



SAFETY DATA SHEET

Prepared in accordance with Commission Regulation (EU) 830/2015 amending Regulation 1907/2006, REACH

CHLORINE - Liquefied gas

Revision: 5 Last up date: 10.10.2017 Date issued: November 15, 2010 pag.1/33

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Trade name	CHLORINE -Liquefied Gas
IUPAC name	CHLORINE
Synonym	-
EC no.	231-959-5
CAS no.	7782-50-5
Nr. Index	017-001-00-7
Molecular formula	Cl ₂
Masa moleculara	70,914
REACH Registration number	01-2119457892-27-0065
Chemical characterization	Inorganic mono constituent substance
Biocide Notice number issued by Romanian Authority	1926BIO/02-05/12.24

1.2. Relevant identified uses of the substance or mixture and uses advised against

Chlorine is used in a number of industrial applications. Its largest use is as a raw material in the production of ethylene dichloride, an intermediate for vinyl chloride monomer and polyvinyl chloride (PVC) resins. Chlorine is also used in the paper industry to bleach pulp, in the production of chlorinated solvents and chlorofluorocarbons (CFCs), as a disinfectant or fungicide for a variety of purposes, including water purification, cooling systems, meat, fish, vegetable, and fruit processing, foot baths, dairy equipment, laundries, and dishwater, as well as for shrink-proofing wool, in special batteries (with lithium or zinc), and in the manufacture of propylene oxide and pesticides.

Table 1: Identified uses

Identified Use	Process Category (PROC)	Sector Of Use (SU)	Environmental release categories (ERC)
Use 1: Manufacturing of chlorine	PROC 1 Use in closed process, no likelihood of exposure PROC 2	SU 8 Manufacture of bulk, large scale chemicals	ERC 1 Manufacture of substances ERC2

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Identified Use	Process Category (PROC)	Sector Of Use (SU)	Environmental release categories (ERC)
	Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC 3 Use in closed batch process (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)	SU10 Formulation of preparations and/or repackaging	Formulation of preparations
Use 2: Industrial use of chlorine: end uses of substance as such or preparations at industrial sites	PROC 1 Use in closed process, no likelihood of exposure PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling) PROC 3 Use in closed batch process (synthesis or formulation) PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises PROC 5 Mixing or blending in batch process for formulation of preparations and articles (multistage and/or significant contact) PROC 8a	SU5 Manufacture of textiles, leather, fur SU6b Manufacture of pulp, paper and paper products SU8 Manufacture of bulk, large scale chemicals SU9 Manufacture of fine chemicals SU13 Manufacture of non-metallic	ERC 1 Manufacture of substances ERC 4 Industrial use of processing aids ERC 6b Industrial use of reactive processing aids



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Identified Use	Process Category (PROC)	Sector Of Use (SU)	Environmental release categories (ERC)
	Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing) PROC 13 Treatment of articles by dipping and pouring PROC 14 Production of preparations or articles by tableting, compression, extrusion, pelletisation	mineral products SU14 Manufacture of basic metals SU16 Manufacture of computer, electronic and optical products	

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Uses advise against: There are no uses advised against.

Recommended intended purpose(s)

Biocidal product.



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1.3. Details of the supplier of the safety data sheet

Name	S.C. OLTCHIM S.A
Address	1 Uzinei Street, 240050 Ramnicu Valcea, Romania
Phone N°	+40 250 701 200
FAX N°	+40 250 735 030
E-mail of competent person responsible for SDS in the MS or in the EU:	tehnic@oltchim.com

1.4. Emergency telephone number

European Emergency N°:	112
Emergency telephone at the company:	+40/250/738141- available 24h/day/365days
For Romania- The institution responsible with providing information in case of a health emergency is The National Institute for Public Health, Department for the International Sanitary Regulation and Toxicological Information.	Telephone: 021.318.36.06, Working hours: Monday - Friday from 8 a.m. to 3 p.m

2. HAZARDS IDENTIFICATION

2.1. Classification of the substance according to Regulation (EC) 1272/2008, Annex VI

Oxid. Gas 1 H270
Compressed gas note U*
Acute Tox. 3 H331
Skin Irrit. 2 H315
Eye Irrit. 2 H319
STOT Single Exp. 3 H335
Aquatic Acute 1 H400
Key word: Danger M100

Note U: is assigned in relation to the classification of chlorine as a Pressurised Gas. The Note was introduced with the CLP Regulation and is used in Table 3.1 of Annex VI. The note reads as follows:

"When put on the market, gases have to be classified as 'Gases under pressure', in one of the



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groups compressed gas, liquefied gas, refrigerated liquefied gas or dissolved gas. The group depends on the physical state in which the gas is packaged and therefore has to be assigned case by case."

2.1.1 Additional information

Chlorine is a greenish yellow gas (or amber liquid) with an irritating odor. High concentration of chlorine gas may cause an oxygen-deficit atmosphere. Chlorine is an oxidizer, which can act to initiate and sustain the combustion of flammable materials. Chlorine is heavier than air and pockets of this gas can accumulate in low-lying areas.

Chlorine is irritating to nose, throat, skin and eyes.also tearing, coughing and chest pain. Higher levels burn the lungs and can cause a build up of fluid in the lungs (pulmonary edema) and death. Contact can severely burn the eyes and skin. Repeated exposures or a single high exposure may permanently damage the lungs. It can also damage the teeth and causes a skin rash.

2.2. Label elements

2.2.1. Labeling according to Regulation (EC) 1272/2008	
Signal word	Danger
Hazard pictograms	
GHS03: flame over circle	
GHS04: gas cylinder	
GHS06: skull and crossbones	
GHS09: environment	
HAZARD STATEMENTS	
	H270: May cause or intensify fire; oxidiser. H315: Causes skin irritation.



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	H319: Causes serious eye irritation. H331: Toxic if inhaled. H335: May cause respiratory irritation. H400: Very toxic to aquatic life. M -FACTOR =100
PRECAUTIONARY STATEMENTS	
Precautionary Statement Prevention	P220: Keep/Store away from clothing/.../combustible materials. P261: Avoid breathing dust/fume/gas/mist/vapours/spray. P280: Wear protective gloves/protective clothing/eye protection/face protection. P273: Avoid release to the environment.
Response Precautionary Statement	P370+P376: In case of fire: Stop leak if safe to do so P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P391: Collect spillage.
Storage Precautionary Statement	P410+P403: Protect from sunlight. Store in a well-ventilated place. P 405: Store locked up.
Notes	Note U

2.3. Other hazards

The substance does not meet the criteria for PBT or vPvB substance.
No other hazards identified.

3. COMPOSITION/ INFORMATION ON INGREDIENTS

Chemical name	Index no.	CAS no	EINECS no (EC no.)	REACH	Concentration (%)
Chlorine	017-001-00-7	7782-50-5	231-959-5	01-2119457892-27-0065	>99.5

Impurities

No impurities relevant for classification and labelling.



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4. FIRST - AID MEASURES

General Advice: IF exposed or if you feel unwell: Call a Poison Center or doctor/physician. Show this safety data sheet to the doctor in attendance.

In case of frostbite place the frostbitten part in warm water. Do not use the hot water! If warm water is not available wrap the affected parts gently in blankets. Encourage victim to gently exercise the affected part while being warmed. Seek immediate medical attention.

If inhaled: Remove victim(s) to fresh air, as quickly as possible. If breathing was stopped, trained personnel should administer supplemental oxygen and/or artificial respiration. Keep the affected person warm at rest. In mild cases, give milk to relieve throat irritation. Get medical attention as soon as possible.

In case of skin contact: If liquid chlorine or high concentrations of chlorine gas gets on the skin, immediately flush the contaminated skin with water for at least 15 minutes. If liquid chlorine or high concentration of chlorine gas penetrates through the clothing, remove clothing under a safety shower and continue to wash the skin for at least 15 minutes. If irritation is present after washing, get medical attention. Do not apply greases unless ordered by a physician.

In case of eye contact: If liquid chlorine or high concentrations of chlorine gas get into the eyes, flush eyes immediately with a direct stream of water for at least 15 minutes, forcibly holding eyelids apart to ensure complete irrigation of all eye and lid tissue. Do not attempt chemical neutralization of any kind. Get medical attention immediately. Contact lenses should not be worn when working with chlorine.

NOTE: Do not use anything other than clean fresh water, or sterile saline on the eye.

In case of ingestion: Ingestion is not considered a potential route of exposure. Never give anything by mouth to an unconscious person. If swallowed do not induce vomiting. Give large quantities of water. If vomiting occurs spontaneously, keep air way clear and give more water. Get medical attention immediately.

4.2. Most important symptoms and effects, both acute and delayed

Toxic and irritating. Inhalation is the major potential route of exposure. Exposure to chlorine gas may cause severe irritation of mucous membranes of the nose, throat and respiratory tract followed by severe coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation. Severe breathing difficulties may occur which may be delayed in onset. Severe exposure may lead



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to chemical pneumonitis and pulmonary edema and may be fatal. Repeated or prolonged exposure may result in reduced pulmonary capacity and dental erosion.

Skin contact with liquid chlorine may cause serious burns, blistering and tissue destruction. Chlorine vapors can cause irritation, burning and blisters. Contact with rapidly expanding gas poses a frostbite hazard.

4.3 Indication of immediate medical attention and special treatment needed

No known antidote. Treatment for inhalation is symptomatic and supportive. Keep patient at rest until respiratory symptoms subside. Sedation for apprehension or restlessness may be considered as well as diuretics and antibiotics to alleviate edema and protect against secondary infection. Administer oxygen under exhalation pressure not exceeding 4 cm water for 15 minutes each hour until symptoms subside (except in presence of impeding or existing cardiovascular failure). Steroid therapy, if given early, has been reported effective in preventing pulmonary edema.

Toxic and irritating. Exposure to chlorine gas may cause severe irritation of mucous membranes of the nose, throat and respiratory tract followed by severe coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation.

Contact with liquid chlorine may cause serious burns, blistering and tissue destruction.

May cause severe chemical burns to cornea.

5. FIRE - FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media: Water spray, fog or foam. Large fire: flood with fine water spray. Use water to keep fire - exposed containers cool and continue until well after fire is out.

Unsuitable extinguishing media: Do not use carbon dioxide or halogenated extinguishing agents.

5.2 Special hazards arising from the substance or mixture

Specific hazards during fire fighting / Specific hazards arising from the chemical

Exposure hazards: Although non-flammable, chlorine is a strong oxidizer and will support the burning of most combustible materials. Flammable gases and vapors can form explosion mixtures with chlorine. Moist chlorine can react violently when in contact with many materials and generate heat with possible flammable and explosive vapor. Chlorine gas is heavier than air and will collect in low-lying areas. Wet chlorine is very corrosive.

Hazardous combustion products: None, but combustible materials burn in chlorine as they do in oxygen.



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5.3 Advice for firefighters

Special protective equipment for fire-fighters: Fire-fighters must use self-contained breathing apparatus operated in positive pressure mode, eye protection and full protective clothing when fighting fire in which chlorine is involved.

6. ACCIDENTAL RELEASE MEASURES

6.1 . Personal precautions, protective equipment and emergency procedures

Personal precaution: Restrict access to the area until completion of the clean-up. Keep unnecessary and unprotected personnel away from entering. Issue a warning: Poison Gas, Do not touch spilled Liquide.

Wear self-contained breathing apparatus and full protective equipment. Use general or local ventilation to keep the noxes in the requirements limits. Minimum Personal Protective Equipment should be Level A: *triple gloves (rubber gloves and nitrile gloves, over latex gloves), fully-encapsulating chemical resistant suit and boots, hard-hat, and self contained breathing apparatus.*

Warning! Direct contact of liquid chlorine with any personal protective equipment item can rapidly destroy the equipment, leading to injury and death.

6.2. Environmental precautions

Isolate area until gas has dispersed. Uncontrollable leaks may require evacuation of surrounding area. Keep material out off water courses and sewers. Use water spray to reduce vapor but do not apply water to point leak or spill area. Use general or local exhaust ventilation. Keep combustibles (such as wood, paper, oil) away from spilled material.

6.3 Methods and materials for containment and cleaning up

Methods for cleaning up / Methods for containment:

If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air and repair the leak or allow the cylinder to empty through a reducing agent such as caustic soda, soda ash, or hydrated lime solutions. Chlorine gas will disperse to the atmosphere leaving no residue. One volume of liquid chlorine released from a container at ambient temperature and pressure will dissipate into approximately 500 volumes of gaseous chlorine.

Therefore, if a chlorine container is leaking, if possible, try to position it so that gas, rather than liquid leaks out. Chlorine vapours are heavier than air, and pockets of chlorine are likely to be trapped in low lying areas.

Use water fog to dampen a chlorine cloud and reduce vapours. Do not spray water directly on the leak or chlorine container.



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Liquid or solid residues must be disposed of in a permitted waste management facility. Dispose according to all applicable federal, state, or local environmental regulations.

6.4 Reference to other sections

Additional advice: Refer to section 8, 13.

7. HANDLING AND STORAGE

7.1. Precautions for safe handling

Protective measures: Special attention is required when chlorine containers are handled. Use only in well ventilated areas. Do not drag, slide or roll cylinders. Use a suitable hand truck for cylinders movement. Protect cylinders and containers from physical damage. Keep containers tightly closed when not in use. For handling chlorine is necessary specially trained, assigned personnel with approved equipment and clothing. Chlorine emergency equipment should be available near the point of use.

Advice on general occupational hygiene: Avoid inhalation of the chlorine gas or contact of skin /eyes with liquefied gas. General occupational hygiene measures are required to ensure safe handling of the substance. These measures involve good personal and housekeeping practices (i.e. regular cleaning with suitable cleaning devices), no drinking, eating and smoking at the workplace. Shower and change clothes at end of work shift. Do not wear contaminated clothing at home.

7.2. Conditions for safe storage, including any incompatibilities

Store chlorine containers and cylinders in cool, dry, well ventilated areas of non-combustible construction away heavily trafficked areas and emergency exit. Do not allow temperature where cylinders are stored to exceed 45°C. Cylinders should be stored upright and firmly secured to prevent falling or being knocked over. *Full and empty cylinders should be segregated.* Full cylinders should not be stored for more than six months. Liquid levels should be less than 85 % of container or cylinder capacity. Use only compatible materials for cylinder, process maintenance activity. Chrome and aluminum are not suitable materials for chlorine cylinders manufacture. Periodic inspections of process equipment by knowledgeable persons should be made to ensure that the equipment is used appropriately and the system is kept in suitable operating condition.

Incompatibles: store chlorine away from finely divided aluminium, brass, copper, manganese, tin, steel and iron, which can react vigorously and violently with chlorine. Nitrogen compounds (ammonia, ammonium compounds and urea) react with chlorine to form highly explosive nitrogen chloride. Phosphorus, boron, activated carbon and silicon can ignite on contact with gaseous chlorine at room temperature. Chlorine is highly corrosive to most metals in the presence of



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moisture – copper may burn spontaneously. Chlorine will react with most metals at elevated temperatures.

7.3. Special precautions for handling:

Regularly test and inspect piping and containment used for chlorine service.

Loading and unloading operations must be attended, at all times. Valves and hoses must be verified to be in the correct positions, before starting the transfer operations. Valve protection caps must remain in place unless container is secured with valve outlet piped to use point. Use a pressure reducing regulator when connecting cylinder to lower pressure (<250 psig) piping or system. Do not heat cylinder by any means to increase rate of product from the cylinder. Use a check valve or trap in the discharge line to prevent hazardous back flow into cylinder. Regulators or manual control valves for chlorine are designed to accommodate only specifically matched cylinder outlets and will not fit the outlets of incompatible gases. The use of adaptor defeats this built in safety measure.

Incompatible materials: Finely divided metals, polypropylene, silicone, some forms of plastic, rubber, and combustible materials.

Materials used for storage tanks: Carbon steel, stainless steel, copper, monel.

7.3 Specific end use(s)

Please check the identified uses from Section 1.2.

For more information please see the relevant exposure scenario, available via your supplier/given in the Annex I.

Recommendation(s) for intended use

Use as biocidal product in accordance with regulation EU 528/2012 and national biocides regulation.

Registered uses: Disinfectants and algaecides not intended for direct application to humans or animals (PT2).

Disinfection of bathing and drinking water (PT5).

[Reference to the EuroChlor website www.EuroChlor.org]

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

8.1 Control parameters

Occupational Exposure Limit (OEL), 8 h TWA: -

Short-term exposure limit (STEL), 15 min: 0.5 ppm (1.5 mg/m³)

ACGIH TLV (threshold limit value) 0.5 ppm



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8.1.2 DNEL values

DNEL acute, short term- inhalation = 1.5 mg/m³ (local and systemic effects)

DNEL long term-inhalation = 0.75 mg/m³ (local and systemic effects)

PNEC fresh water: 0,21 µg/l
 Marine water: 0,042 µg/l
 Intermittent evacuations : 0.26 µg/l

8.2. Exposure control

Engineering control: A system of local and / or general exhaust is recommended to keep employee exposure as low as possible. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source preventing dispersion of it into the general work area. Use enclosed, isolated processing and handling whenever possible.

8.2.2. Personal Protection Equipment

Eye / Face protection: If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles and/ or face shield. Contact lenses must not be worn when working around chlorine.

Warning! Direct contact of liquid chlorine on any personal protective equipment item can rapidly destroy the equipment, leading to injury and death.

Skin protection: Employees should be required to use impermeable body equipment to prevent any possibility of skin contact with liquid chlorine and to prevent the skin from becoming frozen from contact with vessels containing liquid chlorine. The suitable materials for body equipment are: Viton, butyl rubber, Teflon, chlorinated polyethylene.

Hand protection: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Inspect gloves prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. The selected protective gloves have to satisfy the specifications of the standard EN 374 derived from it.

Recommended material for gloves: Neoprene, fluorinated rubber.

Not recommended material: PVC, polyethylene

Above recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Respiratory protection: Minimum respiratory protection required with a gas concentration above



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Other information

Melting point	-101°C
Autoignition temperature	NA
Critical temperature (for gas)	144 °C
Critical pressure (for gas)	77 bar

10. STABILITY AND REACTIVITY

10.1. Reactivity: Chlorine is stable under recommended condition of storage

10.2. Chemical stability: It is not corrosive at normal temperature and moisture absence; may attack iron and stainless steel at high temperature and moisture.

10.3 Possibility of hazardous reactions: Chlorine is a powerful oxidizing agent which reacts violently with a variety of substances over a broad range of conditions including reducing agents and combustible materials. Contact of chlorine with finely divided aluminium, brass, copper, manganese, tin, steel and iron lead to vigorously and violenty reaction. Nitrogen compounds (ammonia, ammonium compounds and urea) react with chlorine to form highly explosive nitrogen chloride.

10.4 Conditions to avoid: Heat, moisture and incompatible substances.

10.5 Incompatible materials: Finely divided aluminium, brass, copper, manganese, tin, steel and iron, combustible materials, nitrogen compounds, acetylene, other hydrocarbons, ammonia, hydrogen, ethers, sulfur.

10.6 Hazardous decomposition products: Chlorine does not decompose but reacts violently to form hydrochloric acid and other potentially toxic and/ or corrosive substances. Dry chlorine is stable in steel containers at room temperature. Intense local heat on steel walls can cause the steel to react and glow in presence of chlorine.

11. INFORMAȚII TOXICOLOGICE

	Concluzii
Absorbtion	No bioaccumulation potential based on study results
Acute toxicity	
Oral	Oral exposure it is not relevant because chlorine is gas at room temperature. However it was realized a study in order



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Inhalation	<p>to determinate the oral toxicity, using sodium hypochlorite with 12% available chlorine. <i>LD 50, rat (male):</i> 1100 mg/kg bw NaOCl as available Cl₂</p> <p><i>LC 50, rat:</i> 0,65 mg/m³ air <i>NOAEL (15 min):</i> > 1330 ppm (male) (based on histopathological examinations 45 days after treatment) <i>LOAEL (67 min):</i> 234 ppm/h (C57BL/6 mice (based on motality only)) Chlorine is clasiffied as Acute Tox. Categ. 2 Inhalation is the major potential route of exposure. Exposure to chlorine gas may cause severe irritation of mucous membranes of the nose, throat and respiratory tract followed by severe coughing, burning, chest pain, vomiting, headache, anxiety and feeling of suffocation.</p>
Dermal	<p><i>LD50, rabbit</i> > 20 g/kg bw Chlorine is gas at room temperature LD50 dermal was obtained using sodium hypochlorite as test material.</p>
Other routs : intraperitoneal	<p><i>LD, soarece:</i>240- 250 mg/kg bw (using NaOCl as chlorine source)</p>
Irritation/Corrosion	<p>Skin irritation / corrosion: irritating Eye irritation: irritating Respiratory irritation: irritating Corrosion: Based on a large dataset of animal and human data on skin and eye irritation/corrosion studies and human occupational data, chlorine is not classified as corrosive.</p>



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Sensitisation	Skin sensitisation: not sensitising Respiratory sensitisation: not sensitising.
Repeated dose toxicity	
Oral	Based on the results obtained in the key study the NOEL was determined to be: NoAEL (oral, rat): 50 mg/kg bw/day.
Inhalation	No systemic effects were observed in repeated dose exposure studies in rats, mice and monkeys with chlorine gas. Additionally, chlorine was discussed by SCOEL and an OEL of 0.5 ppm (1.5 mg/m ³) was agreed based on these studies, with removal of the 8-hour TWA.
Dermal	<i>NoAEC (inhalation, rat): 1,5 mg/m³</i> Active chlorine will not pass the skin and will not be transported via the blood to become systemically available; therefore no systemic toxicity is expected after dermal exposure to hypochlorite. Based on the results obtained in the repeated dose toxicity studies and taking into account the provisions laid down in Council Directive 67/548/EEC and Regulation No (EC) 1272/2008 (GHS, CLP), chlorine does not have to be classified with respect to repeated dose oral, dermal or inhalation toxicity, respectively. Also no specific target organ toxicity was detected by the available studies.
Toxicokinetics	Chlorine reacts at the site of contact where its primary activity is destruction of organic molecules present. It will therefore not be absorbed into the bloodstream. Although only moderately soluble in the epithelial lining fluid, its fast reaction to surface material and tissue of the respiratory tract causes it to be a potential toxic gas. However, available data indicate that in both humans and rodents at low concentrations (below 2.5 ppm, 7.5 mg/m ³) almost all chlorine is absorbed in the upper airways and does not reach the lower airways. Dermal exposure it is not considered a semnificative route of exposure.
Mutagenity -In vito and in vivo	Both the in vitro and the in vivo genetic toxicity tests



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studies	indicated no evidence of mutagenic activity.
Carcinogenity	Chlorine is of no concern with regard to carcinogenicity.
Toxicity for reproduction	Chlorine is not toxic for reproduction according to Reg.1272/2008 (CLP)

12. ECOTOXICOLOGICAL INFORMATION

Aquatic Toxicity

Short-term toxicity to aquatic invertebrates (*Daphnia magna*):

- fresh water (*Daphnia magna*): $EC_{50}/LC_{50} = 0,141 \text{ mg/L}$
- marine water (*Crassostrea virginica*): $EC_{50}/LC_{50} = 50 \text{ } 0.026 \text{ mg/L}$

Long-term toxicity to aquatic invertebrates

- salt water: $EC_{10}/LC_{10} = 0,007 \text{ mg/L}$

Daphnia, long-term, saltwater: NOEC(7 d) = 0.007 mg/L (Linden, 1978)

Short-term toxicity to fish

- fresh water fish $LC_{50} = 0,06 \text{ mg/l}$
- marine water fish $LC_{50} = 0.032 \text{ mg/l}$

Long-term toxicity to fish

- marine water fish $EC_{10}/LC_{10} = 0.04 \text{ mg/l}$

NOEC(28 d) = 0.04 mg/L (Goodman, 1983)

Algae and aquatic plants:

- fresh water algae $EC_{50}/LC_{50} = 0,02 \text{ mg/L}$
- marine water algae $EC_{50}/LC_{50} = 0,4 \text{ mg/L}$
- fresh water algae $EC_{10}/LC_{10} = 0,0021 \text{ mg/L}$

Daphnia, long-term, saltwater: NOEC(7 d) = 0.007 mg/L (Linden, 1978)

Toxicity on sediment microorganism: $EC_{50}/LC_{50} = 3 \text{ mg/L}$

M factor = 100

PNEC values

PNEC aqua – fresh water: 0,21 $\mu\text{g/l}$
aqua –marine waterapa: 0,042 $\mu\text{g/l}$
aqua –intermittent discharges: 0.26 $\mu\text{g/l}$

No PNEC for sediment freshwater and marine water was derived as no exposure of the sediment is expected



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No PNEC for soil was derived as no exposure is expected.

Terrestrial toxicity

The substance has no high potential to adsorb to soil and is not very persistent. Chlorine dissipates rapidly in contact with soil with a DT50 of < 1 minutes (PEC/PNECsoil values are < 1).

Toxicity to soil macro-organisms

Chlorine dissipates rapidly in contact with soil with a DT50 of < 1 minutes. Therefore, long-term effects are not expected and consequently, long-term toxicity testing on invertebrates, are not necessary.

Toxicity to soil micro-organisms

Chlorine dissipates rapidly in contact with soil with a DT50 of < 1 minutes. Therefore, long-term effects are not expected and consequently, long-term toxicity testing on micro-organism, are not necessary.

Toxicity to terrestrial plants

The substance has no high potential to adsorb to soil and is not very persistent. Chlorine dissipates rapidly in contact with soil with a DT50 of < 1 minutes. The environmental risk assessment for the terrestrial compartment was performed on the basis of a calculated PNECsoil of 0.03 µg/kg, derived from the PNECaquatic using the equilibrium partitioning method. The resulting PEC/PNECsoil values are < 1.

Toxicity to birds

EC10/LC10 200 mg/kg of food

Mobility

Adsorbte/desorptie

In water, chlorine is transformed to free available chlorine (gaseous chlorine), hypochlorous acid and hypochlorite ions, whose relative amounts depend on the pH and other physicochemical properties of the water. At environmental pH, only hypochlorous acid and hypochlorite will be present.

In air: In the atmosphere, Cl₂ will degrade during daylight, with half-lives ranging from minutes to several hours, depending on latitude, season, and time of day.

In soil: The high water solubility of chlorine can lead to a high mobility in soil, although chlorine as vapour or as aqueous solution is normally irreversibly bound to soil organics within the first few millimetres or centimetres of the soil surface.



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Persistence and degradability

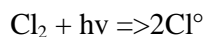
Biotic

Readily biodegradable.

Hydrolysis: In accordance with column 2 of REACH Annex VIII, the hydrolysis test (required in section 9.2.2.1) does not need to be conducted as the reaction of chlorine with water and the speciation of the resulting products hypochlorous acid and hypochlorite anion were well investigated and published several times.

Phototransformation /Photolysis

The main reaction of molecular chlorine emitted to the atmosphere is photolysis, which generates atomic chlorine:



Photolysis occurs only during daylight hours. The estimated half-life for this process is approximately 2-4 hours, which is consistent with an atmospheric lifetime of less than 0.001 year. The chlorine atoms formed by that process can then react with other species present in the atmosphere

Bioaccumulative potential

Chlorine does not bioaccumulate or bioconcentrate, because of its water solubility and high reactivity.

12.5. Results of PBT and vPvB assessment

Chlorine does not fulfil the criteria for persistency, bioaccumulation and toxicity. Therefore, chlorine is not considered a PBT or vPvB substance

13. DISPOSAL CONSIDERATIONS

Waste Code: No waste key number as per the European Waste Types List can be assigned to this product, since such classification is based on the (as yet undetermined) use to which the product is put by the consumer.

Waste treatment: Any disposal practice must be in compliance with all local, regional and national regulations. Do not discharge into any place where its accumulation could be dangerous. Toxic and corrosive gases formed during combustion should be scrubbed before discharge to atmosphere. Avoid discharge to atmosphere.



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IMDG/IMO



Marine pollutant

UN No.	1017
Hazard class	2
Labels	2.3+5.1+8
Packing group	-
Proper shipping name	Chlorine
EmS	F-C, S-U
Marine pollutant	Yes

IATA/IT-ICAO

Proper shipping name Forbiden

Transport Precautions

Transport in open ventilated vehicle, cylinders upright and secured, drum placed lengthwise in the truck tray, with the valve end facing away from the vehicle. Do not transport in confined spaces like refrigerated compartments of vehicles, truck cabs or in passenger compartments. Shipment of a compressed gas cylinder which has not been filled by the owner or with his/her (written) consent is a violation of transport regulations.

15. REGULATORY INFORMATION

Relevant information regarding the European legislation

EU Regulation (EC) No. 1907/2006 (REACH) Regulation (EC) no.1907/2006 of the European Parliament and of the Council regarding the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) Regulation

Regulation (EC) no.1272/2008 of the European Parliament and of the Council on the Classification, Labeling and Packaging of substances and mixtures.

European Agreement concerning the International Carriage of Dangerous Goods by Road (ADR)

Regulation referring to the International Carriage of Dangerous Goods by Rail (RID)

International Maritime Dangerous Goods (IMDG)

Biocide regulation

Regulation EU 528/2012 concerning making available on the market and use of biocidal products, and its amendments.



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Romanian National Legislation: Government's Decision no. 956/2005 -Concerning the placement on the market of biocide product.

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

Substances of very high concern (CMR): Chlorine is not listed on Annex XIV and is not an authorization subject.

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles

Restrictions on use: no restriction

Directive 2012/18/EU (SEVESO III) of the European Parliament and of the Council on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC – Chlorine is a SEVESO substance. Seveso Categories: H2, P4, E1.

Other EU regulations: Chlorine is not subject to:

Regulation (EC) No 1005/2009 on substances that deplete the ozone layer

Regulation (EC) No 850/2004 on persistent organic pollutants

Regulation (EC) No 649/2012 concerning the export and import of dangerous chemicals

WGK (Germany): 3 highly water endangering

15.2 Chemical safety Assessment

A chemical safety assessment (CSA) has been carried out for this substance and and CSR was issued.

16. OTHER INFORMATION

Data are based on our latest knowledge but do not constitute a guarantee for any specific product features and do not establish a legally valid contractual relationsh.

16.1. Full text of H-Statements referred to under sections 2 and 3

H270: May cause or intensify fire; oxidiser.

H315: Causes skin irritation.

H319: Causes serious eye irritation.

H331: Toxic if inhaled.

H335: May cause respiratory irritation.

H400: Very toxic to aquatic life



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16.2. Explanations for possible abbreviations mentioned FDS

CSA - Chemical Safety Assessment

CSR - Chemical Safety Report

PBT: Persistent, bioaccumulative and toxic.

vPvB: Very persistent and very bioaccumulative.

ES: Exposure Scenario

STEL: Short term exposure limit based

TWA: Time Weighted Average (TWA)

WGK: Wassergefährdungsklasse -Water hazard class, in Germany

DNEL: Derived No Effect Level

PNEC: Predicted No-Effect Concentration

NOAEL - No observed adverse effect level

NOAEC - No Observed Adverse Effects Concentration

LOAEC- Lowest Observable Adverse Effect Concentration

EC50 - concentration of toxic material for which 50% of the tested organisms survive

LD50 - lethal dose for 50% of the tested population

LC50 - lethal concentration for 50% of the tested population

UN - United Nations

ADR: European **Agreement** concerning the International Carriage of **Dangerous Goods by Road**

RID: **International** Carriage of **Dangerous Goods by Road**

IMDG Code: International Maritime Dangerous Goods Code

ICAO/IATA: International Civil Aviation Organization/ International Air Transport Association

16.3. Key literature references

The information provided in this eSDS is consistent with the information provided in the REACH CSR. The CSR contains a complete reference list for all data used. Non confidential data from the REACH registration dossier are published by the ECHA, see <https://echa.europa.eu/information-on-chemicals/registered-substances> ; http://echa.europa.eu/clp/c_1_inventory_en.asp
<http://chelist.jrc.ec.europa.eu>

<http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp>

16.4. Revision: Revision 5 replaces revision 4 dated April 26, 2016.

See below Annex I-Exposure Scenario

Disclaimer:

Oltchim provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. Furthermore, this safety data sheet is made up based on the legal requirements as set by EC 1907/2006 (REACH) and EC Regulation 830/2015.



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ANNEX I- EXPOSURE SCENARIO

1. Use 1 Manufacturing of chlorine Exposure Scenario – Manufacturing of chlorine

Use 1 Manufacturing of chlorine

SU 8

Manufacture of bulk, large scale chemicals

SU10

Formulation of preparations and/or repackaging

PROC 1

Use in closed process, no likelihood of exposure

PROC 2

Use in closed, continuous process with occasional controlled exposure (e.g. sampling)

PROC 3

Use in closed batch process (synthesis or formulation)

PROC 4

Use in batch and other process (synthesis) where opportunity for exposure arises

PROC 8b

Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

PROC 9

Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

ERC 1

Manufacture of substances

ERC2

Formulation of preparations

Contributing scenario (1, environment): Manufacturing of chlorine

ERC 1, 2

Contributing scenario (2, worker): Manufacturing of chlorine

PROC 1, 2, 3, 4, 8a, 8b, 9

Exposure Scenario

Contributing scenario (1) controlling environmental exposure for Use 1 Manufacturing of chlorine



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Manufacturing of chlorine

Product characteristics

Concentration: 100%

Physical state: gas (liquefied)

Amounts used

10443 kt/y

Frequency and duration of use

Continuous release; 365 days/year

Environment factors not influenced by risk management

Dilution factor: 10 rivers, 100 costal zones (default)

Other given operational conditions affecting environmental exposure

Available chlorine in effluent is measured as total residual chlorine (TRC).

Technical conditions and measures at process level (source) to prevent release

There is practically no release to waste water and soil (upon contact with water chlorine is converted into sodium hypochlorite which is destroyed rapidly in contact with organic as well as inorganic material).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Immediately notify the appropriate authorities in case of gas spill.

Do not discharge into the environment.

Organizational measures to prevent/limit release from site

All personnel are trained.

Conditions and measures related to municipal sewage treatment plant

Size of STP: 2000 m³/day (default)

Conditions and measures related to external treatment of waste for disposal

Waste treatment

- Dispose in compliance with local/federal and national regulations
- Absorb the product in an alkaline solution (caustic soda or sodium carbonate)
- Reduce the product with sulfite, pyrosulfite or alkaline thiosulfate

Packaging treatment



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-To avoid treatments, as far as possible, use dedicated containers.
-Do not rinse the dedicated containers.

Conditions and measures related to external recovery of waste

None.

Contributing scenario (2) controlling worker exposure for Use 1 Manufacturing of chlorine

Manufacturing of chlorine

Product characteristic

Concentration: 100%

Physical state: gas (liquefied)

Amounts used

Amounts used vary between mL (sampling) and m³ (material transfer).

Frequency and duration of use/exposure

Duration [for one worker]: 1-4 hours

Frequency [for one worker]: 220 days/year

Human factors not influenced by risk management

Respiration volume under conditions of use: 10 m³/8h-day (light activity)

Body weight: 70 kg (worker).

Other given operational conditions affecting workers exposure

The production takes place in- and outdoors at ambient temperature.

Technical conditions and measures at process level (source) to prevent release

The opening of chlorine system takes place only after it has been emptied, purged, completely degassed, shut-off via blind flange and disconnected. In case of chlorine leaks, detection and monitoring are performed.

Loading and unloading: Gaseous chlorine is transferred via pipelines to on-site users and chlorine is filled into the reaction vessel through closed systems, while off-gases from the reactor are treated before release to the atmosphere. When tankers or cylinders are used for smaller productions, the transfer of chlorine is done through loading stations adapted to the size of the vessel.

Technical conditions and measures to control dispersion from source towards the worker

Plants are equipped with chlorine detectors in different locations. They can generally detect 0.1 ppmV and have a pre-alarm level of 0.25 ppmV and an alarm level of 0.5 ppmV. The measuring device used for chlorine monitoring is an electrochemical sensor, which is sensible not only to



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chlorine, but also to other chlorinated substances present in the air. Chlorine concentration measured in the atmosphere of a Chlor-Alkali plant takes into account the exposure coming from the production of various substances (chlorine and, in most cases, other chlorinated chemicals).

Sufficient air exchange and/or exhaust in work rooms.

Appropriate exhaust ventilation at machinery.

Organisational measures to prevent /limit releases, dispersion and exposure

All personnel are trained. Safety procedures and protective equipment to be used to prevent dermal and inhalation exposure are dictated by the plant supervisor and documented in the work permit.

Conditions and measures related to personal protection, hygiene and health evaluation

Chlorine is produced in a closed system, and during normal working procedures, exposure to chlorine is possible only in case of leaks. Liquefaction, storage and loading areas are equipped with detectors. All workers in the plant receive specific training to react in a safe way in case of leaks. Personal Protective Equipment (PPE) is always used: safety glasses, safety shoes, long sleeved shirt, long pants, escape mask. In case of chlorine leaks, detection and monitoring are performed. Self-contained breathing apparatus are used for emergency operations.

Respiratory protection

- In case of emissions, face mask with type B cartridge.
- Self-contained breathing apparatus in medium confinement/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection.
- Use only respiratory protection that conforms to international/national standards.

Hand protection

- Protective gloves – chemical resistant.
- Recommended materials: Neoprene (Non recommended materials: PVC, polyethylene).

Eye protection

- Wear protective goggles for all industrial operations.
- If risk of splashing, chemical proof goggles/face shield.

Skin protection

- Overalls.
- Apron/boots of neoprene if risk of splashing.

Other precautions

- Shower and eye wash stations.



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- Take off contaminated clothing immediately after work.
- Consult the industrial hygienist or the safety manager for the selection of personal protective equipment suitable for the working conditions



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2. Use 2 Industrial use of chlorine: end uses of substance as such or preparations at Industrial sites

Exposure scenario – Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

Use 2 Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

SU5

Manufacture of textiles, leather, fur

SU6b

Manufacture of pulp, paper and paper products

SU8

Manufacture of bulk, large scale chemicals

SU9

Manufacture of fine chemicals

SU13

Manufacture of non-metallic mineral products

SU14

Manufacture of basic metals

SU16

Manufacture of computer, electronic and optical products

PROC 1

Use in closed process, no likelihood of exposure

PROC 2

Use in closed, continuous process with occasional controlled exposure (e.g. sampling)

PROC 3

Use in closed batch process (synthesis or formulation)

PROC 4

Use in batch and other process (synthesis) where opportunity for exposure arises

PROC 5

Mixing or blending in batch processes for formulation of preparations and articles (multistage and/or significant contact)

PROC 8a

Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at non-dedicated facilities

PROC 8b

Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities

PROC 9



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Transfer of substance or preparation into small containers (dedicated filling line, including weighing)

PROC 13

Treatment of articles by dipping and pouring

PROC 14

Production of preparations or articles by tableting, compression, extrusion, pelletisation

ERC 1

Manufacture of substances

ERC 4

Industrial use of processing aids

ERC 6b

Industrial use of reactive processing aids

Contributing scenario (1, environment): Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

ERC 1, 4, 6b

Contributing scenario (2, worker): Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

PROC 1, 2, 3, 4, 8a, 8b, 9, 13, 14

Exposure Scenario

Contributing scenario (1) controlling environmental exposure for Use 2 Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

Product characteristics

Concentration: 100%

Physical state: gas (liquefied)

Amounts used

10443 kt/y

Frequency and duration of use

Continuous release; 365 days/year

Environment factors not influenced by risk management

Dilution factor: 10 rivers, 100 costal zones (default)

Other given operational conditions affecting environmental exposure

Available chlorine in effluent is measured as total residual chlorine (TRC).



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Technical conditions and measures at process level (source) to prevent release

There is practically no release to waste water and soil (upon contact with water chlorine is converted into sodium hypochlorite which is destroyed rapidly in contact with organic as well as inorganic material).

Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil

Immediately notify the appropriate authorities in case of gas spill.

Do not discharge into the environment.

Organizational measures to prevent/limit release from site

All personnel are trained.

Conditions and measures related to municipal sewage treatment plant

Size of STP: 2000 m³/day (default)

Conditions and measures related to external treatment of waste for disposal

Waste treatment

- Dispose in compliance with local/federal and national regulations
- Absorb the product in an alkaline solution (caustic soda or sodium carbonate)
- Reduce the product with sulfite, pyrosulfite or alkaline thiosulfate

Packaging treatment

- To avoid treatments, as far as possible, use dedicated containers.
- Do not rinse the dedicated containers.

Conditions and measures related to external recovery of waste

None.

Contributing scenario (2) controlling worker exposure for Use 2 Industrial use of chlorine: end uses of substance as such or preparations at industrial sites

Manufacturing of chlorine

Product characteristic

Concentration: 100%

Physical state: gas (liquefied)

Amounts used

Amounts used vary between mL (sampling) and m³ (material transfer).

Frequency and duration of use/exposure



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Code: FDS 011

SAFETY DATA SHEET

Prepared in accordance with Commission Regulation (EU) 830/2015 amending
Regulation 1907/2006, REACH
CHLORINE - Liquefied Gas

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Duration [for one worker]: > 4 hours per shift (8 hours/day)

Frequency [for one worker]: 220 days/year

Human factors not influenced by risk management

Respiration volume under conditions of use: 10 m³/8h-day (light activity)

Body weight: 70 kg (worker).

Other given operational conditions affecting workers exposure

The production takes place in- and outdoors at ambient temperature.

Technical conditions and measures at process level (source) to prevent release

The opening of chlorine system takes place only after it has been emptied, purged, completely degassed, shut-off via blind flange and disconnected. In case of chlorine leaks, detection and monitoring are performed.

Loading and unloading: Gaseous chlorine is transferred via pipelines to on-site users and chlorine is filled into the reaction vessel through closed systems, while off-gases from the reactor are treated before release to the atmosphere. When tankers or cylinders are used for smaller productions, the transfer of chlorine is done through loading stations adapted to the size of the vessel.

Technical conditions and measures to control dispersion from source towards the worker

Plants are equipped with chlorine detectors in different locations. They can generally detect 0.1 ppmV and have a pre-alarm level of 0.25 ppmV and an alarm level of 0.5 ppmV. The measuring device used for chlorine monitoring is an electrochemical sensor, which is sensible not only to chlorine, but also to other chlorinated substances present in the air. Chlorine concentration measured in the atmosphere of a Chlor-Alkali plant takes into account the exposure coming from the production of various substances (chlorine and, in most cases, other chlorinated chemicals).

Sufficient air exchange and/or exhaust in work rooms.

Appropriate exhaust ventilation at machinery.

Organisational measures to prevent /limit releases, dispersion and exposure

All personnel are trained. Safety procedures and protective equipment to be used to prevent dermal and inhalation exposure are dictated by the plant supervisor and documented in the work permit.

Conditions and measures related to personal protection, hygiene and health evaluation

Chlorine is produced in a closed system, and during normal working procedures, exposure to chlorine is possible only in case of leaks. Liquefaction, storage and loading areas are equipped with detectors. All workers in the plant receive specific training to react in a safe way in case of leaks. Personal Protective Equipment (PPE) is always used: safety glasses, safety shoes, long



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sleeved shirt, long pants, escape mask. In case of chlorine leaks, detection and monitoring are performed. Self-contained breathing apparatus are used for emergency operations.

Respiratory protection

- In case of emissions, face mask with type B cartridge.
- Self-contained breathing apparatus in medium confinement/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection.
- Use only respiratory protection that conforms to international/national standards.

Hand protection

- Protective gloves – chemical resistant.
- Recommended materials: Neoprene (Non recommended materials: PVC, polyethylene).

Eye protection

- Wear protective goggles for all industrial operations.
- If risk of splashing, chemical proof goggles/face shield.

Skin protection

- Overalls.
- Apron/boots of neoprene if risk of splashing.

Other precautions

- Shower and eye wash stations.
- Take off contaminated clothing immediately after work.
- Consult the industrial hygienist or the safety manager for the selection of personal protective equipment suitable for the working conditions



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