



**SECTION 1. IDENTIFICATION OF THE DANGEROUS CHEMICAL SUBSTANCE AND THE MANUFACTURER**

<b>1.1. Name of the dangerous chemical</b>	Chlorine						
<b>1.2. Other means of identification</b>	Commercial name: Chlorine Formula: Cl <sub>2</sub>						
<b>1.3. Recommended use of the hazardous chemical or mixture, and restrictions on use</b>	<b>Recommended uses:</b> Industrial and professional. Perform risk assessment before use. Bleaching agent Use for manufacturing electronic components. Use of gas for the manufacture of pharmaceutical products. Use of gas alone or in mixtures for the calibration of analysis equipment. Use of gas as raw material in chemical processes. Use of gas for metal treatment. Water treatment. Formulation of gas mixtures in pressure vessels. Other general uses Perform risk assessment before use. <b>Uses not recommended:</b> Private consumption.						
<b>1.4. Details of the supplier or manufacturer</b>	<b>INDUSTRIA QUÍMICA DEL ISTMO, S.A DE C.V</b>  <table border="1"> <tr> <td><b>COATZACOALCOS PLANT</b> Pajaritos Industrial Complex S/N Between 4th and 5th Avenue Coatzacoalcos, Ver. CP 96400</td> <td><b>NORTHEAST PLANT</b> Road Sta. Catarina - García km 5.5 Puerto Durazno Station Lot 1 García Industrial Park García, Nuevo León CP 66000</td> </tr> <tr> <td><b>SANTA CLARA PLANT</b> Km 16.5 Via Morelos Santa Clara colony Ecatepec, EDOMEX C.P 55540</td> <td><b>TLAXCALA PLANT</b> Mexico-Veracruz Highway Km 128 San Cosme-Xaloztoc Industrial Corridor Tlaxcala CP 90460</td> </tr> <tr> <td><b>HERMOSILLO PLANT</b> Lead Street No. 45 Industrial park colony Hermosillo, Sonora CP 83299</td> <td><b>Website</b>  <a href="http://www.cydsa.com/">http://www.cydsa.com/</a></td> </tr> </table>	<b>COATZACOALCOS PLANT</b> Pajaritos Industrial Complex S/N Between 4th and 5th Avenue Coatzacoalcos, Ver. CP 96400	<b>NORTHEAST PLANT</b> Road Sta. Catarina - García km 5.5 Puerto Durazno Station Lot 1 García Industrial Park García, Nuevo León CP 66000	<b>SANTA CLARA PLANT</b> Km 16.5 Via Morelos Santa Clara colony Ecatepec, EDOMEX C.P 55540	<b>TLAXCALA PLANT</b> Mexico-Veracruz Highway Km 128 San Cosme-Xaloztoc Industrial Corridor Tlaxcala CP 90460	<b>HERMOSILLO PLANT</b> Lead Street No. 45 Industrial park colony Hermosillo, Sonora CP 83299	<b>Website</b>  <a href="http://www.cydsa.com/">http://www.cydsa.com/</a>
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<b>1.5. Telephone number in case of emergency</b>	<b>SETIQ:</b> +52 800 00 21400, 555 55 94049 <b>COATZACOALCOS PLANT:</b> +52 921 21 13428 <b>SANTA CLARA PLANT:</b> +52 555 69 92460, 555 69 92483 <b>HERMOSILLO PLANT:</b> +52 662 25 11024, 662 25 11027 <b>NORTHEAST PLANT:</b> +52 818 15 82679, 818 15 82680 <b>TLAXCALA PLANT:</b> +52 241 41 84726						

**SECTION 2. IDENTIFICATION OF HAZARDS**

<b>2.1. Classification of the dangerous chemical</b>	<b>Classification of the globally harmonized system</b>	
	Oxidizing Gas	<b>H270</b>
	Liquefied Pressure Gas	<b>H280</b>
	Corrosive Substance for Metals	<b>H290</b>
	Acute Toxicity by inhalation, Category 3	<b>H331</b>
	Corrosion and Skin Irritation, Category 2	<b>H315</b>
	Serious eye injuries, Category 2A	<b>H319</b>
	Specific systemic toxicity in target organs after single exposure, Category 3	<b>H335</b>

Specific systemic toxicity in target organs after repeated exposures, Category 2	<b>H373</b>
Aspiration Hazard, Category 1	<b>H304</b>
Short-term (acute) hazard to the aquatic environment, Category 1	<b>H400</b>
Long-term hazard to the aquatic environment, Category 1	<b>H410</b>

**2.2. Elements of signaling, including precautionary statements and precautionary pictograms**

**GHS pictograms**



Word of Warning: **DANGER**

**Hazard Indications**

Code	Indication of danger
<b>H270</b>	It can cause or aggravate a fire; comburent
<b>H280</b>	Contains gas under pressure; it can explode if heated
<b>H290</b>	It can be corrosive to metals
<b>H331</b>	Toxic if inhaled
<b>H315</b>	Causes skin irritation
<b>H319</b>	Causes Serious eye irritation
<b>H335</b>	it can irritate the respiratory tract
<b>H373</b>	May cause organ damage through prolonged or repeated exposure
<b>H304</b>	May be fatal in case of ingestion and penetration into the respiratory tract
<b>H400</b>	Very toxic for aquatic organisms
<b>H410</b>	Very toxic to aquatic organisms, with long-lasting harmful effects

**Caution messages**

**Prevention:**

<b>P244</b>	Keep the valves and connections free of oil and grease
<b>P234</b>	Store only in the original container
<b>P233</b>	Keep container tightly closed
<b>P280</b>	Wear butyl rubber gloves, protective clothing, lenses or goggles
<b>P260</b>	Do not breathe gas / vapor
<b>P273</b>	Do not disperse in the environment

**Intervention:**

<b>P376</b>	Stop the leak if it can be done without risk
<b>P403+P233</b>	Store in a well ventilated place. Keep container tightly closed
<b>P32+313</b>	In case of skin irritation: consult a doctor
<b>P304+P340</b>	In case of inhalation / transport the person outdoors and keep them in a position that facilitates breathing
<b>P305+P351+P338</b>	In case of eye contact, rinse carefully with water for several minutes. Remove contact lenses when they are present and can be done easily. continue with the washing
<b>P312</b>	Call a TOXICOLOGY CENTER or a doctor if the person is ill

**2.3. Other hazards that do not lead to a classification**

Contact with a liquid that is evaporating can cause cold burns or freezing of the skin.

**SECTION 3. COMPOSITION / INFORMATION ON INGREDIENTS**

<b>3.1. Chemical identity of the substance</b>	Chemical name: Chlorine Family: Halogens
<b>3.2. Common name, synonyms of the dangerous chemical or mixture</b>	Commercial name: Chlorine Synonyms: Dichloro, Bertolito, Molecular chlorine
<b>3.3. CAS number, UN number, among others</b>	CAS Number: 7782-50-5 UN Number: 1017
<b>3.4. Impurities and stabilizing additives which are in turn classified and which contribute to the classification of the substance</b>	Purity of Chlorine: > 99.5% CO <sub>2</sub> : 0.2% Other gases: 0.3%

**SECTION 4. FIRST AID**

**4.1. Description of first aid** First aid is the immediate temporary treatment given to an exposed person. Quick the action is essential. The tranquility for the individual will help relieve anxiety. Medical assistance should be obtained as soon as possible. Never give anything by mouth to an unconscious or convulsed person. If the chlorine has saturated the clothes and / or the skin of the exposed persons, the decontamination must be done eliminating affected clothes and showering as appropriate. Responders should take the necessary precautions to protect themselves from any exposure to chlorine while administering first aid and should move the victim from any contaminated area as quickly as possible.

**Ingestion:**  
 Ingestion is not an applicable route of exposure for gases.

**Inhalation:**  
 Remove the victim outdoors and wrap it up.  
 An individual with exposure to chlorine inhalation should be evaluated for adequate airway, breathing, and circulation after inhalation. If breathing seems to have stopped, the victim should receive cardiopulmonary resuscitation (CPR) immediately. If breathing has not stopped, the exposed person should be placed in a comfortable position. The person should sit upright with the head and trunk elevated to a position of 45-60 ° C (unless there is a medical contraindication). Slow and deep breathing should be encouraged. Vital signs (respiratory rate, pulse and blood pressure) and oxygen saturation should be obtained if trained personnel and equipment are available. The proper equipment for oxygen administration must be available on site or at a nearby facility. Such equipment must be tested periodically.  
 Historically, oxygen therapy, specifically humidified oxygen, has been considered the primary treatment for chlorine inhalations. Humidified oxygen is preferred since moisture relieves irritation of mucous membranes caused by chlorine.  
 Oxygen without moisture can have a drying effect, which can aggravate irritating symptoms. However, if humidified oxygen is not available, oxygen without moisture should not be withheld if oxygen therapy is indicated. With the advancement in technology, the equipment (pulse oximeter) is now available and can quickly measure oxygen saturation in an individual. This measure can be useful in deciding whether supplemental oxygen is needed after a chlorine inhalation.  
 Oxygen therapy may not be necessary for all cases of chlorine inhalation. However, in any case, in which an individual with chlorine inhalation continues to be symptomatic after leaving the exposure area, oxygen therapy is recommended unless it can be determined that it is not necessary. Circumstances in which oxygen therapy is not necessary should be defined in advance by a physician, based on clinical findings and a case-by-case determination made by first aid providers specifically trained in this area.

**Skin contact:**

If liquid chlorine has contaminated skin or clothing, an emergency shower should be used immediately and contaminated clothing should be removed under the shower. Rinse contaminated skin with plenty of warm water for 15 minutes or more. Thermal burns, due to the cold temperature of liquid chlorine, can be more harmful than any chemical reaction of chlorine and skin. Exposure to chlorine gas can irritate the skin. Do not attempt chemical neutralization or apply balms or ointments on damaged skin. Consult a qualified health care provider if irritation persists after watering or if the skin is broken or blistered.

**Eye contact:**

If the eyes have become irritated due to exposure to chlorine, they should be rinsed immediately with copious amounts of warm water for at least 15 minutes. Never try to neutralize with chemical products. The eyelids should be kept separate during this period to ensure water contact with all accessible tissues of the eyes. Medical assistance should be obtained as soon as possible. If such assistance is not immediately available, eye irrigation should be continued for a second period of 15 minutes. Nothing but water should be applied unless requested by a qualified health care provider.

**4.2. Most important symptoms and effects, acute or chronic**

The most important route of exposure is inhalation, followed by exposure to eyes or skin; liquefied chlorine can freeze the skin tissue.

**Ingestion:**

Ingestion is not an applicable route of exposure for gases.

**Inhalation:**

Chlorine causes severe irritation of the nasal mucosa, throat and upper respiratory tree.

**Skin contact:**

It is not absorbed by the skin. The gas in the air can irritate and burn the skin, direct contact with liquefied gas can cause frostbite (-15 ° C). The symptoms of light freezing include numbness, itching and burning in the affected area. The symptoms of severe frostbite include a burning sensation and hardening of the affected area, the skin can acquire a whitish or yellowish tone.

**Eye contact:**

The gas is severe irritant of the eyes have been observed sensation of itching, burning, chemical conjunctivitis at concentrations of 1 or more ppm. Direct contact with liquefied chlorine that is leaking from a pressurized cylinder can cause freezing, burns and permanent damage including blindness.

**Effects by exposure.**

**Light:**

Rhinorrhea, cough, headache, pharyngeal irritation, chest pain, shortness of breath, nausea, deficits in lung function.

**Severe:**

Ulcerative tracheobronchitis, pulmonary edema, respiratory failure and death.

**Chronicle:**

The studies have been conducted in people, have not shown significant effects on the respiratory system in employees with exposure to chlorine in the long term and with low levels (usually less than 1 ppm). No relationship has been found between exposure to chlorine and the frequency of colds, respiratory difficulties and abnormal heart rhythm or chest pains. No significant effects on lung function have been observed.

**4.3. Indication of the need to receive immediate medical attention and, where appropriate, special treatment**

**Mild poisoning:**

Pharyngeal irritation, cough and tearing.

**Recommended treatment:**

Administration of syrup with analgesic, anti-inflammatory, antispasmodic and reducing exudate (Bredon, Coricidin Expec, Broxol plus) at the established doses. For eyes: Application of ophthalmic drops, anti-inflammatory (Maxitrol oft, Decadron oft.)

**Moderate intoxication:**

Pharyngeal and ocular irritation, shortness of breath, cough and feeling of anguish or anxiety.

**Recommended treatment:**

Administer moist oxygen through a mask with a reservoir at a rate of 6 to 7 liters per minute; oral syrup, ophthalmic drops to relieve irritation, inhalation of glucocorticoids suspension in spray a shot every 3 minutes until the remission of symptoms, keep warm the injured at rest.

**Acute anxiety**

Acute anxiety (fear and / or apprehension) by an employee exposed to chlorine may occur. Tranquility is best achieved without the use of sedatives. The use of sedatives should only be considered by qualified medical personnel following evaluation and only employed under close supervision of respiratory function to monitor progress.

**Serious Poisoning:**

Significant irritation of the upper airways and eyes, intense coughing in access, difficulty in breathing, feeling of suffocation, bronchospasm, anguish and retrosternal pain.

**Recommended treatment:**

Administration of moist oxygen by mask with reservoir (6-7 lt / min) inhalation of glucocorticoids and bronchodilators (becotide 100 suspension in aerosol, ventolin suspension in aerosol); Hydrocortizone (Flebocortizone) 500mg. Diluted venous route for every 8 hr. Perform chest radiography (monitor the formation of acute pulmonary edema).

**Pulmonary edema**

Once the pulmonary edema has developed from the inhalation of acute chlorine, the treatment is basically that of acute respiratory failure. This person should be under the care of a health professional familiar with this disease process in an intensive care setting. It should be noted that there is no conclusive evidence on the use of corticosteroids to prevent or alleviate pulmonary edema after acute inhalation of chlorine.

**Bronchospasm (wheezing)**

Bronchodilators administered by nebulization or subcutaneously may be beneficial if the patient has bronchospasm (wheezing).

**Delayed effects**

After acute exposure to chlorine, lung function usually returns to pre-exposure levels in 7 to 14 days, and full recovery usually occurs. Spirograms after the incident can be used for clinical follow-up. There have been reports of Respiratory Tract Dysfunction Syndrome (RADS), an asthma induced by chemical irritants, after a major inhalation of chlorine.

Inhalation of any irritant gas can cause delayed reactions, such as pulmonary edema. Since physical exercise seems to have some relation to the incidence of late reaction, it is recommended that any patient who has had severe inhalation exposure should be kept at rest for a period of observation. During the observation period, it is recommended to avoid irritants (for example, cigarette smoke, dust, etc.). The duration of the observation will depend on the clinical evaluation of the exposed individual. Observation may be required up to several days after exposure. Excitement, apprehension and / or emotional distress may persist for a period of time after severe exposure.

**SECTION 5. FIRE MEASURES**

<b>5.1. Suitable extinguishing media</b>	Use the extinguishing medium (s) for the surrounding fire, such as: Dry chemical powder, carbon dioxide or foam.
<b>5.2. Specific hazards of the chemical</b>	<p>Chlorine is a strong oxidizing agent and presents a serious risk of fire and explosion because it is a promoter of combustion as well as oxygen.</p> <p>Most combustible materials are burned or burned in atmospheres with chlorine, forming irritating and toxic gases.</p> <p>Containers or cylinders can break violently due to excess pressure, if exposed to fire or excessive heat, for a sufficient period of time.</p> <p>Intense heat (May at 200C °) and located on the steel walls of the cylinders with chlorine, can cause a fire that results in the rupture of the container.</p> <p>The cylinders and / or containers (1 Ton, approx. Capacity) will begin to vent the chlorine once the fuse plugs reach 71 ° C.</p>
<b>5.3. Special measures to be followed by fire fighting groups</b>	<p><b>Special fire-fighting measures:</b></p> <p>The use of water can generate the formation of very toxic aqueous solutions. Keep excess water out of ponds and sewers. Place dams to control the water.</p> <p>Use fire extinguishers to contain the fire. Isolate the source of the fire or let it burn.</p> <p>Apply water from the greatest possible distance in flooding quantities, either as spray or mist, so that the cylinders, containers or equipment remain cool and heat is absorbed, do so until after the fire has been off.</p> <p>If there is a chlorine leak, stop the flow if it is possible to do so safely.</p> <p>A chlorine fire can only be extinguished by stopping the flow of chlorine.</p> <p>Use water spray to protect personnel who are trying to close the flow.</p> <p>Remove all combustible materials that are concentrated near, especially oil and grease.</p> <p>Use water carefully, do not apply it directly to liquefied or gaseous chlorine as it forms a corrosive solution.</p> <p>Be careful not to block the pressure relief valves</p> <p>Stay away from the ends of the tanks (note that fragments can fly in any direction.</p> <p>In an advanced or massive fire, the area should be evacuated.</p> <p><b>Special protective equipment to be worn by firefighters:</b></p> <p>Normal equipment for firefighters does not provide adequate protection.</p> <p>Gas-tight protective clothing (Level A Protection) may be required in combination with a positive-pressure self-contained breathing apparatus.</p>

## SECTION 6. MEASURES TO BE TAKEN IN CASE OF SPILL OR ACCIDENTAL LEAKAGE

<b>6.1. Personal precautions, protective equipment and emergency procedure</b>	<p>Evacuate the area. Eliminate all sources of ignition if there is no danger in doing so.</p> <p>Ensure adequate ventilation. Monitor the concentration of the released product. Prevent entry into sewers, basements, work pits or any place where their accumulation could be dangerous. Use self-contained breathing apparatus when entering the area unless it is proven that the atmosphere is safe.</p> <p><b>Spills or emissions:</b></p> <p>Wear self-contained breathing apparatus and encapsulated suit (Level A protection).</p> <p>Restrict access to the area until the emission / spill has been stopped and there is no presence of chlorine gas.</p> <p>Restrict access to the area until the cleaning is completed.</p> <p>Eliminate all sources of ignition (smokers, burners, sparks, flames). Note: All equipment must be grounded.</p> <p>If possible, stop the emission / spill without risk for the personnel.</p> <p><b>Emissions of great magnitude:</b></p> <p>Keep all unauthorized personnel away.</p> <p>Stay in the direction of the wind.</p> <p>Stay away from low-level areas.</p> <p>Avoid people entering drains and confined areas.</p>
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Be sure to use materials that are chemically compatible with chlorine

**6.2. Environmental precautions**

Make sure that the cleaning is done by trained personnel.  
 The water used to eliminate vapors is corrosive and toxic; where possible, it should be prosecuted in a safe manner.  
 Dispose of the waste according to its internal mechanism or according to environmental regulations.  
 A cylinder with emission should never be submerged in a pond with water.

**6.3. Methods and materials for the containment and cleaning of spills or leaks**

**Emission of a cylinder:**

Use the required emergency kit (A for 68 kg cylinders, B for 907 or 850 kg containers and C for tank cars). If possible, move the cylinder to an encapsulated area and have a neutralization system.  
 If practical, reduce the cylinder pressure, evacuating the gas (not liquid) phase to a venting - neutralization system; Discharge at a moderate speed to a container with approximately 15% sodium hydroxide solution or other alkali or reducing solution. When you have discharged all the gas, label the cylinder as defective. If possible, turn the cylinder until it is positioned so that the emission is chlorine gas and not liquid; the amount of emission in the gas phase is approximately 15 times less than in the liquid phase. Move the cylinder out of hot areas.

**Neutralization of Chlorine:**

A safe method to absorb the chlorine leak from a container is to bring it to a previously prepared solution of caustic soda or whitewash. The following table indicates the amounts of solution to absorb the chlorine contained in each case.

Size of the container with chlorine	Caustic soda		Hydrated Lime	
	Kg	Liters of water	Kg	Liters of water
68	85	230	159	570
500	625	1,680	1,120	4,160
907	1,140	3,050	2,040	7,570

**Waste disposal:**

Dispose waste according to current environmental regulations; Do not dispose of them in drainage systems.

## SECTION 7. HANDLING AND STORAGE

**7.1. Precautions to be taken to ensure safe handling**

Storage temperature: Never expose the cylinders in places where the temperature may be higher than 65 ° C.  
 The storage area must be identified, free of obstructions, clean, free of cylinders and bumpers designed for containers.  
 All warehouses must have devices for securing cylinders and bumpers designed for containers.

**7.2. Conditions of safe storage, including any incompatibility**

Never store cylinders and chlorine containers near other chemicals such as ammonia or ammonia compounds, hydrocarbons and animal oils / greases.  
 The containers must not be stored under conditions that may favor the corrosion of the container. Keep away from foodstuffs, beverages and feed. The containers must be checked periodically to ensure correct conditions of use and the absence of leaks. The valve guards must be in place. Store containers in locations free from fire hazard and away from sources of heat and ignition. Keep away from combustible materials. Avoid asphalted areas for storage and use (there is a risk of ignition in case of spillage). Separate flammable gases from other flammable stored materials.

## SECTION 8. EXPOSURE CONTROLS / PERSONAL PROTECTION

**8.1. Control parameters**
**VLE PPT:** Not available in NOM-010-STPS-2014

**VLE CT o P:** 0.5 PPM According to NOM-010-STPS-2014

OSHA has established Permissible Exposure Limits (PEL) (Reference 13.6.6 - 29 CFR 1910.1000 - 1910.1052) to regulate the exposure of employees to numerous chemical products. Similarly, ACGIH has established Threshold Limit Value (TLV) guidelines (Reference 13.2.1) and NIOSH has developed the Recommended Exposure Limits (REL) (Reference 13.10.3). These can be expressed as TWA, STEL, roofs or a combination.

**PHYSIOLOGICAL EFFECTS OF CHLORINE**

Chlorine is a potential irritant for the eyes, skin, mucous membranes and respiratory tract. The main concerns with exposure to chlorine are the respiratory system, followed by the eyes. The impact of exposure to chlorine depends on the concentration and exposure time. The following table summarizes the health effects for humans:

Exposure level (PPM) 1 ppm = 2.90 mg/m <sup>3</sup>	Effects
0.2 – 0.4	Odor threshold (there is a decrease in the perception of smell over time)
< 0.5	No known acute or chronic effect
0.5	TLV – TWA REL - Ceiling
1 - 3	Mild, irritation of the mucous membrane, tolerated up to 1 hour
1 – 15	Moderate irritation of the respiratory tract
3	ERPG-2
10	IDLH
20	ERPG-3
30	Immediate pain in the chest, vomiting, dyspnea, cough Moderate irritation of the respiratory tract
40 – 60	Toxic pneumonitis and pulmonary edema
430	Lethal for 30 minutes
1000	Fatal in a few minutes

**Non-respiratory effects of exposure to chlorine gas.**

Chlorine gas is absorbed in water to form both hypochlorous acid and hydrochloric acid. Chlorine gas can be dissolved in body moisture (ie, perspiration) to form these acids. At 3,500 ppm of chlorine in the air, the pH of the moisture in the skin would be approximately 4. The pH of 4 is comparable to carbonated water. While a burning sensation and skin irritation may occur due to such exposure, a review of the literature has not provided specific information from human data to determine the concentration of chlorine required to produce such effects. As mentioned above, irritation of the eye, when exposed to gaseous chlorine, begins to occur at the 1-3 ppm level.

**Non-respiratory effects of exposure to liquid chlorine.**

Liquid chlorine is a liquefied compressed gas. At atmospheric pressure, liquid chlorine vaporizes at 34 ° C (-29 ° F). In general, chlorine is stored in containers as a liquid at atmospheric or elevated pressures. Liquid chlorine will cause burns to eyes and skin contact, similar to freezing.

**After exposure to chlorine.**

If liquid chlorine comes in contact with the skin or penetrates through clothing, immediately flush the affected area with water for at least 15 minutes. Care should be taken when removing protective clothing after use to avoid inhalation of chlorine from contaminated clothing. Medical attention may be necessary for any exposed personnel (by inhalation or contact with the skin) to liquid or gaseous chlorine.

**8.2. Appropriate technical controls**

Use system of work permits (for example for maintenance activities). Ensure proper air ventilation. Provide adequate general and local exhaust ventilation. Keep concentrations well below exposure limits. Gas detectors should be used when toxic gases can be released. Gas detectors should be used when combustion gases can be released. Avoid atmospheres rich in oxygen (greater than



23.5%). Systems under pressure must be regularly checked for leaks. The product must be used in closed systems and under strictly controlled conditions. Use only permanently leak-free installations (eg welded pipes). Forbidden to eat, drink and smoke while using the product.

**8.3. Individual protection measures, such as personal protective equipment, PPE**

**General protection:**

The risk assessment must be carried out and documented in each work area to assess the risks related to the use of the product and to select the personal protective equipment corresponding to the risk. The following recommendations should be followed. Have a self-contained breathing apparatus for use in an emergency. Personal protective equipment for the body should be selected based on the task to be performed and the risk involved. Protect your eyes, face and skin from contact with the product. Consult local regulations of emissions to the atmosphere. See section 13 for specific methods for treating waste gases.

**Eyes and face protection**

Safety glasses and face shield should be worn to avoid risk of liquid splash exposure. Wear eye protection that meets ANSE Z87.1 requirements for droplet (splash) protection, or EN 166, when using gases. Guide: EN166. Protective glasses.

Not wear contact lenses.

Keep an eye wash fountain and quick wash showers in the work area.

**Hands protection:**

Wear protective gloves against mechanical risks when handling containers. Chemical resistant gloves should be worn whenever chemicals are handled, if the risk assessment indicates this is necessary.

For short-term use.

Material: Chloroprene Rubber

Break through time: > 30 min

Para uso a corto plazo:

Material: Goma de cloropreno.

Tiempo de perforación: > 30 min

Espesor del guante: 0,4 mm

Para uso a largo plazo:

Material: Fluoro elastómero.

Tiempo de perforación: > 480 min

Espesor del guante: 0,7 mm

**Skin protection:**

No particular measure.

Some operations may require the use of a chemical resistant encapsulated full body suit with respiratory protection.

**Resistencia de materiales para la ropa protectora:**

Guidelines for liquid Chlorine

RECOMMENDED (more than eight hours of penetration resistance): Responder (®), Tychem10000 (®), Trelchem VPS(®).

Guideline for gas Chlorine

RECOMMENDED (more than eight hours of penetration resistance): Butyl Rubber, Neoprene, Teflón (®), Viton(®), Saranex(®), Barricade(®), CPF 3(®), Responder(®), Trelchem VPS(®), Tychem 10 000(®).

RECOMMENDED (more than four hours of penetration resistance): Nitrile rubber 4H(®).

NOT RECOMMENDED for use (more than four hours of penetration resistance): Polyethylene, Polyvinyl Chloride.

The recommendations are not valid for very thing natural rubber gloves (0.3 mm or less), neoprene, nitrile and PVC.

The recommendations are valid for permeation rate reaching 0.1 g/cm/min or 1 mg/min or more. Resistance to specific materials may vary from product to product. Breakthrough time are obtained under conditions of continuous contact, generally at room temperature. Evaluate resistance under your conditions of use and keep clothing protected.

**Others:**

Wear safety shoes when handling the containers, according to NOM-113-STPS-2009, Safety personal, protective equipment-protective foot wear- Classification specifications and test methods.

**Breathing protection**

If the risk assessment indicate this is necessary, use a well-fitting, supplied-air or air purifying respirator that meets an approved standard. Respirator selection should be bases on exposure levels. NIOSH Recommendations for Chlorine concentrations in Air.

Up to 5 ppm: Respirator with chemical cartridge for protection against chlorine, or Supplied Air Respirator (SAR).

Up to 10 ppm: Supplied Air operating in continuous flow mode (may require eye protection); o powered air-purifying respirator with a chlorine protection cartridge, a full facepiece respiratory with a chlorine protection chemical cartridge, a gas mask with a chlorine protection filter, or a sel-contained breathing apparatus with a full facepiece (SCBA); Full facepiece SAR.

For emergency or planned entry into areas with unknown concentrations or immediately dangerous to life or health /IPVS or IDHL): A positive pressure full facepiece SCB, or a positive pressure full facepiece SAR with an SCBA auxiliary with positive pressure.

Exhaust: Mouthpiece or cartridge respirator with approved cartridge for chlorine or gas mask with filter for protection against chlorine.

**Thermal hazards:**

There are no preventive measures necessary.

**Hygiene measures**

Ask for special instructions before use. Risk assessment measures are not necessary beyond correct handling in accordance with industrial hygiene and safety procedures. Eating, drinking, and smoking are prohibited while using the product.

**Environmetal exposure controls:**

For information on disposal, see section 13

**SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES**

<b>9.1. Appearance (physical state, color, etc)</b>	:Liquid and Gas Gas color: Green/yellow ; Liquid: clear amber
<b>9.2. Odor</b>	Pungent and irritating
<b>9.3. Odor threshold</b>	0.2 – 0.4 PPM.( varies from person to person)

9.4. Potential Hydrogen, PH	Not available In case of dissolution in water
9.5. Melting Point	-100.98°C (-149.76°F) (172.17 K)
9.6. Boiling Point	-33.97°C (-29.15°F) (239.18 K)
9.7. Flash point	Not applicable
9.8. Evaporation rate	Not applicable to gas a mixes to gases
9.9. Flamability (solid/gas)	Not Flamable gas, Strong Oxidizer
9.10. Upper/lower flammable limit or explosion limint	Upper limit: Not applicable Lower limit: Not applicable
9.11. Vapor pressure	777.2556 kPa (25 °C)
9.12. Vapor density (air=1)	2.5
9.13. Relative vapor density	Not available
9.14. Solubility	Solubility water: 5.1 g/l (30 °C)
9.15. Partition coefficient n-octano/water	Not available
9.16. Auto-ignation temperature	Not applicable
9.17. Decomposition temperature	Not available
9.18. Viscosity	Not available
9.19. Molecular Weight	Molecular Weight: 70.906 g/mol (Cl <sub>2</sub> )Atomic Weight: 35.453 g/mol
9.20. Other relevant data	Atomic number: 17 Critical temperature: 143.75°C (290.75°F) (416.90 K) Critical pressure: 7977 kPa (78.73 atm.) (1157 PSIA) Critical Density: 573. kg/m <sup>3</sup> (35.8 lb/ft <sup>3</sup> ) Critical volume: 1.745 x 10 <sup>-3</sup> m <sup>3</sup> /kg (0.02796 ft <sup>3</sup> /lb) Explosive properties: Not applicable Oxidizer properties: Strong Oxidizer Other information: The chlorine gas is heavier that air. Will settle and concentrate in low places and inside of buildings.

**SECTION 10. STABILITY AND REACTIVITY**

10.1. Reactivity	The chlorine is very reactive with a lot of substances because is strong oxidizer
10.2. Chemical stability	Stable in normal conditions
10.3. Possibility of hazardous reactions	Oxidizer violently with organics chemicals. Reacts violently with many combustible. May cause reacts violently with reducing agent. The Liquis Chlorine may cause reactions violently explosive or flammable in contact with: Carbon disulfide, Iron, Bismuth, Dibutyl, phthalate, Mold wax, Gasoline, Glycerol, Lysine oil, White phosphorus, polydimethylsiloxane, Silicon, Sodium hydroxide, Titanium, Vanadium powder.
10.4. Conditions to avoid	Avoid to moisture in the container and temperature more than 121 °C
10.5. Hazardous decomposition products	Humidity. Combustible materials. Reducing agents. Keep the equipment free of oil and grease. In the event of combustion be aware of the potential toxicity hazard due to the presence of chlorinated or fluorinated polymers in high pressure oxygen lines (30 bar). Chlorine gas can react explosively with: Alcohols, Ammonia and its compounds, Hydrocarbon gases (Acetulene and Ethylene), Hydrogen, Antimony Trchloride and tetramethylsilane, ethyleneimine, bromine pentafluoride, Bioxygen bifluoride, Oxygen bifluoride, fluorine, Diborane, Bichloro, (methyl) arsine, Disilane oxide, Ethylphosphine strong reducing agents, Aqueous sulfamic acid, stibine, synthetic rubber, Tetraselenium tetraniride, White phosphorus, Mono and di-alkali metal acetylide, Cooper acetylide, Halocarbons (dichloromethane. Metals (fine powder of aluminum, brass foil, cooper foil, iron, potassium, sodium, titanium , Nonmetallic (boron, activated carbon, phosphorus, silicon), Iron,

Uranium and Zirconium carbides, Diethyl ether, Zinc diethyl, metallic and nonmetallic hybrids, phosphorus compounds, sulfides, tellurium, trialkyl, borans, tungsten dioxide.

**10.6. Hazardous decomposition products**

Under normal conditions of usage and storage, decomposition should not occur in hazardous products.  
The chlorine reacts with water produces corrosive solution hydrochloric acid and hypochlorous acid which oxygen and chloric acid.

**SECTION 11. TOXICOLOGICAL INFORMATION**

**11.1. Information about probable income routes**

The most likely routes of entry are through the respiratory system and skin contact.

**11.2. Symptoms related to physical, chemical and toxicological characteristics**

Chlorine gas primarily a respiratory irritant. At low concentrations, chlorine gas has a odor similar to household bleach. As the concentration increase from the level of detection by smell, so do the symptoms in the exposed individual.  
Chlorine gas in concentrations above 5 ppm is very irritating and a person is unlikely to remain in such exposure for more than a very short time unless the person is trapped or unconscious. If symptoms persist for more than a few hours, the effect of chlorine exposure can become more severe for several days after the incident. In such cases, the observation of exposed individuals should be part of medical response.

**11.3. Immediate and delayed effects, as well as chronic effects produced by a short or long term exposure**

The following list is a compilation of potential chlorine exposure thresholds and potential responses in humans, with considerable variation among subjects:

- 0.2 - 0.4 ppm – Odor threshold (decrease in odor perception occurs over time)
- 1 - 3 ppm – Mild mucous membrane irritation, tolerated up to 1 hour.
- 5 - 15 ppm – Moderate irritation of the respiratory tract.
- 30 ppm – Immediate chest pain, vomiting, dyspnea (shortness of breath) and cough.
- 40 - 60 ppm – Toxic pneumonitis and pulmonary edema
- 430 ppm – Lethal over 30 minutes
- 1000 ppm – Fatal within minutes.

**11.4. Numerical measures of toxicity (such as estimates of acute toxicity)**

**Acute toxicity**

**Respiratory / Cardiovascular**  
The toxic effects of chlorine are due to its corrosive properties. Chlorine is primarily removed by the upper airways. Exposure to low concentrations of chlorine gas may cause irritation to nose, respiratory tract, and eyes (burning, discomfort, blinking, redness, conjunctivitis and tearing). As concentrations increase, so does the irritating effect on the upper and lower respiratory tract, manifested as coughing with eventual difficulty breathing. Inhalation of chlorine gas at greater than 15 ppm may lead to airway constriction and accumulation of fluid in the lungs (pulmonary edema). As duration of exposure and/or concentration increase, the affected individual may develop rapid, breathing, wheezing and hemoptysis (blood in spit). In extreme cases, difficulty in breathing can progress to the point of death through cardiovascular collapse from respiratory failure. An exposed person with a preexisting respiratory condition can have an exaggerated response.  
Cases of reactive Airway Dysfunction Syndrome (RADS), a type of asthma induced by chemical irritant, have been reported.

**Dermic**  
Contact of liquid chlorine with skin will result in serious thermal and chemical burns. (Frostbite). Gas Chlorine in contact with skin can dissolve in body moisture to form hypochlorous acids. At 3.5 PPM of chlorine in air, the PH of moisture in the skin would be about 4 a pH is comparable to carbonated water. Although a burning sensation and skin, irritation may occur from such exposure. A review of the literature has not provided specific human data to demine the concentration of chlorine required to

produce such effects

**Eyes**

Low concentrations of chlorine in the air can cause eye irritation, burning discomfort. Spasmodic blinking, redness, conjunctivitis and tearing. Exposure to higher concentrations of chlorine gas cause injury that is more serious. Liquid chlorine in contact with the eyes will cause severe thermal and/or chemical burns.

**Chronic Toxicity**

Most studies indicate no significant connection between adverse health effect and chronic exposure to low concentrations of chlorine. However, a 1983 finish study (Grenquist-Norden, B Institute of Occupational Health, pp1-863, 1983) did show an increase in chronic coughs and a tendency for hypersecretion of mucous among worker. These workers showed no abnormal pulmonary function in test or chest x-rays.

There have been indirect references in the literature (for example, in some Safety, Data Sheets) that chronic exposure to chlorine can cause tooth corrosion.

In December 1993, The Chemical Industry Toxicology Institute published its report on chronic in rats (9.2.2). Rats and mice were exposed o chlorine gas at 0.4, 1.0 o 2.5 PPM for six hours per day and three to five days a week for up to two years. There was no evidence of cancer. Exposure to chlorine at all levels produced nasal lesions. Because rodents are mandatory nasal breathers, it is unclear how these results must be interpreted.

<b>11.5. Interactive effects</b>	No available
<b>11.6. When specific chemical data are not availabel</b>	Not applicable
<b>11.7. Mixtures</b>	Not applicable
<b>11.8. Information about the mixture or its components</b>	Not applicable
<b>11.9. Other information</b>	<p>LC<sub>50</sub> (Rat, 4 h): 146.5 ppm Remarks: Possible pulmonary edema with fatal outcome.</p> <p>Skin Corrosion/Irritation. Causes skin irritation.</p> <p>In vivo (Guinea pig; Rabbit): Slightly irritating Severely irritating to the skin. In vivo (Guinea pig; Rabbit): Slightly irritating</p> <p>Serious Eye Damage/Eye Irritation. Cause serious eye irritating to the eyes.</p> <p>Germ Cell Mutagenicity. Based on available data, the criteria are not in classification.</p> <p>Carcinogenicity. Based on available data, the criteria are not in classification.</p> <p>Reproductive toxicity. Based on available data, the criteria are not in classification.</p> <p>Target Organ Specific Systemic Toxicity-Single Exposure. Based on available data ,the criteria are not in classification. Severe respiratory tract corrosion in high concentrations.</p> <p>Target organ Specific Systemic toxicity-Repeated Exposure. In view of the data available, classification criteria not met.</p>

**SECTION 12. ECOTOXICOLOGICAL INFORMATION**

**12.1. Toxicity**

**General Information.**

Don't release it into the environment. The discharge of the product into groundwater or the aquatic environment is not allowed.

Vegetation. Causes spots in the plant leaves due to the action on chlorophyll

**Acute toxicity**

Very toxic for aquatic organisms

Acute Toxicity - Fish  
 LC50 (Pez, 96 h): 0.032 mg/l

Acute Toxicity – Acuatic Invertebrates  
 LC50 (Water flea (Daphnia magna), 48 h): 0.15 mg/l (Static) Observations:Mortality

Toxicity to microorganisms  
 LC50 (Scenedesmus subspicatus., 72 h): 0,001 mg/l

Additional ecological information:  
 None

**12.2. Persistence and degradability**

Inorgánico. The chlorine is non biodegradable

**12.3. Bioaccumulation potential**

The substance hasn't potential bioaccumulation

**12.4. Mobility in the soil**

The substance has low mobility in the soil.

**12.5. Other adverse effects**

May cause PH changes in aquatic ecological systems. Depending on local conditions and existing concentrations alterations in the biodegradation process are possible.

**SECTION 13. DISPOSAL CONSIDERATIONS**

**13.1. Description of waste and information on how to handle it safely and its disposal methods, including disposal of containers Contaminated**







**General information:**

This material should not be discharge into the atmosphere. Consult the supplier for specific recommendations.

Disposal methods: Consult the EIGA code of good practice (Doc.30 "Gas Disposal", downloadable at <http://www.eiga.org>) for further guidance on proper disposal methods.  
 Disposal of the container only through the supplier. Discharge, treatment, or disposal activities may be subject to national, state, or local laws.



**SECTION 14. TRANSPORT INFORMATION**

<b>14.1. UN Number</b>	UN 1017				
<b>14.2. UN proper shipping name</b>	Chlorine				
<b>14.3. Transport hazard class(es)</b>	Class: 2 Division:3 secondary hazard: 8, 5.1				
	<table border="0"> <tr> <td style="text-align: center;"><b>Primary hazard label</b></td> <td style="text-align: center;"><b>Secondary hazard label</b></td> </tr> <tr> <td style="text-align: center;">  </td> <td style="text-align: center;">  </td> </tr> </table>	<b>Primary hazard label</b>	<b>Secondary hazard label</b>		
<b>Primary hazard label</b>	<b>Secondary hazard label</b>				
					
<b>14.4. Packing group</b>	does not apply				
<b>14.5. Environmental hazards</b>	Environmentally Hazardous Substances				
<b>14.6. Special precautions for user</b>	Air transport of passengers and goods is prohibited.  Avoid transport in vehicles where the cargo space is not separated from the driver's compartment. Ensure that the driver is aware of the potential hazards of the load and that he knows what to do in the event of an accident or emergency. Secure the gas container before transportation. Make sure the cylinder valves are closed and do not leak. The valve guards must be in place. Ensure proper air ventilation.				
<b>14.7. Transport in bulk according to Annex II of MARPOL (International Convention for the Prevention of Pollution From Ships, 1973) 73/78 and the IBC Code (IBC Intermediate Bulk Container)</b>	Does not apply				

**SECTION 15. REGULATORY INFORMATION**

<b>15.1. Specific provisions on safety, health and environment for the dangerous chemical substances or mixture in question.</b>	<p>First List of Highly Risk Activities - PROFEPA.</p> <p>A Highly Risk Activity is considered to be any activity such as production, processing, transport, storage, use or final disposal, when volumes equal to or greater than 1 kg of chlorine are handled.</p> <p>NOM-028-STPS-2012, System for work administration - Safety in critical processes and equipment that handle dangerous chemical substances.</p> <p>Threshold quantity: 700 kg</p> <p>Threshold quantity: The value equal to or greater in mass (kg) of the established dangerous chemical, regardless of its physical state, whose uncontrolled release, due to natural causes or those derived from human activity, may cause a major accident.</p>
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## SECTION 16. OTHER INFORMATION INCLUDING THAT RELATING TO THE PREPARATION AND UPDATING OF SAFETY DATA SHEETS

16.1. The information is believe to be correct, but is not exhaustive and is to be use for guidance only, which is based on current knowledge of the chemical or mixture and is applicable to the appropriate safety precautions for the product.

Before using the product in a new process or experiment, a complete safety and material compatibility study should be carried out. Ensure proper air ventilation. Make sure national and local regulations are followed. Although special care has been taken in preparing this document, no liability is accepted for injury or damage.

This information should be used to make an independent determination of methods to protect workers and the environment.

### NFPA Risk

Health: **4**

Flamability: **0**

Reactivity: **0**

Special: **OX**

### 16.2. Abbreviations and acronyms

**OSHA:** Occupational Safety and Health Administration

**ACGIH:** American Conference of Governmental Hygienists

**TLV:** Threshold Limit Value

**VLE PPT:** Exposure Limit Value, Weighted Average in Time

**VLE CT o P:** Exposure Limit Value, Short Time or Peak

**NIOSH:** National Institute for Occupational Safety and Health

**TWA:** Time Weighted Average

**STEL:** Short Term Exposure Limit

**REL – Ceiling:** Recommended Exposure Limit -

**ERPG-1:** The maximum concentration in the air below which it is believed that almost all individuals could be exposed for up to one hour without experiencing more than mild transient adverse health effects or without perceiving a clearly defined and objectionable health condition.

**ERPG-2:** The maximum concentration in the air below which it is believed that almost all individuals could be exposed for up to one hour without experiencing or developing irreversible effects or other serious health effects or symptoms that could affect an individual's ability to take protection measures.

**ERPG-3:** The maximum concentration in the air below which it is believed that almost all people could be exposed for up to an hour without experiencing or developing a life threatening health effects.

### 16.3. References

**PAMPHLET 65 of the Chlorine institute,** Personal Protective Equipment for Chlor-Alkali Chemicals. 5<sup>a</sup> Edition.

**NOM-010-STPS-2014,** Chemical agents polluting the work environment recognition, evaluation and control.

**PAMPHLET 72 of the Chlorine institute,** Chlorine properties. 3<sup>a</sup> Edition

**PAMPHLET 63 of the Chlorine institute,** First Aid, Medical Management / Medical Evaluation and Occupational Hygiene Monitoring Practices for Chlorine, 8<sup>a</sup> Edition.