

1 IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product Identifier

Chemical name: Chlorine
 EC number: 231-959-5
 CAS number (EC inventory): 7782-50-5
 Annex I index number: 017-001-00-7
 Registration number: 01-2119486560-35-0030
 Chemical characterization: Inorganic mono constituent substance

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

Chlorine is used as a chemical intermediate, in the manufacture of PVC, inorganic chemicals and chloromethane, etc. Chlorine is also used as a non-intermediate in drinking water and swimming-pool disinfection, waste water and refrigeration water treatment, textile processing and in the pulp and paper industry.

Relevant Identified Uses (see corresponding Exposure Scenario - ES, annexed to this SDS)	Chlorine manufacture - Exposure Scenario 1 - Annex 1 Industrial use of chlorine - Exposure Scenario 2 - Annex 2
Uses advised against	There are no uses advised against

1.3 Details of the supplier of the safety data sheet

See footnote.

1.4 Emergency telephone number

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Emergency National Number: 112

2 HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

2.1.1 Classification (Regulation (EC) No 1272/2008 amended by EU Regulation No. 758/2013)

Classification	Hazard statements:
Ox. Gas 1 <i>Liquefied</i> gas Skin Irrit. 2 Eye Irrit. 2 Acute Tox. 3 STOT SE 3 Aquatic Acute 1 <i>Chronic aquatic</i>	H270: May cause or intensify fire; H280: Contains gas under pressure; may explode if heated. H315 Causes skin irritation H319 Causes serious eye irritation. H331 Toxic if inhaled. H335 May cause respiratory irritation. H400 Very toxic to aquatic life.M=100 <i>H410 Very toxic to aquatic life with long lasting effects</i>

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2.1.2 Classification (67/548/EEC)





Classification	Risk phrases:
T - Toxic; Xi - Irritating; N - Dangerous for the environment;	R23: Toxic by inhalation R36/37/38: Irritating to eyes, respiratory system and skin R50: Very toxic to aquatic organisms

Specific concentration limit to Dir 67/548/EEC

Classification	Specific concentration limit
N; R50	C ≥ 0,25 %

2.2 Label Elements

2.2.1 Labelling (REGULATION (EC) No 1272/2008)



<i>Hazard Pictogram:</i>	    <p>GHS06 GHS09 GHS03 GHS04</p>
Signal word:	Danger
Hazard statements:	H270: May cause or intensify fire; oxidiser. H280: Contains gas under pressure; may explode if heated. H315 Causes skin irritation. H319 Causes serious eye irritation. H331 Toxic if inhaled. H335 May cause respiratory irritation. H400 Very toxic to aquatic life.
Precautionary statements:	P220: Keep/Store away from clothing/.../combustible materials. P261: Avoid breathing dust/fume/gas/mist/vapours/spray. P273: Avoid release to the environment. P280: Wear protective gloves/protective clothing/eye protection/face protection. P391: Collect spillage. P304+P340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P370+P376: In case of fire: Stop leak if safe to do so. P403+P233: Store in a well-ventilated place. Keep container tightly closed. P410+P403: Protect from sunlight. Store in a well-ventilated place. P305+P351+P338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. <i>P501 Dispose of contents in absorbent solution</i>
Precautionary statements for end user:	P101 If medical advice is needed, have product container or label at hand. P102 Keep out of reach of children. P103 Read label before use.

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2.2.2 Labelling in Annex I of Directive 67/548/EEC or 1999/45/EC

Symbol(s):	  T- TOXIC N-DANGEROUS TO THE ENVIRONMENT
R - phrases:	R23 - toxic by inhalation R36/37/38 - irritating to eyes, respiratory system and skin R50 - very toxic to aquatic organisms
S - phrases:	S1/2 - keep locked up and out of reach of children S9 - keep container in a well-ventilated place S45 - in case of accident or if you feel unwell, seek medical advice immediately (show the label where possible) S61 - avoid release to the environment. Refer to special instructions/safety data sheets.

When the substance is sold to the general public at a concentration of 0.2% or greater, the following is obligatory:

- The packaging must be provided with a childproof seal.
- The label always carries a danger indication detectable to the touch.

The packaging of the product should have:

- A single seal for opening.
- CE no.
- Indication of "CE Labelling".

2.3 Other Hazard

Not available.

3 COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Hazardous substance

Chemical Name	CAS-No.	EC-No.	REACH No.	Concentration[%]
Chlorine	7782-50-5	231-959-5	01-2119486560-35-0030	99.9%

3.2 Mixtures

Not applicable.

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4 FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled:	Remove the subject from the contaminated areas soon as possible: transport him/her lying down with the head higher than the body, to a quiet, uncontaminated and well-ventilated location. Apply Oxygen or cardiopulmonary resuscitation if necessary. Consult with a physician immediately in all cases. Take to hospital immediately. Keep warm.
In case of skin contact:	Immediately bring the clothed subject under shower. Remove contaminated shoes, socks and clothing; wash the affected with running water. Consult with a physician immediately in all cases. Keep warm (blanket), provide clean clothing.
In case of eye contact:	Flush eyes as soon as possible it running water for 15 minutes while keeping the eyelids wide open. In the case of difficulty of opening the lids, administer analgesic eyewash (oxybuprocaine). Consult with an ophthalmologist and physician immediately in all cases. Take to hospital immediately.
If swallowed:	Arrange urgent transportation to hospital.

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

4.2.1 Inhalation

- Cough
- Shortness of breath
- Dizziness
- Headache
- Irritant *to respiratory tract.*
- Chest pain
- Fever
- Fatigue upon exertion
- Dryness of the oropharyngeal mucous

4.2.2 Skin contact

- *Skin irritation and burns*

4.2.3 Eye contact

- *Conjunctival irritation.*
- *Lacrimation*

4.2.4 Swallowing

Not applicable.

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4.3 Indication of immediate medical attention and special treatment needed:

- Remove clothing and footwear under running water.
- Skin contact: rinse exposed areas with water and dry without rubbing
- Eye contact: rinse with saline solution or water for 15-30 minutes
- Inhalation: Administer oxygen, bronchodilators

5 FIRE-FIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media: In case of fire in close proximity, all means of extinguishing are acceptable.

Unsuitable extinguishing media: All known extinguishing media can be used

5.2 Special hazards arising from the substance or mixture

Product is not explosive.

Product is not self-inflammable, combustible or inflammable

If there is a fire in the surrounding area, use CO₂, dry chemical powders or alcohol-resistant foam. If water is used, contain drainage.

If safe, remove the exposed containers or cool them with large amounts of water.

Approach upwind.

Do not spray in the direction of the spillage or gas leak.

Depending on wind direction, alert people to the danger of intoxication.

Close doors and windows and switch off ventilation.

Use a chlorine detector to determine the danger zones.

5.3 Advice for firefighters

Always use self-contained breathing apparatus.

If interventions take place very close to the accident zone, wear chemical-resistant protective clothing.

After the intervention, clean the equipment.

6 ACIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

6.1.1 Staff not involved in emergency response

- Evacuate or shelter the staff depending on the gravity of the situation (consult a specialist/or comply with a safety radius).
- Advise staff to take shelter on upper floors or in closed rooms and await instructions.

6.1.2 Staff responsible for emergency response

- During the intervention wear a chemical protection suit and use respiratory protective equipment.
- If safe – and without exposing anyone, try to stop the leak – Approach upwind.
- Disperse gases/vapours with jets of water.
- Avoid spraying the source of the spillage.

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- Isolate the area.
- Cover the spilt liquid with foam to reduce evaporation.
- If the chlorine escapes from the container in a liquid state, try to surround it so that the liquid leak transforms into a gas leak.

6.2 Environmental precautions

- In case of spillage/leak, contact the authorities immediately. Try to stop the leak/spillage, containing the advance of the gas cloud using a curtain of sprayed water.
- Do not discharge into the environment (sewers, rivers, soil).

6.3 Methods and material for containment and cleaning up

- 6.3.1 - If possible, contain the spillage with sand or earth, and cover the sewer entrances.

6.4 Reference to other sections

- See points 7 and 8 for protective measures.
- See point 13 on waste treatment.

7 HANDLING AND STORAGE

7.1 Precautions for safe handling

- Perform all operations in closed circuits of tubes and equipment.
 - Work in a well-ventilated place.
 - Clean and dry the tube circuits and equipment before any operation.
 - Use only equipment and materials compatible with the product.
- Avoid any contact with organic matter.
Avoid contact with water or humidity.

7.2 Conditions for safe storage, including any incompatibilities

- Store in a cool, ventilated area.
- Avoid direct sunlight.
- Keep away from reactive products: reducing agents, combustible materials, metal powders, acetylene, hydrogen, ammonia, hydrocarbons and organic matter).
- Do not store in a restricted space.
- The containers must be used exclusively for chlorine.
- Keep a retention basin around the storage containers and transfer facility.
- Storage temperature below 50 °C.
- The electrical equipment installed must be protected against corrosion.
- Use adequate signs in the storage area.

7.3 Specific end use(s)

Chlorine is used as a chemical intermediate, in the manufacture of PVC, inorganic chemicals and chloromethane, etc. Chlorine is also used as a non-intermediate in drinking water and swimming-pool disinfection, waste water and refrigeration water treatment, textile processing and in the pulp and paper industry.

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8 EXPOSURE CONTROL/ PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Legal Basis
Chlorine	7782-50-5	0.5 ppm	TWA	TLV (ACGIH-USA) 2004
		1.5 mg/m ³	TWA	
		1 ppm	STEL	
		2.9 mg/m ³	STEL	NP1796:2007
		0.5 ppm (v/v)	TLV-TWA	
0.5 ppm (v/v)	STEL	Decree-Law 24/2012		

TLV-TWA: Threshold limit value – time weighted average

STEL: Short-term exposure limit

8.1.2 DNEL/PNEC values

DNEL value(s)

Acute short-term inhalation = 1.5 mg/m³(local and systemic effects)

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

Long-term oral exposure = 0.25 mg/kg bw/day.

PNEC value(s)

Freshwater = 2.1E-04 mg/L

Seawater = 4.2E-05 mg/L

Freshwater food chain = 11.1 mg/L

Seawater food chain = 11.1 mg/L

Land food chain = 11.1 mg/kg food

STP = 0.03 mg/L

8.2 Exposure controls

8.2.1 Appropriate technical controls

Ensure adequate ventilation.

Apply the necessary technical measures to comply with occupational exposure limits.

8.2.2 Individual Protection Measures, Suchs as Personal Protective Equipment

Respiratory protection:	In case of release, use a mask with type B filter. Use self-contained breathing apparatus in limited spaces with insufficient oxygenation, in case of uncontrolled releases or inlarge quantity, or in any case in which the mask or filter do not provide adequate protection. Only use equipment that meets national/international standards.
Hand protection:	Wear chemically resistant protective gloves; Recommended materials: Neoprene Non-recommended materials: PVC, polyethylene

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Eye protection:	Wear protective goggles for all industrial operations. Where there is risk of splashing, wear chemically resistant goggles/face protection.
Skin and body protection:	Wear coveralls. Where there is risk of splashing, wear a neoprene apron and boots.
Thermal hazards	Wear clothing and gloves suitable for thermal protection in case of contact with equipment in decompression or in case of exposure to chlorine in liquid state.

8.2.3 Environmental exposure controls

- Ventilation equipment connected to emergency absorption unit
- Comply with local/national standards for gas emissions.

9 PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance: Yellow liquid

b) Odour: Irritant

c) Odour threshold: 3 ppm

pH: Not applicable

d) Melting point/freezing point: -101.05 °C

e) Initial boiling point and boiling range: -34.05 °C

f) Flash point: Non-flammable

g) Evaporation rate:

h) Flammability (solid, gas): Not applicable

i) Upper/lower limits of flammability or explosivity: Non-flammable

j) Vapour pressure: 6 780 hPa at 20 °C

k) Vapour density: 2.491 at 20 °C (air=1)

l) Relative density: 1.409 at 20 °C

m) Solubility(ies): 7 410 mg/l in water at 20 °C

n) Partition coefficient n-octanol/water: Not applicable

o) Auto-ignition temperature: Not applicable

p) Decomposition temperature: Not applicable

q) Viscosity: (*)

r) Explosive properties: Non-explosive

s) Oxidising properties: Molecular chlorine is a strong oxidiser

(*) Gas viscosity at 20 °C (dynamic) – 0.0134 mPar

9.2 Other information

Vapours are heavier than air. They may accumulate in confined spaces particularly at ground level or in basements.

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10 STABILITY AND REACTIVITY

10.1 Reactivity

Reacts with most materials, in particular:

- Reducing agents
- Combustible materials:
- Some metal powders
- Acetylene, hydrogen, ammonia, hydrocarbons and organic matter.

10.2 Chemical stability

Stable, if stored in the recommended conditions.

10.3 Possibility of hazardous reactions

- Contact with inflammable products may cause fire or explosions.
- Contact with organic matter may cause explosions or violent fires.
- Contact with metal powders may cause fire or violent explosions.

10.4 Conditions to avoid

Avoid humidity.

10.5 Incompatible materials

- *Dry chlorine reacts violently with titanium.*
- *Corrosive action on some metals where humidity is present.*
- The product (in liquid form) is not compatible with titanium, ebonite, rubbers, PVC, polyethylene and polypropylene.

10.6 Hazardous decomposition products

Not applicable.

11 TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Chlorine is a strong oxidiser which in contact with most mucous membranes forms both hypochlorous acid and hydrochloric acid. The damage results from the rupture of cellular proteins caused by its strong oxidising nature.

Hypochlorite reacts quickly with organic matter such as amino acids, proteins, nucleic acids, lipids and carbohydrates. The resulting organic compounds may have their own inherent toxicity, and may cause cellular lesions (BIBRA, 1990). Chlorine reacts at the place of contact, where its main activity is the destruction of organic molecules. Consequently, it is not absorbed into the bloodstream. Though only moderately soluble in the epithelial fluid, its rapid reaction to the surface material and tissues of the respiratory tract make it a potentially toxic gas. Clinical and morphological observations, together with pulmonary function tests confirm that exposure to chlorine leads to effects on pulmonary function and the histological integrity of the respiratory system. Oral administration of a solution of hypochlorous acid in mice resulted in rapid absorption and distribution of the ion- Chlorine in the blood, with a peak between 2 and 4 hours and a half-life between 2 and 4 days. The interaction of chlorine and the stomach may result in the formation of organic chlorine compounds, such as chloroform, DCAN, DCA, TCA and

chlorinated amino acids. It can be assumed that no systemic exposure to chlorine will occur after skin absorption. Contact with liquid chlorine will burn the skin.

Hazard class	Dose descriptor	Method/reference
Acute oral toxicity single exposure:	LD ₅₀ : 1100 mg/kg bw (male rat) (NaClO as av. Cl ₂)	Equivalent or similar to OECD Guideline 401 (Acute Oral Toxicity); Kästner, W.; Heitland; Disch; Gloxhuber (1981)
Acute oral toxicity repeated exposure:	NOAEL: 50 mg/kg bw/day (nominal) (male) ((assuming a water consumption of 25 mL/day for a rat and a body weight of 500 g))	Hasegawa et al. (1986)
Acute dermal toxicity:	LD ₅₀ : 20000 mg/kg bw (male/female rabbit)	Guideline 402 (Acute Dermal Toxicity); Griffiths, B.S. (1978a)
Acute inhalation toxicity single exposure:	LD ₅₀ : 0.65 mg/m ³ air (male rat);	Equivalent or similar to OECD Guideline 403 (gas whole body); Zwart, A. (1987)
Acute inhalation toxicity repeated exposure:	NOAEL: 0.5 ppm (male/female monkey) (corresponding to 1.5 mg/m ³ (4.5 mg/kg bw/d assuming a body weight of 2.5 kg and a respiratory volume of 0.021 m ³ /min. similar to humans))	Equivalent or similar to OECD Guideline 413 (Subchronic Inhalation Toxicity: 90-Day); Klonne, D. R. et al (1987)
Skin irritation/ corrosion:	Irritating Primary dermal irritation index-PDII: 1.2 of max. 8 (mean) (Time point: 4/24/48 h) (fully reversible) (Rabbit) Primary dermal irritation index-PDII: 0.8 of max. 8 (mean) (Time point: 4/24/48 h) (fully reversible) (Guinea Pig)	OECD Guideline 404 Coverage: Semi occlusive (abraded); Nixon, G.A. et al. (1975)
Eye irritation/corrosion:	Irritating (rabbit) Irritating effects on the eyes were reported at a chlorine concentration range of 0.2 to 4 ppm (0.6 to 12 mg/m ³) According to secondary literature exposure to chlorine can result in injury of the cornea and enduring impaired vision and blindness (corrosive effect).	Equivalent or similar to OECD Guideline 405; Carter, R.O., Griffith, J.F. (1965)
Respiratory irritation.	Irritating	

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Hazard class	Dose descriptor	Method/reference
	NOAEC 1.5 mg/m ³ (human volunteers)	
Skin Sensitisation:	Not sensitizing N° with positive reactions: 1st reading: 0 out of 20 (test group); 24 h after chall.; dose:40 % 1st reading: 0 out of 10 (negative control); 24 h after chall.; dose:40 % 2nd reading: 0 out of 20 (test group); 48 h after chall.; dose:40 % 2nd reading: 0 out of 10 (negative control); 48 h after chall.; dose: 40 %	Equivalent or similar to OECD Guideline 406 (Skin Sensitisation); Gardner et al. (1982)
Germ cell mutagenicity:	In vitro: Positive with metabolic activation; Test results: positive for S. typhimurium TA 100 (strain/cell type: S. typhimurium TA100); met. act.: with In vivo: Evaluation of results: negative Test results: Genotoxicity: negative (male); toxicity: no effects	Equivalent or similar to OECD Guideline 471 (Bacterial Reverse Mutation Assay); Kawachi et al. (1980) Equivalent or similar to OECD Guideline 474 (Mammalian Erythrocyte Micronucleus Test); Hayashi et al. (1988)
Carcinogenicity:	LOAEL (toxicity): 100 mg/kg bw/day (nominal) (male rat) (oral drinking water); NOAEL (toxicity): 50 mg/kg bw/day (nominal) (male rat) (oral drinking water); Neoplastic effects: no effects	Equivalent or similar to OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies); Hasegawa, R. et al. (1986)
Reproductive toxicity:	Fertility impairment: LOAEL (P): 5 mg/kg bw/day (nominal) (male/female rat) (oral gavage) Developmental toxicity: NOAEL(teratogenicity): ≥ 5.7 mg/kg bw/day	Equivalent or similar to OECD Guideline 415 (One-Generation Reproduction Toxicity Study); Carlton, B.D. and Barlett P., Basaran A., Colling K., Osis I. and Smith K. (1986) Equivalent or similar to OECD Guideline 414 (Prenatal Developmental Toxicity Study)

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12 ECOLOGICAL INFORMATION

12.1 Toxicity

Information on environmental effects

In contact with water, chlorine is immediately converted to hypochlorite. The substance does not constitute an immediate concern for the environment (aquatic and land zones). In the air, Cl₂ will degrade during the day, with half-lives varying from minutes to several hours, depending on the latitude, season and time of day. The sensitivity of sodium hypochlorite/chlorine to light (sun) is high: in relevant environmental conditions, the half-life varies between 12 min at pH 8 (OCl⁻) and 60 min at pH 5 (HOCl).

Hazard class	Dose descriptor	Method/reference
Toxicity to fish:	Trout fish (freshwater) LC ₅₀ = 0.06 mg/L TRC after 96h (most sensitive species) Coho salmon (<i>Oncorhynchus Kisutch</i>) LC ₅₀ for marine water fish: 0.032 mg/L <i>Menidia peninsulae</i> NOEC (28 d): 0.04 mg /L test mat. (nominal) (saltwater fish) <i>Menidia peninsulae</i> LOEC (28 d): 0.21 mg /L test mat. (nominal) (saltwater fish)	No guideline indicated; Heath, A.G. (1978) No guideline indicated; Thatcher, T.O. (1978a) (rated1 on Klimish scale); Goodman, L.R (1983)
Toxicity to daphnia and other aquatic invertebrates:	Daphnia 48 h LC ₅₀ =0.141 mg active chlorine/L, continuous, flow-through exposure Daphnia 48 h EC ₅₀ : 141µg active chlorine/L (Daphnia magna flow through) Aquatic invertebrates NOEC (15 d): 7 µg TRO/L test mat. (estimated) aquatic invertebrates LOEC (15 d): 14 µg TRO/L test mat. (nominal)	OECD Guideline 202 (Daphnia sp. Acute Immobilisation Test); Gallagher, S.P.; Lezotte, F.; Krueger, H.O. (2009) No guideline indicated. ;Liden, L.H (1980)
Toxicity to algae/cyanobacteria	NOEC (7d) for freshwater algae: 0.0021 mg/L EC ₅₀ /LC ₅₀ for marine water algae: 0.4 mg/L	Cairns et al. (1990)
Toxicity to freshwater plants	EC ₅₀ /LC ₅₀ for freshwater plants: 0.1 mg/L NOEC for freshwater plants: 0.02 mg/L	Continuous and intermittent (2 experiments) exposure of to dissolved chlorine in a flow-through design of an aquatic vascular ubiquitous plant species. ;Watkins C.H. & Hammerschlag R.S. (1984)

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12.2 Persistence and degradability

Biodegradability: *All species constitute simple and basic inorganic structures, which are non-biodegradable*

Degradation (abiotic): Chlorine is a highly reactive compound, which will react rapidly in the air and in soil and with organic matter. In water chlorine will form hypochlorous acid and hypochlorite at an environmentally relevant pH. Chlorine discharged into the sewers will react forming chloramines. Since it is inorganic, chlorine is not biodegradable.

12.3 Bioaccumulative potential

Secondary poisoning is not relevant for chlorine, since it does not bioaccumulate or bioconcentrate due to its solubility in water and the aquatic species with high reactivity to chlorine do not bioaccumulate. (SIAR, 2003).

12.4 Mobility in soil

High solubility of chlorine in water may lead to great mobility in soil, though chlorine as vapour or aqueous solution is normally irreversible when combined with organic products from the soil at the level of the first millimetres or centimetres of the soil surface (SIAR, 2003).

12.5 Results of PBT/vPvB assessment

Chlorine does not bioaccumulate or bioconcentrate due to its solubility in water and high reactivity. Log Kow measured = -0.85 for chlorine.

12.6 Other adverse effects

Not applicable.

13 DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Waste disposal procedures:

- Absorb the product in an alkaline solution (caustic soda or sodium carbonate).
- Reduce the product with sulphite, sodium metabisulphite or alkaline thiosulphate.

Packaging treatment:

- Chlorine packaging to be discarded must be degassed and the residual chlorine neutralised before being dispatched as packaging waste.

Applicable regulations:

- Administrative Ruling no. 209/2004, of 3 March – European Waste List;
- Decree-Law no. 178/2006 of 5 September – Waste Management;
- Administrative Ruling no. 1408/2006 of 18 December – Regulations on operating the integrated electronic waste record system.
- Decree-Law no. 73/2011 of 17 June – Amends the general regime for waste management and transposes Directive 2008/98/EC of the European Parliament and of the Council of 19 November on waste.

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14 TRANSPORT INFORMATION

ADR	UN number: 1017 UN proper shipping name: Chlorine Transport hazard class(es): 2 Packing group: - Classification Code: 2TOC Hazard identification No: 265 Labels: T,N 2.3 + 5. 1 + 8 Tunnel restriction code: (C/D) Environmentally hazardous : Yes
IMDG	UN number: 1017 UN proper shipping name: Chlorine Transport hazard class(es): 2.3 Packing group: - Classification Code: 2TOC Hazard identification No: 265 Labels: T,N 2.3+5.1+8 Hazard lable: TOXIC GAS +CORROSIVE+COMBURENT+ MARINE POLLUTANT EmS Number 1: F-C, S-U Marine pollutant: Yes (P)
RID	UN number: 1017 UN proper shipping name: Chlorine Transport hazard class(es): 2 Packing group: - Classification Code: 2TOC Hazard identification No: 265 Labels: T,N 2.3 + 5. 1 + 8 Environmentally hazardous: Yes

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15 REGULATORY INFORMATION

- Regulation (EC) No.1907/2006, of the European Parliament and of the Council of 18 December 2006, concerning the registration, evaluation, authorisation and restriction of chemicals (REACH), and respective amendments;
- Directive 1999/45/EC of the European Parliament and of the Council of 31 May 1999 concerning the approximation of the laws, regulations and administrative provisions of the Member States relating to the classification, packaging and labelling of dangerous preparations, and respective amendments;
- Regulation (EC) No. 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, and respective amendments;
- Council Directive 98/24/EC of 7 April 1998 on the protection of the health and safety of workers from the risks related to chemical agents at work and respective amendments;
- Commission Directive 2000/39/EC of 8 June 2000 establishing a first list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work, and respective amendments.
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste.
- Administrative Ruling no. 209/2004 of 3 March – European Waste List;
- Decree-Law no. 178/2006 of 5 September – Waste Management;
- Administrative Ruling no. 1408/2006 of 18 December – Regulations on operating the integrated electronic waste record system;
- Decree-Law no. 73/2011, of 17 June – Amends the general regime for waste management and transposes Directive 2008/98/EC of the European Parliament and of the Council of 19 November on waste;
- Decree-Law no. 24/2012 – Establishes the minimum requirements regarding protection of workers against health and safety risks due to exposure to chemical agents at work, transposing to internal law Commission Directive 2009/161/EU of 17 December 2009, which establishes a third list of indicative occupational exposure limit values of Council Directive 98/24/EC of 7 April 1998 and Commission Directive 2000/39/EC of 8 June 2000;
- Recommendation 2008/98/EC of the European Commission of 6 December 2007.
- NP 1796:2007 – Occupational threshold limit value (TLVs) for chemical agents, and respective updates.
- Decree-Law 41-A/2012 of 29 April with amendments introduced by Decree-Law 206-A/2012 of 31 August.
- Decree-Law 14-A/2014 of 7 February

16 OTHER INFORMATION

Abbreviations mentioned on the Sheet:

ADR: - The European Agreement concerning the International Carriage of Dangerous Goods by Road.

ES: - Exposure Scenario

MC: - Maximum concentration

DNEL: – Derived No-Effect Level

EC50 – Half of maximum effective concentration

PPE – Personal Protective Equipment

ERC – Environmental Release Category

WTP: - Water Treatment Plant

WWTP: - Wastewater Treatment Plant

SDS: - Safety Data Sheet

IATA: - International Air Transport Association

ICAO: - International Civil Aviation Organisation

IMDG: - International Maritime Dangerous Goods

LEV: - Low exposure level

m/m: - Mass concentration

vPvB: - Very persistent and very bioaccumulative.

OEL: - Occupational exposure limit

UNO: – United Nations Organisation

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PBT: - Persistent, bioaccumulative and toxic.

PC - Product Category

PNEC: - Predicted No-Effect Concentration

PROC- Process Category

RID: - Regulations Concerning the International Carriage of Dangerous Goods by Rail

STOT - SE: - Specific Target Organ Toxicant - Single Exposure

STOT- RE: - Specific Target Organ Toxicant - Repeated Exposure

SU - Sector of Use

STEL: - Short-term exposure limit

List of Changes:

DATE	REVISION	CHANGES MADE
05/12/2014	3	Points 1.2. and 1.3.
		Points 2.1.to 2.3
		Points 4.1.to 4.3.
		Point 4.3.
		Points 5.1. and 5.2.
		Points 6.1.to 6.4.
		Points 7.2. and 7.3.
		Point 8.2.
		Points 9.1. and 9.2.
		Points 10.3. and 10.5.
		Point 13
		Points 14 to 16

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Drinking water and wastewater treatment

The use of chlorine in the scenarios of drinking water and wastewater represents a biocide use and is covered by a dossier presented under the Biocides Directive No. 98/8/EC and also included in the EU's Chlorine Risk Assessment, 2007. Since the operations concerning the use of chlorine in the drinking water disinfection scenario are very similar to those of the wastewater treatment scenario, the results have been summarised below.

Annex 1: Exposure Scenario 1 – Chlorine manufacture

Annex 2: Exposure Scenario 2 – Industrial uses of chlorine

Annex 1 Exposure Scenario 1 –Chlorine manufacture

Application 1-- Chlorine manufacture

SU8
Manufacture of bulk, large-scale chemicals (including petroleum products)
SU10
Formulation [mixing] of preparations and/or re-packaging (excluding alloys)
PROC1
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): Chlorine manufacture ERC 1, 2

Contributing scenario (2, worker): Chlorine manufacture PROC 1, 2, 3, 4, 8a, 8b, 9

Exposure Scenario

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

Chlorine manufacture

Product characteristics

Concentration: 100%
Physical state: gas (liquefied)

Amounts used

10443 kt/y

Frequency and duration of use

Continuous release; 365 days/year

Environmental factors not influenced by risk management

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

Other given operational conditions affecting environmental exposure

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 into wastewater or soil (in contact with water chlorine is converted into sodium hypochlorite which is rapidly destroyed in contact with organic and inorganic matter)).
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
Notify the competent authorities immediately in case of gas release Do not release into the environment.
Organizational measures to prevent/limit release from site
All employees have received training.
Conditions and measures related to municipal sewage treatment plant
Size of STP: 2000 m ³ /day (default)
Conditions and measures related to external treatment of waste for disposal
Treatment of waste - Dispose according to local and national regulations. - Absorb the product in alkaline solution (caustic soda or sodium carbonate) - Reduce the product with sulphite, sodium metabisulphite or alkaline thiosulphate Packing treatment: - To avoid packing treatments, use dedicated containers where possible. - 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
Chlorine manufacture
Product characteristic
Concentration: 100% Physical state: gas (liquefied)
Amounts used
The amounts used may 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 m ³ /8h-day (light activity) Body weight: 70 kg (worker).
Other given operational conditions affecting workers exposure
Production occurs inside and outside the facilities at room temperature.

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

The chlorine system is only opened after being emptied, purged, completely degassed, totally sealed using blind flanges and disconnected. In case of chlorine leaks, detection and monitoring are performed.

Loading and unloading: gaseous chlorine is transferred via pipeline to local users and the containers are filled with chlorine in closed systems, with the gases extracted from the reactor treated before being released into the air. When tanks or cylinders are used for smaller production, the chlorine is transferred through loading stations adapted to the container size.

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

Factories 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 monitoring chlorine is an electrochemical sensor sensitive not only to chlorine, but also to other substances present in the air. The concentration of chlorine measured in the air of a chloro-alkaline factory takes into account the exposure resulting from the manufacture of various substances (chlorine and, in many cases, other chlorinated chemicals).

Sufficient ventilation and/or extractor system in workplaces.

Adequate ventilation in machinery.

Organisational measures to prevent /limit releases, dispersion and exposure

All employees have received training. Safety procedures and protective equipment used to avoid skin and inhalation exposure must be dictated by the factory supervisor and documented at the work authority.

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

During normal work procedures, since chlorine is produced in a closed system, the worker can only be exposed to chlorine in case of a leak. Liquefaction, storage and loading areas are fitted with detectors. All factory workers receive specific training on how to react safely in the event of leaks. Personal Protective Equipment (PPE) is always used: safety goggles and shoes, long-sleeved shirts, long trousers, masks. In case of chlorine leaks detection and monitoring are performed. Self-contained breathing apparatus is used in emergency operations.

Respiratory protection

- In case of releases, facial mask with type-B filter.
- Self-contained breathing apparatus in restricted space/insufficient oxygenation, in case of uncontrolled releases or in large amounts, or whenever the mask or filter does not provide adequate protection.
- Use only respiratory protection which meets international/national standards.

Hand protection

- Chemically resistant protective gloves.
- Recommended materials: Neoprene (Non-recommended materials: PVC, polyethylene)

Eye protection

- Wear protective goggles for all industrial operations.
- Where there is risk of splashing wear chemically resistant goggles/face protection.

Skin protection

- Coveralls
- Neoprene apron and boots, where there is risk of splashing

Other precautions

- Shower and eye-bath facilities.
- Remove contaminated clothing immediately after work.
- Consult the person responsible for industrial health and safety to choose adequate personal protective equipment for the working conditions

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Annex 2 Exposure Scenario 2 - Industrial use of chlorine

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

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 other non-metallic mineral products
SU14
Manufacture of basic metals, including alloys
SU16
Manufacture of computer, electronic and optical products, electrical equipment
PROC1
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
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 the substance as such or preparations at industrial facilities.
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

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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 coastal zones (default)
Other given operational conditions affecting environmental exposure
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 into wastewater or soil (in contact with water chlorine is converted into sodium hypochlorite which is rapidly destroyed in contact with organic and inorganic matter)).
Technical onsite conditions and measures to reduce or limit discharges, air emissions and releases to soil
Notify the competent authorities immediately in case of gas release Do not release into the environment.
Organizational measures to prevent/limit release from site
All employees have received training.
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
Treatment of waste - Dispose according to local and national regulations. - Absorb the product in alkaline solution (caustic soda or sodium carbonate) - Reduce the product with sulphite, sodiummetabisulphite or alkaline thiosulphate Packing treatment: - To avoid packing treatments, use dedicated containers where possible. - Do not rinse the dedicated containers.
Conditions and measures related to external recovery of waste
None.

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

Chlorine manufacture

Product characteristic

Concentration: 100%
Physical state: gas (liquefied)

Amounts used

The amounts used may vary between mL (sampling) and m3 (material transfer).

Frequency and duration of use/exposure

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

Production occurs inside and outside the facilities at room temperature.

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

The chlorine system is only opened after being emptied, purged, completely degassed, totally sealed using blind flanges and disconnected. In case of chlorine leaks, detection and monitoring are performed.
Loading and unloading: gaseous chlorine is transferred via pipeline to local users and the containers are filled with chlorine in closed systems, with the gases extracted from the reactor treated before being released into the air. When tanks or cylinders are used for smaller production, the chlorine is transferred through loading stations adapted to the container size.

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

Factories 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 monitoring chlorine is an electrochemical sensor sensitive not only to chlorine, but also to other substances present in the air. The concentration of chlorine measured in the air of a chloro-alkaline factory takes into account the exposure resulting from the manufacture of various substances (chlorine and, in many cases, other chlorinated chemicals).
Sufficient ventilation and/or extractor system in workplaces.
Adequate ventilation in machinery.

Organisational measures to prevent /limit releases, dispersion and exposure

All employees have received training. Safety procedures and protective equipment used to avoid skin and inhalation exposure must be dictated by the factory supervisor and documented at the work authority.

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

During normal work procedures, since chlorine is produced in a closed system, the worker can only be exposed to chlorine in case of a leak. Liquefaction, storage and loading areas are fitted with detectors. All factory workers receive specific training on how to react safely in the event of leaks. Personal Protective Equipment (PPE) is always used: safety goggles and shoes, long-sleeved shirts, long trousers, masks. In case of chlorine leaks detection and monitoring are performed. Self-contained breathing apparatus is used in emergency operations.
Respiratory protection

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- In case of releases, facial mask with type-B filter.
 - Self-contained breathing apparatus in restricted space/insufficient oxygenation, in case of uncontrolled releases or in large amounts, or whenever the mask or filter does not provide adequate protection.
 - Use only respiratory protection which meets international/national standards.
- Hand protection
- Chemically resistant protective gloves.
 - Recommended materials: Neoprene (Non-recommended materials: PVC, polyethylene)
- Eye protection
- Wear protective goggles for all industrial operations.
 - Where there is risk of splashing wear chemically resistant goggles/face protection.
- Skin protection
- Coveralls
 - Neoprene apron and boots, where there is risk of splashing
- Other precautions
- Shower and eye-bath facilities.
 - Remove contaminated clothing immediately after work.
 - Consult the person responsible for industrial health and safety to choose adequate personal protective equipment

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