated skin contact may cause allergic reactions in some individuals
- This product is toxic to fish and aquatic organisms
- Chlorine is a non-flammable gas, liquefied, under pressure
- Corrosive to most metals in the presence of moisture

EPA'S CLEAN WATER AND CLEAN AIR ACTS:

CHLORINE (LIQUEFIED GAS UNDER PRESSURE) (PESTICIDE)

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Regulated as noted in table below.

Component	Clean Water Act - Priority Pollutants	CAA - ODS CLASS 1 AND CLASS 2	CAA - Volatile Organic Compounds (VOCs) in SOCM	CAA - HON Rule - Organic HAPs	CAA - Hazard Air Pollutants	CAA - Urban HAPs List (Integrated Urban Strategy)	SNAP - Substitutes for ODS	EPA RMP Toxic or Flammable TPQ
Chlorine 7782-50-5 (99.5 - 100 %)	Not Listed	Not Listed	Not Listed	Not Listed	Present	Not Listed	Not Listed	Toxic (2500 lbs. threshold quantity)

NATIONAL INVENTORY STATUS**U.S. INVENTORY STATUS: Toxic Substance Control Act (TSCA):**

Component	TSCA Inventory	TSCA ACTIVE LIST	TSCA 12(b)	TSCA/Section 4	TSCA/Section 5	TSCA/Section 6	TSCA/Section 8
Chlorine 7782-50-5 (99.5 - 100 %)	Listed	ACTIVE	----	Not Listed	----	Not Listed	Not Listed

Canadian Chemical Inventory: All components of this product are listed on either the DSL or the NDSL.

Component	DSL	NDSL
Chlorine 7782-50-5 (99.5 - 100 %)	Listed	Not Listed

STATE REGULATIONS**California Proposition 65:**

This product is not listed on the California Governor's current list of Carcinogens, Reproductive Toxicants, and/or Candidate Carcinogens (Proposition 65), but it may contain trace amounts of impurities that are listed. For additional information, contact Occidental Chemical Corporation Customer Service (1-800-752-5151 or 1-972-404-3700).

Component	U.S. - California - Proposition 65 - Carcinogens List	CA. Prop. 65 Teratogen	California Proposition 65 CRT List - Male reproductive toxin:	California Proposition 65 CRT List - Female reproductive toxin:	Massachusetts Right to Know Hazardous Substance List	Rhode Island Right to Know Hazardous Substance List
Chlorine 7782-50-5 (99.5 - 100 %)	Not listed	Not listed	Not Listed	Not Listed	Listed	Listed

Component	New Jersey Right to Know Hazardous Substance List	New Jersey Special Health Hazards Substance List	New Jersey - Environmental Hazardous Substance List	Pennsylvania Right to Know Hazardous Substance List	Pennsylvania Right to Know Special Hazardous Substances	Pennsylvania Right to Know Environmental Hazard List
Chlorine	0367	Not Listed	Listed	Listed	Not Listed	Present

CANADIAN REGULATIONS

This product has been classified in accordance with the hazard criteria of the Workplace Hazardous Materials Information System (WHMIS 2015) which includes the amended Hazardous Products Act (HPA) and the Hazardous Product Regulations (HPR).

Component	Canada - CEPA -	Canada - NPRI	Canada - CEPA -	Canadian Chemical	NDSL

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	Schedule I - List of Toxic Substances		Greenhouse Gases (GHG) Subject to Mandatory Reporting	Inventory:	
Chlorine 7782-50-5 (99.5 - 100)	Not listed	Part 1, Group A Substance (045)	Not Listed	Listed	Not Listed

SECTION 16. OTHER INFORMATION

Prepared by: Occidental Chemical Corporation - HES&S Product Stewardship Department

Rev. Date: 04-Dec-2025

Reason for Revision:

- Scheduled review
- SDS format adopts revisions to the Hazardous Products Regulations (HPR) to include revisions to "Section 9: Physical and chemical properties" and ensures classification with at a minimum the seventh revised edition of GHS and certain elements from the eighth revised edition (Revision 8)
- SDS format adopts revisions to the OSHA's 2024 Hazard Communication Rule 29CFR 1910.1200 and ensures classification with at a minimum the seventh revised edition of GHS and certain elements from the eighth revised edition (Revision 8)

IMPORTANT:

Important: The information presented herein, while not guaranteed, was prepared by technical personnel and is true and accurate to the best of our current knowledge. NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE, OR WARRANTY OR GUARANTY OF ANY OTHER KIND, EXPRESS OR IMPLIED, IS MADE REGARDING PERFORMANCE, SAFETY, SUITABILITY, STABILITY OR OTHERWISE. This information is not intended to be all-inclusive as to the manner and conditions of use, handling, storage, disposal, and other factors that may involve other or additional legal, environmental, safety or performance considerations, and Occidental Chemical Corporation assumes no liability whatsoever for the use of or reliance upon this information. Appropriate handling and use of the product remains the responsibility of the customer. No suggestions for use are intended as, and nothing herein shall be construed as, a recommendation to infringe any existing patents or to violate any Federal, State, local or foreign laws.

OSHA Standard 29 CFR 1910.1200 requires that information be provided to employees regarding the hazards of chemicals by means of a hazard communication program including labeling, safety data sheets, training and access to written records. We request that you, and it is your legal duty to, make all information in this Safety Data Sheet available to your employees.

End of Safety Data Sheet