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	<h1 style="font-size: 2em;">Chlorine</h1>	

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

1.1 Product Identifier

Chemical name:	Chlorine
EC number:	231-959-5
CAS No:	7782-50-5
Index no.:	017-001-00-7
Registration number:	01-2119486560-35-0030
Chemical characterisation:	Inorganic mono-constituent substance
Others means of identification/ Trade names	BE-CLR


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)	Industrial manufacture & distribution of chlorine- ES 1 - Annex 1 Industrial & professional use of chlorine- ES 2 - Annex 2
Uses advised against	There are no uses advised against

1.3 Details of the supplier of the safety data sheet

Company:	BONDALTI CHEMICALS, SA Rua do Amoníaco Português, nº 10 Quinta da Indústria, Beduído 3860-680 Estarreja - Portugal
Telephone:	+351 234 810 300
Fax:	+351 234 810 361
Web page:	www.bondalti.com
Contact:	Maria José Alves
E-mail:	fds@bondalti.com

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

1.4 Emergency telephone number

BONDALTI CHEMICALS, SA Telephone: Fax:	+351 234 810 300 (24 hours/day - 7 days/week) +351 234 810 361
Portuguese emergency number	112
SOS – Poisons Centre	In England and Wales: NHS 111 - dial 111 In Scotland: NHS 24 - dial 111 In North Ireland: Contact local GP or pharmacist during normal hours; In Republic of Ireland: 01 809 2166 United States of America: 1-800-222-1222 Cyprus: Department of Labour Inspection, Ministry of Labour

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Self classification of Chlorine according to EU regulation 1272/2008

Hazard Class	Hazard Category	Hazard Statements
Oxidising gas	Oxid. Gas 1	H270: May cause or intensify fire; oxidiser
Gases under pressure	Press. Gas (Liq.)	H280: Contains gas under pressure; may explode if heated
Acute Toxicity	Acute Tox. 2	H330: Fatal if inhaled
Serious eye damage/eye irritation	Eye irrit. 2	H319: Causes serious eye irritation
Specific target organ toxicity — single exposure	STOT SE 3	H335: May cause respiratory irritation
Skin corrosion/irritation	Skin irrit. 2	H315 Causes skin irritation
Hazardous to the aquatic environment	Aquatic Acute 1	H400: Very toxic to aquatic life (M-Factor: 100)

2.2 Label elements

Regulation (EC) No 1272/2008

Hazard Pictogram:



GHS03




GHS04



GHS06



GHS09

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments</p> <p style="text-align: center;">Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
	<h1 style="font-size: 1.5em;">Chlorine</h1>	

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 H330: Fatal if inhaled H335: May cause respiratory irritation. H400: Very toxic to aquatic life
Precautionary statements:	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. P304+P340: IF INHALED: Remove person to fresh air and keep comfortable for breathing. 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

2.3 Other hazards

Data unavailable.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances


Hazardous substances

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

SECTION 4: FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled:	Remove the victim from the contaminated area as quickly as possible: transport the victim, keeping the head higher than the body, to a calm, decontaminated and well ventilated location. Administer oxygen or cardiopulmonary resuscitation if necessary.
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	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments</p> <p style="text-align: center;">Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

	<p>Always call a physician immediately Take the victim to hospital Keep victim warm.</p>
In case of skin contact:	<p>Put the victim under a shower still fully clothed. Remove shoes, socks and contaminated clothing: wash the exposed skin with plenty of running water. Always call a physician immediately. Keep the individual warm (with a blanket) and provide clean clothing.</p>
In case of eye contact:	<p>Rinse with plenty of water (minimum 15 minutes), lifting up the eyelids. In case of difficulty opening eyelids, administer analgesic collyrium (oxybuprocaine). Always consult an eye specialist and physician immediately. Take the victim to hospital immediately.</p>
If swallowed:	<p>Take the victim to hospital immediately.</p>


First aider protection

Respiratory protection:	<p>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 in large quantity, or in any case in which the mask or filter do not provide adequate protection. Only use equipment that meets national/international standards.</p>
Hand protection:	<p>Wear chemically resistant protective gloves; Recommended materials: Neoprene rubber Non-recommended materials: PVC, polyethylene</p>
Eye protection:	<p>Wear goggles for all industrial operations. Where there is risk of splashing, wear chemically resistant goggles/face protection.</p>

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

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

4.2.2 Skin contact

- Skin irritation and burns

4.2.3 Eye contact

- Conjunctival irritation.
- Lacrimation

4.2.4 Swallowing

Not applicable.

4.3. Indication of any 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

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media:	In case of very close fire, all extinguishing media 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

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	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

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.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

6.1.1 For 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 For 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.
- 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 flush into surface water or into sanitary sewer system.

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.


6.3.2 – Water curtains should be applied to the enclosure.

- If applicable, use suitable foam.

6.3.3 - Do not use water directly on the product.

- Collect the waste for suitable containers and send it to an authorized entity.

6.4 Reference to other sections

	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

- See sections 7 and 8 for protective measures.
- See section 13 on waste treatment.

SECTION 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, cooling and swimming-pool disinfection, waste water treatment, textile and in the pulp and paper industry.

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

8.1 Control parameters

8.1.1 Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Legal basis
Chlorine	7782-50-5	0.5 ppm 1.5 mg/m ³	TWA TWA	TLV (ACGIH-USA) 2004
		1 ppm 2.9 mg/m ³	STEL STEL	
		0.5 ppm 1.5 mg/m ³	STEL	Commission Directive 2006/15/EC

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)

PNEC aqua (freshwater): 0.21µg/L

Intermittent releases: 0.26µg/L

PNEC aqua (marine water): 0.042µg/L

PNEC Sewage treatment plant: 0.03mg/L


8.2 Exposure control

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, such as personal protective equipment

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

Respiratory protection:	<p>In case of release, use a mask with type B filter.</p> <p>Use self-contained breathing apparatus in limited spaces with insufficient oxygenation, in case of uncontrolled releases or in large quantity, or in any case in which the mask or filter do not provide adequate protection.</p> <p>Only use equipment that meets national/international standards.</p>
Hand protection:	<p>Wear chemically resistant protective gloves;</p> <p>Recommended materials: Neoprene</p> <p>Non-recommended materials: PVC, polyethylene</p>
Eye protection:	<p>Wear goggles for all industrial operations.</p> <p>Where there is risk of splashing, wear chemically resistant goggles/face protection.</p>
Body and skin protection:	<p>Wear coveralls.</p> <p>Where there is risk of splashing, wear a neoprene apron and boots.</p>
Thermal hazards	<p>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.</p>


8.2.3 Environmental exposure controls

- Ventilation equipment connected to emergency absorption unit

Applicable regulations:

- 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council;
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
- Commission Regulation (EU) No 1357/2014 of 18 December 2014 - replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives

9. PHYSICAL AND CHEMICAL PROPERTIES

	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

9.1 Information on basic physical and chemical properties

a) Appearance:	Yellow liquid
b) Odour:	Irritant
c) Odour threshold:	3 ppm
d) pH:	Not applicable
e) Melting point/freezing point:	172.12K (-101.05 °C) at 101.3 kPa
f) Initial boiling point and boiling range:	239.12K (-34.05 °C) at 101.3 kPa
g) Flash point:	Non-flammable
h) Evaporation rate:	No data
i) Flammability (solid, gas):	Non-flammable
j) Upper/lower flammability or explosive limits:	Non-flammable
k) Vapour pressure:	6780 hPa at 20 °C
l) Vapour density:	2.491 at 20 °C (air=1)
m) Relative density:	1411 Kg/dm ³ at 20 °C
n) Solubility(ies):	7 410 mg/L in water at 20 °C
o) Partition coefficient: n-octanol/water:	The test is not applicable for chlorine as the organic phase will be oxidised immediately.
p) Auto-ignition temperature:	Not applicable
q) Decomposition temperature:	Not applicable
r) Viscosity:	(*)
s) Explosive properties:	Non-explosive
t) Oxidising properties:	Molecular chlorine is a strong oxidiser


(*) Gas viscosity at 20 °C (dynamic) – 13.3mPa.s

9.2 Other information

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

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity

	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

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.

SECTION 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

Chlorine

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.

<i>Hazard Class</i>	<i>Dose descriptor</i>	<i>Method/reference</i>
Acute oral toxicity:	LD ₅₀ : 1100 mg/kg bw (male Wistar rat) (NaClO as Cl ₂ available)	equivalent or similar to OECD Guideline 401 (Acute Oral Toxicity) [before 2002] Kästner, W.; Heitland; Disch; Gloxhuber 1981
Acute Oral: repeated dose toxicity	NOAEL: 50 mg/kg bw/day (nominal) (male) (presupposing a water consumption of 25 mL/day for a mouse and body weight of 500 g)	Equivalent or similar to OECD Guideline 453 (Combined Chronic Toxicity / Carcinogenicity Studies) ; equivalent or similar to OECD Guideline 408 (Repeated Dose 90-Day Oral Toxicity in Rodents) Hasegawa et al. 1986
Acute dermal toxicity:	LD ₅₀ : >20000 mg/kg bw (male/female Albino rat)	Equivalent or similar to OECD Guideline 402 (Acute Dermal Toxicity) Griffiths, B.S. 1978
Acute inhalation toxicity:	LC ₅₀ : 0.65 mg/m ³ air (male Wistar rat));	Zwart, A. (1987)
Inhalation toxicity, repeated dose:	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)	Similar to OECD guideline 413 "Subchronic Inhalation Toxicity: 90-day Study" Klönne, D.R. et al 1987
Skin Irritation/corrosion:	Slightly Irritant Primary dermal irritation index-PDII: 1.2 of max. 8 (Time point: 4/24/48 h) Reversibility: fully reversible (Rabbit) 0.8 of max. 8 (Time point: 4/24/48 h) Reversibility: fully reversible (Guinea pig)	According to OECD Guideline 404 (Acute Dermal Irritation/Corrosion) Nixon, G.A. et al. (1975)
<i>Hazard Class</i>	<i>Dose descriptor</i>	<i>Method/reference</i>
Serious Eye damage/irritation:	Irritant (rabbit) Irritant effects on eyes were reported in a variation of chlorine concentration of 0.2 at 4 ppm (0.6 at 12 mg/m ³) According to secondary literature,	Equivalent or similar to OECD Guideline 405 (Acute Eye Irritation / Corrosion); Carter, R.O., Griffith, J.F. (1965)

Safety Data Sheet

according to EU Regulations 1907/2006 and other
 amendments
 Integrated Management System

Processed by computer
 FS-84-005

Revision: 01-04-2019


Version: 15

(Replaces the version 14 from 08-01-2019)

Chlorine

	exposure to chlorine may result in cornea lesions, weakened vision and blindness (corrosive effect).	
Skin sensitisation:	Not sensitising No. with positive reactions: 1st reading: 0 of 20 (group test); 24 h after challenge dose; dose: 50% 1st reading: 0 of 10 (negative control); 24 h after the challenge dose; dose: 50 % 2nd reading: 0 of 20 (group test); 48 h after the challenge dose; dose: 50 % 2nd reading: 0 of 10 (negative control); 48h after challenge dose; dose: 50 %	Equivalent or similar to OECD Guideline 406 (Skin sensitisation); Buehler method Sternier, W. 1985
Respiratory sensitisation:	Irritant NOAEC 1.5 mg/m ³ (human volunteers)	
Germ cell mutagenicity	Positive with metabolic activation;	Equivalent or similar to OECD Guideline 471 (Bacterial Reverse Mutation Assay); Kawachi et al. (1980)
In vitro:	Test results: positive for <i>S. typhimurium</i> TA 100 (cell type/load: <i>S. typhimurium</i> TA100); met. act.: with Result assessment: negative	
In vivo:	Test results: Genotoxicity: negative (male); Toxicity: no effects	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 mouse) (drinking water oral); NOAEL (toxicity): 50 mg/kg bw/day (nominal) (male mouse) (drinking water oral); Neoplasia effects: none	Equivalent or similar to OECD Guideline 453 (Combined Chronic Toxicity/Carcinogenicity Studies); Hasegawa, R. et al. (1986)

Hazard Class	Dose descriptor	Method/reference
Reproductive toxicity: Effects on fertility:	NOAEL: 5 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

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

Toxicity development:	NOAEL: ≥ 5.7 mg/kg/bw/ day	Smith K. (1986) Equivalent or similar to OECD Guideline 414 (Prenatal Development Toxicity Study); Abdel-Raahman et al (1982)
STOT – Single Exposure	Affected organs: Respiratory tract Route of exposure: Inhalation	

SECTION 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/species	Dose descriptor	Method/reference
Toxicity in fish	Freshwater: Trout: LC ₅₀ (96h) = 0.06 mgTRC/L (most sensitive species) Marine Water: Coho salmon (<i>Oncorhynchus Kisutch</i>): LC ₅₀ (96h) = 0.032 mg/L	Directive not indicated; Heath, A.G. (1978) Directive not indicated; Thatcher, T.O. (1978a)
Toxicity in daphnia and other aquatic invertebrates (Short-term): Toxicity in daphnia and other aquatic invertebrates (Long-term):	Daphnia Freshwater (48h) EC ₅₀ /LC ₅₀ : 0.141 mg/L Marine water invertebrates (48h) EC ₅₀ /LC ₅₀ : 0.026 mg/L Freshwater /Marine water (15 days) EC ₁₀ /LC ₁₀ /NOEC: 0.007 mg/L	OECD Directive 202 (Daphnia sp. Acute immobilisation test); Gallagher, S. P.; Lezotte, F.; Krueger, H. O. (2009). Roberts and Glesson, (1978) No indication of Directive; Liden, L.H (1980)

Hazard Class/species	Dose descriptor	Method/reference
Toxicity in algae	NOEC (7d) for freshwater algae: 0.002 mg/L EC ₅₀ /LC ₅₀ for saltwater algae: 0.4 mg/L	Cairns et al. (1990) Videau, C. (1979)
Toxicity to freshwater	EC ₅₀ /LC ₅₀ for freshwater plants 0.1	Continuous and intermittent

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Print Date: 23-05-19

	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

plants	mg/L NOEC for freshwater plants: 0.02 mg/L	exposure (2 experiments) on chlorine dissolved in a continuous flow system of vascular and ubiquitous specimens of aquatic plants. 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 and 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

Data unavailable.


13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

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Print Date: 23-05-19

 BONDALTI <small>EVOLVING CHEMISTRY</small>	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

Waste disposal procedures:

- Absorb the product in an alkaline solution (caustic soda or sodium carbonate).
- Reduce the product with sulphite, pyrosulphite or alkaline thiosulphate.
- EWC Code 06 07 99 – Wastes not otherwise specified

Packaging treatment:

- Chlorine packaging to be discarded must be degassed and the residual chlorine neutralised before being dispatched as packaging waste.
- Recycling of packaging is preferable to elimination.
- Rinse containers with water and neutralize obtained water
- EWC Code 15 01 10(*) – Packaging containing / contaminated by waste from hazardous substances. The waste from this product must be treated as hazardous and in accordance with current legislation.


Applicable regulations:

- 2014/955/EU: Commission Decision of 18 December 2014 amending Decision 2000/532/EC on the list of waste pursuant to Directive 2008/98/EC of the European Parliament and of the Council;
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives
- Commission Regulation (EU) No 1357/2014 of 18 December 2014 - replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives

SECTION 14: TRANSPORT INFORMATION

Transport Classification for ADR

14.1 UN number:	1017
14.2 UN proper shipping name:	Chlorine
14.3 Transport hazard class(es):	2
Labels:	2.3 + 5.1 + 8
Packing Instruction (LQ):	-

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

Packing Instruction (EQ):	-
14.4 Packing group:	-
14.5 Environmentally hazardous:	Yes
14.6 Special precautions for user	
Tunnel restriction code:	(C/D)
Hazard Identification no:	265
Classification code:	2TOC

Transport Classification for IMDG

14.1 UN number:	1017
14.2 UN proper shipping name:	Chlorine
14.3 Transport hazard class(es):	2
Labels:	Toxic Gas + Corrosive + Oxidising + Marine Pollutant
14.4 Packing group:	-
14.5 Environmentally hazardous:	Yes
14.6 Special precautions for user:	
EmS:	F-C, S-U

Transport Classification for RID


14.1 UN number:	1017
14.2 UN proper shipping name:	Chlorine
14.3 Transport hazard class(es):	2
Labels:	T, N 2.3 + 5.1 + 8
14.4 Packing group:	-
14.5 Environmentally hazardous:	Yes
14.6 Special precautions for user:	
Classification Code:	2TOC
Hazard Identification no:	265
HI/UN	

Transport Classification for IATA

Transportation allowed only on special circumstances

SECTION 15: REGULATORY INFORMATION

15.1. Specific Safety, Health and Environmental Regulations/Legislation for the Substance or mixture

 BONDALTI <small>EVOLVING CHEMISTRY</small>	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

- Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH), establishing a European Chemicals Agency, amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC, and other 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, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006, and other amendments;
- Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products and other 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 (fourteenth individual Directive within the meaning of Article 16(1) of Directive 89/391/EEC) and other amendments;
- Commission Directive 2006/15/EC of 7 February 2006 establishing a second list of indicative occupational exposure limit values in implementation of Council Directive 98/24/EC and amending Directives 91/322/EEC and 2000/39/EC ;
- Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives and other amendments;
- Commission Regulation (EU) No 1357/2014 of 18 December 2014 - replacing Annex III to Directive 2008/98/EC of the European Parliament and of the Council on waste and repealing certain Directives;
- Directive 2008/68/EC of the European Parliament and of the Council of 24 September 2008, on the inland transport of dangerous goods (ADR; RID and ADN) and other amendments;
- Directive 2012/18/EU of the European Parliament and of the Council of 4 July 2012 on the control of major-accident hazards involving dangerous substances, amending and subsequently repealing Council Directive 96/82/EC.

15.2 Chemical safety assessment

A chemical safety study was made.

SECTION 16: OTHER INFORMATION


Changes are on blue colour.

DATE	REVISION	CHANGES MADE
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Updated: 01-04-2019

Print Date: 23-05-19

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments</p> <p style="text-align: center;">Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
	<h1 style="font-size: 1.5em;">Chlorine</h1>	

01-04-2019	15	Section 2.2
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Abbreviations mentioned on the Sheet:

- Acute Tox. 2 - Acute toxicity when inhaled, category 2
- ADR – European Agreement concerning the International Carriage of Dangerous Goods by Road
- Aquatic Acute 1 - Acute toxicity in aquatic environment, category 1
- bw – body weight
- CAS No. – World authority for chemical information
- DNEL – Derived Non Effect Concentration"
- EC No. – European Community
- EC50 – Medium effective concentration
- EQ - Excepted quantities
- ERC - Environmental Release Category
- ES: - Exposure Scenario
- EWG - European Waste Catalogue
- Eye Irrit. 2 - Serious eye damage/eye irritation, category 2
- IATA – International Air Transport Association
- IMDG – International Maritime Dangerous Goods
- LC₅₀ – Median lethal concentration
- LD₅₀ – Median lethal dose
- LOAEL – Lowest observed adverse effect level
- LQ – Limited Quantities
- M-factor - Multiplying factor for substances that are highly toxic to aquatic environment
- NOAEC – No observed adverse effect concentration
- NOAEL – No observed adverse effect level
- NOEC- No Observed Effect Concentration
- Oxid. Gas 1 - Oxidising gas, category 1
- PBT - Persistent, bioaccumulative and toxic.
- PC - Product Category
- PNEC – Predicted Non Effect Concentration
- Press. Gas - Gases under pressure
- PROC - Process Category
- REACH - Registration, Evaluation, Authorization and Restriction of Chemicals
- RID – International Rule for Transport of Dangerous Substances by Railway
- SDS - Safety Data Sheet
- Skin Irrit. 2 - Skin corrosion/irritation, category 2
- STOT SE - Specific target organ toxicity – single exposure
- STOT SE 3 - Specific target organ toxicity – single exposure, category 3
- SU - Sector of Use
- vPvB - Very persistent and very bioaccumulative.


References:

CHEMICAL SAFETY REPORT- 31-05-2018 – IUCLID 6 v2.0.0

Printout not checked

Updated: 01-04-2019

Print Date: 23-05-19


	<p align="center">Safety Data Sheet</p> <p align="center">according to EU Regulations 1907/2006 and other amendments</p> <p align="center">Integrated Management System</p>	<p align="right">Processed by computer FS-84-005</p> <p align="right">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
Chlorine		

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: ES 1 Industrial manufacture & distribution of chlorine

Annex 2: ES 2 Industrial & professional use of chlorine

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments</p> <p style="text-align: center;">Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1 style="margin: 0;">Chlorine</h1>		

Annex 1

Exposure Scenario 1 – Industrial manufacture & distribution of chlorine

Use 1 - Industrial manufacture & distribution of chlorine
<p>SU8 Manufacture of bulk, large-scale chemicals</p> <p>SU10 Formulation of preparations and/or re-packaging</p> <p>PROC1 Use in closed process, no likelihood of exposure</p> <p>PROC 2 Use in closed, continuous process with occasional controlled exposure (e.g. sampling)</p> <p>PROC 3 Use in closed batch process (synthesis or formulation)</p> <p>PROC 4 Use in batch and other process (synthesis) where opportunity for exposure arises</p> <p>PROC 8b Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities</p> <p>PROC 9 Transfer of substance or preparation into small containers (dedicated filling line, including weighing)</p> <p>PROC 15 Use of laboratory reagents in small scale laboratories</p> <p>ERC1 Manufacture of substances</p> <p>ERC2 Formulation of preparations</p>
<p>Contributing scenario (1, environment): Manufacturing of chlorine ERC 1, 2</p>
<p>Contributing scenario (2, worker): Manufacturing of chlorine PROC 1, 2, 3, 4, 8a, 8b, 9,15</p>
Exposure scenario
Contributing scenario (1) controlling environmental exposure for use 1— Manufacturing of chlorine
<p>Manufacturing of chlorine</p>
<p>Product characteristics</p>
<p>Concentration: 100%</p> <p>Physical form: gas (liquefied)</p>
<p>Amounts used</p>
<p>10443 kt/year</p>
<p>Frequency and duration of use</p>
<p>Continuous release; 365 days/year</p>
<p>Environment factors not influenced by risk management</p>
<p>Dilution factor: 10 rivers, 100 coastal zones (default)</p>
<p>Other given operational conditions affecting environmental exposure</p>

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
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Chlorine

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 or 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 release
Do not discharge into the environment.

Organisational 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, pyrosulfate or alkaline thiosulfate

Packing treatment:

- To avoid treatment, 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 characteristics

Concentration: 100%

Physical form: 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 m³/8h-day (light activity)

Body weight: 70 kg (worker).

Safety Data Sheet

according to EU Regulations 1907/2006 and other
amendments
Integrated Management System

Processed by computer
FS-84-005

Revision: 01-04-2019

Version: 15

(Replaces the version 14 from 08-01-2019)

Chlorine

Other given operational conditions affecting worker exposure

The production takes place both indoors and outdoors at ambient temperature.

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

The opening of a 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 volumes, chlorine is transferred 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 sensitive not only to chlorine, but also to other chlorinated substances present in the air. Chlorine levels measured in the vicinity of a chloro-alkaline plant may also reflect the levels of other chlorinated chemicals present in the atmosphere.

Sufficient ventilation 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 determined 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 will occur only in the event of a leak. Liquefaction, storage and loading areas are equipped with detectors. All workers in the plant receive specific training to react in a safe way in the event of a leak. Personal Protective Equipment (PPE) is always used: goggles, safety shoes, long sleeved shirt, long pants, escape mask. In the event of a chlorine leak, detection and monitoring are performed.


Self-contained breathing apparatus are used for emergency operations.

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<h1>Chlorine</h1>		


Annex 2

Exposure Scenario 2 - Industrial & professional use of chlorine

Use 2 Industrial & professional use of chlorine:
<p>SU3 Industrial uses SU6b Manufacture of pulp, paper and paper products SU8 Manufacture of bulk, large scale chemicals SU9 Manufacture of fine chemicals SU16 Manufacture of computer, electronic and optical products, electrical equipment SU22 Professional uses SU24 Scientific research and development</p> <p>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 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 15 Use of laboratory reagents in small scale laboratories ERC 6a Industrial use resulting in manufacture of another substance (use of intermediates) ERC 6b Industrial use of reactive processing aids</p>
Contributing scenario (1, environment): Industrial & professional use of chlorine ERC 6a, 6b
Contributing scenario (2, worker): Industrial & professional use of chlorine PROC 1, 2, 3, 4, 15
Exposure scenario
Contributing scenario (1) controlling environmental exposure for use 2 Industrial & professional use of chlorine
Industrial & professional use of chlorine
Product characteristics
Concentration: 100%
Physical form: gas (liquefied)
Amounts used
10443 kt/year
Frequency and duration of use/exposure
Continuous release; 365 days/year
Environment factors not influenced by risk management
Dilution factor: 10 rivers, 100 coastal zones (default)

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

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 or 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 release Do not discharge into the environment.
Organisational measures to prevent/limit release from site
All personnel are trained.
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
Waste treatment <ul style="list-style-type: none"> - 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 Packing treatment: <ul style="list-style-type: none"> - To avoid treatment, 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 & professional use of chlorine
Industrial & professional use of chlorine
Product characteristics
Concentration: 100%
Physical form: gas (liquefied)
Amounts used
The amounts used may vary between ml (sampling) and m ³ (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

	<h2 style="text-align: center;">Safety Data Sheet</h2> <p style="text-align: center;">according to EU Regulations 1907/2006 and other amendments Integrated Management System</p>	<p style="text-align: right;">Processed by computer FS-84-005</p> <p style="text-align: right;">Revision: 01-04-2019 Version: 15 (Replaces the version 14 from 08-01-2019)</p>
<h1>Chlorine</h1>		

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

Body weight: 70 kg (worker).

Other given operational conditions affecting worker exposure

The use takes place both indoors and outdoors at ambient temperature.

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

The opening of a 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 volumes, chlorine is transferred 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 sensitive not only to chlorine, but also to other chlorinated substances present in the air. Chlorine levels measured in the vicinity of a chloro-alkaline plant may also reflect the levels of other chlorinated chemicals present in the atmosphere.

Sufficient ventilation and/or exhaust in work rooms.

Appropriate exhaust ventilation at machinery.

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Self-contained breathing apparatus are used for emergency operations.