SAFETY DATA SHEET

According to Regulation (EC) No. 1907/2006 (REACH) Article 31, Annex II as amended

Chlorine

Issue Date: Revision Date: Last revised date :	16.01.2013 21.11.2023 14.04.2022	Version: 2.2	SDS No.: 000010021781 1/42

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier

Product name: Chlorine

Trade name: Chlorine 2.8 Chemical, Chlorine 4.0, Chlorine 5.0

Additional identification

Chemical name:	Chlorine
Chemical formula:	Cl2
INDEX No.	017-001-00-7
CAS-No.	7782-50-5
EC No.	231-959-5
REACH Registration No.	01-2119486560-35

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

Identified uses:
Industrial and professional. Perform risk assessment prior to use.
Bleaching agent.
Use as an Intermediate (transported, on-site isolated).
Use for electronic component manufacture.
Using gas alone or in mixtures for the calibration of analysis equipment.
Using gas as feedstock in chemical processes.
Using gas for metal treatment.
Water treatment.
Formulation of mixtures with gas in pressure receptacles.
Exempt from registration requirements.
Use of gas to manufacture pharmaceutical products.
Biocidal uses.

Uses advised against Consumer use.

1.3 Details of the supplier of the safety data sheet

Supplier

Oy Linde Gas Ab
Itsehallintokuja 6
FIN-02600 ESPOO

Telephone: +358 10 2421

E-mail: sds.ren@linde.com

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1.4 Emergency telephone number: Poison Information Center: open 24 hours a day, tel. 09 471 977

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Classification according to Regulation (EC) No 1272/2008 as amended.

Physical Hazards

Oxidizing gases	Category 1	H270: May cause or intensify fire; oxidizer.
Gases under pressure	Liquefied gas	H280: Contains gas under pressure; may explode if heated.

Health Hazards

Acute toxicity (Inhalation - gas)	Category 2	H330: Fatal if inhaled.
Skin irritation	Category 2	H315: Causes skin irritation.
Serious eye irritation	Category 2	H319: Causes serious eye irritation.
Specific Target Organ Toxicity - Single Exposure	Category 3	H335: May cause respiratory irritation.

Environmental Hazards

Acute hazards to the aquatic environment	Category 1	H400: Very toxic to aquatic life.
Chronic hazards to the aquatic environment	Category 1	H410: Very toxic to aquatic life with long lasting effects.

2.2 Label Elements

Contains: Chlorine

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Signal Word: Danger

Hazard Statement(s):
H270: May cause or intensify fire; oxidizer.
H280: Contains gas under pressure; may explode if heated.
H330: Fatal if inhaled.
H315: Causes skin irritation.
H319: Causes serious eye irritation.
H410: Very toxic to aquatic life with long lasting effects.

Precautionary Statements

General None.

Prevention:
P220: Keep away from clothing and other combustible materials.
P244: Keep valves and fittings free from oil and grease.
P260: Do not breathe gas/vapors.
P273: Avoid release to the environment.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response:
P302+P352: IF ON SKIN: Wash with plenty of soap and water.
P332+P313: If skin irritation occurs: Get medical advice/attention.
P304+P340+P315: IF INHALED: Remove person to fresh air and keep comfortable for breathing. Get immediate medical advice/attention.
P305+P351+P338+P315: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.
P370+P376: In case of fire: Stop leak if safe to do so.

Storage:
P403: Store in a well-ventilated place.
P405: Store locked up.

Disposal None.

Supplemental information
EUH071: Corrosive to the respiratory tract.

Unknown toxicity - Health

Acute toxicity, inhalation, gas	100 %
Acute toxicity, inhalation, gas	0 %

Unknown toxicity - Environment

Acute hazards to the aquatic environment	0 %
Chronic hazards to the aquatic environment	0 %

2.3 Other hazards

Contact with evaporating liquid may cause frostbite or freezing of skin.

Endocrine disrupting properties-Toxicity

The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Endocrine disrupting properties-Ecotoxicity

The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

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SECTION 3: Composition/information on ingredients

3.1 Substances

Chemical name Chlorine
INDEX No.: 017-001-00-7
CAS-No.: 7782-50-5
EC No.: 231-959-5
REACH Registration No.: 01-2119486560-35
Purity: 100%
The purity of the substance in this section is used for classification only, and does not represent the actual purity of the substance as supplied, for which other documentation should be consulted.
Trade name: Chlorine 2.8 Chemical, Chlorine 4.0, Chlorine 5.0

Chemical name	Chemical formula	Concentration	CAS-No.	EC No.	REACH Registration No.	M-Factor:	Notes
Chlorine	Cl2	100%	7782-50-5	231-959-5	01-2119486560-35	Aquatic Toxicity (Acute): 100; Aquatic Toxicity (Chronic): 1	#

The concentrations of the components in the SDS header, product name on page one and in section 3.2 are in mol due to regulatory requirements. All concentrations are nominal.
This substance has workplace exposure limit(s).
This substance is listed as SVHC.PBT: persistent, bioaccumulative and toxic substance.
vPvB: very persistent and very bioaccumulative substance.

SECTION 4: First aid measures

General: Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

4.1 Description of first aid measures

Inhalation: Remove victim to uncontaminated area wearing self contained breathing apparatus. Keep victim warm and rested. Call a doctor. Apply artificial respiration if breathing stopped.

Eye contact: Rinse the eye with water immediately. Remove contact lenses, if present and easy to do. Continue rinsing. Flush thoroughly with water for at least 15 minutes. Get immediate medical assistance. If medical assistance is not immediately available, flush an additional 15 minutes.

Skin Contact: Immediately flush with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention. Contact with evaporating liquid may cause frostbite or freezing of skin.

Ingestion: Ingestion is not considered a potential route of exposure.

4.2 Most important symptoms and effects, both acute and delayed: Irritating to eyes, respiratory system and skin. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling. May be fatal if inhaled. Causes damage to organs.

4.3 Indication of any immediate medical attention and special treatment needed

Hazards: Irritating to eyes, respiratory system and skin. Contact with liquefied gas can cause damage (frostbite) due to rapid evaporative cooling. May be fatal if inhaled. Causes damage to organs.

Treatment: Thaw frosted parts with lukewarm water. Do not rub affected area. Get immediate medical advice/attention. Treat with a corticosteroid spray as soon as possible after inhalation. Get immediate medical advice/attention.

SECTION 5: Firefighting measures

General Fire Hazards: Heat may cause the containers to explode.

5.1 Extinguishing media

Suitable extinguishing media: Use water spray to reduce vapors or divert vapor cloud drift. Water Spray or Fog. Dry powder. Foam. Carbon Dioxide.

Unsuitable extinguishing media: None.

5.2 Special hazards arising from the substance or mixture: Fire or excessive heat may produce hazardous decomposition products. Supports combustion.

5.3 Advice for firefighters

Special fire-fighting procedures:	In case of fire: Stop leak if safe to do so. Use of water may result in the formation of very toxic aqueous solutions. Keep run-off water out of sewers and water sources. Dike for water control. Continue water spray from protected position until container stays cool. Use extinguishants to contain the fire. Isolate the source of the fire or let it burn out.
Special protective equipment for fire-fighters:	Gas tight chemically protective clothing (Type 1) in combination with self contained breathing apparatus. Guideline: EN 943-2 Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Performance requirements for gas-tight (Type 1) chemical protective suits for emergency teams (ET)

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures:	Evacuate area. In case of leakage, eliminate all ignition sources. Provide adequate ventilation. Monitor the concentration of the released product. Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous. Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe. EN 137 Respiratory protective devices - Self-contained open-circuit compressed air breathing apparatus with full face mask - Requirements, testing, marking.
6.2 Environmental Precautions:	Prevent further leakage or spillage if safe to do so. Reduce vapour with fog or fine water spray. Keep run-off water out of sewers and water sources. Dike for water control.
6.3 Methods and material for containment and cleaning up:	Provide adequate ventilation. Wash contaminated equipment or sites of leaks with copious quantities of water.
6.4 Reference to other sections:	Refer to sections 8 and 13.

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SECTION 7: Handling and storage:

7.1 Precautions for safe handling:

Only experienced and properly instructed persons should handle gases under pressure. Avoid exposure - obtain special instructions before use. Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Keep equipment free from oil and grease. Open valve slowly to avoid pressure shock. Use only oxygen approved lubricants and sealants. Use only with equipment cleaned for oxygen service and rated for the pressure. Installation of a cross purge assembly between the container and the regulator is recommended. Excess pressure must be vented through an appropriate scrubber system. Refer to supplier's handling instructions. The substance must be handled in accordance with good industrial hygiene and safety procedures. Protect containers from physical damage; do not drag, roll, slide or drop. Do not remove or deface labels provided by the supplier for the identification of the container contents. When moving containers, even for short distances, use appropriate equipment eg. trolley, hand truck, fork truck etc. Secure cylinders in an upright position at all times, close all valves when not in use. Provide adequate ventilation. Suck back of water into the container must be prevented. Do not allow backfeed into the container. Avoid suckback of water, acid and alkalis. Keep container below 50°C in a well ventilated place. Observe all regulations and local requirements regarding storage of containers. When using do not eat, drink or smoke. Store in accordance with local/regional/national/international regulations. Never use direct flame or electrical heating devices to raise the pressure of a container. Leave valve protection caps in place until the container has been secured against either a wall or bench or placed in a container stand and is ready for use. Damaged valves should be reported immediately to the supplier Close container valve after each use and when empty, even if still connected to equipment. Never attempt to repair or modify container valves or safety relief devices. Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment. Keep container valve outlets clean and free from contaminates particularly oil and water. If user experiences any difficulty operating container valve discontinue use and contact supplier. Never attempt to transfer gases from one container to another. Container valve guards or caps should be in place.

7.2 Conditions for safe storage, including any incompatibilities: Containers should not be stored in conditions likely to encourage corrosion. Keep away from food, drink and animal feeding stuffs. Stored containers should be periodically checked for general conditions and leakage. Container valve guards or caps should be in place. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible material. Avoid asphalted locations for storage, transfer and use (ignition risk if spilt). Segregate from flammable gases and other flammable materials being stored.

7.3 Specific end use(s): None.

SECTION 8: Exposure controls/personal protection

8.1 Control Parameters

Occupational Exposure Limits

Chemical name	Type	Form of exposure	Exposure Limit Values		Source
chlorine	HTP 15MIN		0,5 ppm	1,5 mg/m3	Finland. Workplace Exposure Limits, as amended (08 2007)
	STEL		0,5 ppm	1,5 mg/m3	EU. Indicative Occupational Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU, 2017/164/EU, as amended (12 2009)

Please refer to the latest edition of the appropriate source text and consult an industrial hygienist or similar professional, or local agencies, for further information.

Biological Limit Values

No biological exposure limits noted for the ingredient(s).

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DNEL-Values

Critical component	Type	Value	Remarks
Chlorine	Workers - Inhalation, Local, long-term	0,75 mg/m3	Repeated dose toxicity
	Workers - Inhalation, Systemic, long-term	0,75 mg/m3	Repeated dose toxicity
	Workers - Inhalation, Local, short-term	1,5 mg/m3	Repeated dose toxicity
	Workers - Inhalation, Systemic, short-term	1,5 mg/m3	Repeated dose toxicity
	Workers - Dermal, Systemic, short-term		Low hazard (no threshold derived)
	Workers - Dermal, Systemic, long-term		Low hazard (no threshold derived)
	Workers - Dermal, Local, short-term	0,5 %	Skin irritation
	Workers - Dermal, Local, short-term		No hazard identified

PNEC-Values

Critical component	Type	Value	Remarks
Chlorine	Sewage treatment plant	0,03 mg/l	-
Chlorine	Aquatic (freshwater)	0,21 µg/l	-
Chlorine	Aquatic (marine water)	0,042 µg/l	-
Chlorine	Aquatic (intermit. releases)	0,26 µg/l	-

8.2 Exposure controls

Appropriate engineering controls:

Consider a work permit system e.g. for maintenance activities. Ensure adequate air ventilation. Provide adequate general and local exhaust ventilation. Keep concentrations well below occupational exposure limits. Gas detectors should be used when toxic quantities may be released. Gas detectors should be used when quantities of oxidizing gases may be released. Avoid oxygen rich (>23,5%) atmospheres. Systems under pressure should be regularly checked for leakages. Product to be handled in a closed system and under strictly controlled conditions. Only use permanent leak tight installations (e.g. welded pipes). Do not eat, drink or smoke when using the product.

Individual protection measures, such as personal protective equipment

General information:

A risk assessment should be conducted and documented in each work area to assess the risks related to the use of the product and to select the PPE that matches the relevant risk. The following recommendations should be considered. Keep self contained breathing apparatus readily available for emergency use. Keep suitable chemically resistant protective clothing readily available for emergency use. Personal protective equipment for the body should be selected based on the task being performed and the risks involved. Protect eyes, face and skin from contact with product. Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

Eye/face protection:

Safety eyewear, goggles or face-shield to EN166 should be used to avoid exposure to liquid splashes. Wear eye protection to EN 166 when using gases. Guideline: EN 166 Personal Eye Protection.

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Skin protection

Hand Protection:

Guideline: EN 388 Protective gloves against mechanical risks.
Additional Information: Wear working gloves while handling containers
Guideline: EN 374-1/2/3 Protective gloves against chemicals and micro-organisms.
Additional Information: Chemically resistant gloves complying with EN 374 should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Material: Chloroprene rubber.
Break-through time: > 30 min
Glove thickness: 0,4 mm
Additional Information: For short term use:
Material: Fluoroelastomer.
Break-through time: > 480 min
Glove thickness: 0,7 mm
Additional Information: For long term use:

Body protection:

No special precautions.

Other:

Wear safety shoes while handling containers
Guideline: ISO 20345 Personal protective equipment - Safety footwear.

Respiratory Protection:

Reference should be made to European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for methods for the determination of hazardous substances. The selection of the Respiratory Protective Device (RPD) must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected RPD.
Material: Filter ABEK
Guideline: EN 14387 Respiratory protective devices. Gas filter(s) and combined filter(s). Requirements, testing, marking.
Guideline: EN 136 Respiratory protective devices. Full face masks. Requirements, testing, marking.

Thermal hazards:

No precautionary measures are necessary.

Hygiene measures:

Obtain special instructions before use. Specific risk management measures are not required beyond good industrial hygiene and safety procedures. Do not eat, drink or smoke when using the product.

Environmental exposure controls: For waste disposal, see section 13 of the SDS.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical state:	Gas
Form:	Liquefied gas
Color:	Greenish yellow
Odor:	Pungent irritating odor
Odor Threshold:	Odor threshold is subjective and is inadequate to warn of over exposure.
Melting Point:	-150 °F/-101 °C
Boiling Point:	-29 °F/-34 °C
Flammability:	This product is not flammable.
Upper/lower limit on flammability or explosive limits	
Explosive limit - upper:	Not applicable
Explosive limit - lower:	Not applicable
Flash Point:	Not applicable to gases and gas mixtures.
Autoignition Temperature:	Not applicable.
Decomposition Temperature:	Not known.
pH:	If dissolved in water pH-value will be affected.
Viscosity	
Dynamic viscosity:	0,013 mPa.s (68 °F/20 °C) Experimental result, Key study Gas
Kinematic viscosity:	No data available.
Solubility(ies)	
Solubility in Water:	5,1 g/l (86 °F/30 °C)
Solubility (other):	No data available.
Partition coefficient (n-octanol/water):	Not known.
Dispersion Stability:	No data available.

Vapor pressure:	6.780 hPa (68 °F/20 °C) Experimental result, Key study
Relative density:	No data available.
Density:	1,409 g/cm3 (68,0 °F/20,0 °C) 1,316 g/cm3 (122,0 °F/50,0 °C)
Relative vapor density:	2,5
Particle characteristics:	Not applicable

9.2 Other information

Oxidizing properties:	Ci: 0,7 Oxidizing
Molecular weight:	70,91 g/mol (Cl_2)
Critical Temp. (°C):	144,0 °C

SECTION 10: Stability and reactivity

10.1 Reactivity:	No reactivity hazard other than the effects described in sub-section below.
10.2 Chemical Stability:	Stable under normal conditions.
10.3 Possibility of hazardous reactions:	Violently oxidises organic material. May react violently with combustible materials. May react violently with reducing agents.
10.4 Conditions to avoid:	Avoid moisture in the installation.
10.5 Incompatible Materials:	Moisture. Combustible materials Reducing agents. Keep equipment free from oil and grease. For material compatibility see latest version of ISO-11114. Consider the potential toxicity hazard due to the presence of chlorinated or fluorinated polymers in high pressure (>30 bar) oxygen lines and equipment in case of combustion.
10.6 Hazardous Decomposition Products:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.

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SECTION 11: Toxicological information

General information: None.

11.1 Information on hazard classes as defined in Regulation (EC) No 1272/2008

Acute toxicity - Oral

Product Based on available data, the classification criteria are not met.

Chlorine: LD 50 (Rat, Male): 8.910 mg/kg Remarks: Read-across from supporting substance (structural analogue or surrogate), Supporting study
LD 50 (Wistar rat, Male): 1.100 mg/kg Remarks: Read-across from supporting substance (structural analogue or surrogate), Key study
LD 0 (Wistar rat, Male): 626 mg/kg Remarks: Read-across from supporting substance (structural analogue or surrogate), Key study

Acute toxicity - Dermal

Product Based on available data, the classification criteria are not met.

Chlorine: LD 50 (Albino rabbit, Female, Male): > 20.000 mg/kg (OECD Guideline 402 (Acute Dermal Toxicity).) Remarks: Read-across from supporting substance (structural analogue or surrogate), Key study

Acute toxicity - Inhalation

Product

Fatal if inhaled.

Chlorine: LC 50 (Wistar rat, Female, Male, 1 h): 834 mg/m3 (OECD Guideline 403 (Acute Inhalation Toxicity)) Remarks: Experimental result, Key study

Repeated dose toxicity

Chlorine: NOAEL (Monkey, rhesus (Macaca mulatta)(Female, Male), Inhalation, 1 yr): 0,5 ppm(m) Inhalation Experimental result, Key study
NOAEL (Sprague-Dawley rat(Female), Oral, 90 d): >= 24,9 mg/kg Experimental result, Key study
NOAEL (Sprague-Dawley rat(Male), Oral, 90 d): >= 16,7 mg/kg Experimental

result, Key study

Skin Corrosion/Irritation

Product — Causes skin irritation.

Chlorine — OECD Guideline 404 (Acute Dermal Irritation/Corrosion) (Guinea pig; Rabbit): Slightly irritating Read-across from supporting substance (structural analogue or surrogate), Key study 2 = reliable with restrictions

Serious Eye Damage/Eye Irritation

Product — Causes serious eye irritation.

Chlorine — OECD Guideline 405 (Draize Test for Acute Eye Irritation/Corrosion) (Rabbit (New Zealand White - Albino)): Irritatingread across 2 = reliable with restrictions

Respiratory or Skin Sensitization

Product — Based on available data, the classification criteria are not met.

Chlorine — Skin sensitization:, read-across (Guinea pig): Not sensitising

Germ Cell Mutagenicity

Product — Based on available data, the classification criteria are not met.

In vitro

Chlorine — Ames test in vitro: (OECD Guideline 471 (Bacterial Reverse Mutation Test)): Negative.

In vivo

Chlorine — Chromosome aberration Oral (Mouse): Negative.

Carcinogenicity

Product — Based on available data, the classification criteria are not met.

Reproductive toxicity

Product — Based on available data, the classification criteria are not met.

Specific Target Organ Toxicity - Single Exposure

Product May cause respiratory irritation.

Specific Target Organ Toxicity - Repeated Exposure

Product Based on available data, the classification criteria are not met.

Aspiration Hazard

Product Not applicable to gases and gas mixtures..

11.2 Information on other hazards

Endocrine disrupting properties

Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.;

Components:

Chlorine The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.;

Other information

Product: No data available.

SECTION 12: Ecological information

General information: Not applicable Not applicable

12.1 Toxicity

Acute toxicity

Product Very toxic to aquatic life with long lasting effects.

Acute toxicity - Fish

Chlorine LC 50 (Various, 96 h): 0,032 mg/l (flow-through) Remarks: 2 = reliable with restrictions Read-across from supporting substance (structural analogue or surrogate), Key study

Acute toxicity - Aquatic Invertebrates

Chlorine	NOEC (Daphnia magna, 48 h): 50 µg/l (flow-through) Remarks: Read-across from supporting substance (structural analogue or surrogate), Key study 1 = reliable without restrictions EC 50 (Daphnia magna, 48 h): 141 µg/l (flow-through) Remarks: Read-across from supporting substance (structural analogue or surrogate), Key study 1 = reliable without restrictions

Toxicity to microorganisms

Chlorine	Activated sludge, domestic. EC 50 (3 h): 77,1 mg/l Static Activated sludge, domestic. NOEC (3 h): 41,1 mg/l Static Activated sludge, domestic. EC10 (3 h): 46,9 mg/l Static Static NOEC (Algae (Pseudokirchneriella subcapitata), 72 h): 0,0054 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test)) EC 50 (Algae (Pseudokirchneriella subcapitata), 72 h): 0,0365 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test)) EC10 (Algae (Pseudokirchneriella subcapitata), 72 h): 0,0199 mg/l (OECD Guideline 201 (Freshwater Alga and Cyanobacteria, Growth Inhibition Test))

Chronic Toxicity - Fish

Chlorine	LOAEL (Various): 0,014 mg/l (flow-through) Read-across from supporting substance (structural analogue or surrogate), Supporting study NOAEL (Various): 0,014 mg/l (flow-through) Read-across from supporting substance (structural analogue or surrogate), Supporting study NOAEL (Various): 0,062 mg/l (flow-through) Read-across from supporting substance (structural analogue or surrogate), Supporting study

Chronic Toxicity - Aquatic Invertebrates

Chlorine	LOAEL (V. iris (Ambloplites rupestris) and Cottus carolinae (E. capsaeformis)): 30 µg/l (flow-through) Read-across from supporting substance (structural analogue or surrogate), Supporting study

Additional ecological information

None.

12.2 Persistence and Degradability

Product Not applicable to gases and gas mixtures..

12.3 Bioaccumulative potential

Product The subject product is expected to biodegrade and is not expected to persist for long periods in an aquatic environment.

12.4 Mobility in soil

Product Because of its high volatility, the product is unlikely to cause ground or water pollution.

12.5 Results of PBT and vPvB assessment

Product Not classified as PBT or vPvB.

12.6 Endocrine disrupting properties:

Product: The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

Components:

Chlorine The substance/mixture does not contain components considered to have endocrine disrupting properties according to REACH Article 57(f) or Commission Delegated regulation (EU) 2017/2100 or Commission Regulation (EU) 2018/605 at levels of 0.1% or higher.

12.7 Other adverse effects:

Other hazards

Product: None.

Other effects: No ecological damage caused by this product.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

General information: Must not be discharged to atmosphere. Consult supplier for specific recommendations.

Disposal methods: Refer to the EIGA code of practice (Doc.30 "Disposal of Gases", downloadable at http://www.eiga.org) for more guidance on suitable disposal methods. Dispose of container via supplier only. Discharge, treatment, or disposal may be subject to national, state, or local laws.

European Waste Codes
Container: 16 05 04*: Gases in pressure containers (including halons) containing hazardous substances.

SECTION 14: Transport information

ADR

14.1 UN number or ID number:	UN 1017
14.2 UN Proper Shipping Name:	CHLORINE
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.3, 5.1, 8
Hazard No. (ADR):	265
Tunnel restriction code:	(C/D)
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	Environmentally Hazardous
14.6 Special precautions for user:	–

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RID

14.1 UN number or ID number:	UN 1017
14.2 UN Proper Shipping Name	CHLORINE
14.3 Transport Hazard Class(es)	
Class:	2
Label(s):	2.3, 5.1, 8
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	Environmentally Hazardous
14.6 Special precautions for user:	–

IMDG

14.1 UN number or ID number:	UN 1017
14.2 UN Proper Shipping Name:	CHLORINE
14.3 Transport Hazard Class(es)	
Class:	2.3
Label(s):	2.3, 5.1, 8
EmS No.:	F-C, S-U
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.
14.5 Environmental hazards:	MARINE POLLUTANT
14.6 Special precautions for user:	–

IATA

14.1 UN number or ID number:	UN 1017
14.2 Proper Shipping Name:	Chlorine
14.3 Transport Hazard Class(es):	
Class:	2.3
Label(s):	–
14.4 Packing Group:	–
Limited quantity	None.
Excepted quantity	None.

14.5 Environmental hazards:	Environmentally Hazardous
14.6 Special precautions for user:	–
Other information	
Passenger and cargo aircraft:	Forbidden.
Cargo aircraft only:	Forbidden.

14.7 Maritime transport in bulk according to IMO instruments
Not applicable for product as supplied.

Additional identification: Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers ensure that they are firmly secured. Ensure that the container valve is closed and not leaking. Container valve guards or caps should be in place. Ensure adequate air ventilation.

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture:

EU Regulations

EU. REACH Annex XIV, Substances Subject to Authorization as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 1 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 2 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex I, Part 3 as amended: None present or none present in regulated quantities.

Regulation (EU) No. 649/2012 concerning the export and import of dangerous chemicals, Annex V as amended: None present or none present in regulated quantities.

EU. Directive 2012/18/EU (SEVESO III) on major accident hazards involving dangerous substances, Annex I:

Chemical	CAS-No.	Lower-tier Requirements	Upper-tier Requirements
Chlorine	7782-50-5	10 t	25 t

Directive 98/24/EC on the protection of workers from the risks related to chemical agents at work:

Chemical name	CAS-No.	Concentration
Chlorine	7782-50-5	100%

National Regulations

Council Directive 89/391/EEC on the introduction of measures to encourage improvements in the safety and health of workers at work Directive 2016/425/EEC on personal protective equipment Only products that comply with the food regulations (EC) No. 1333/2008 and (EU) No. 231/2012 and are labelled as such may be used as food additives.
This Safety Data Sheet has been produced to comply with Regulation (EU) 2020/878.

15.2 Chemical safety assessment: Chemical Safety Assessment has been carried out.

International regulations

Montreal protocol
Not applicable

Stockholm convention
Not applicable

Rotterdam convention
Not applicable

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Kyoto protocol
Not applicable

SECTION 16: Other information

Revision Information: Not relevant.

Abbreviations and acronyms:

ECTLV:	EU. Indicative Occupational Exposure Limit Values in Directives 91/322/EEC, 2000/39/EC, 2006/15/EC, 2009/161/EU, 2017/164/EU, as amended
FN_OEL:	Finland. Workplace Exposure Limits, as amended
ECTLV / STEL:	Short Term Exposure Limit (STEL):
FN_OEL / HTP 15MIN:	Short Term Exposure Limit (STEL):

ADN - European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways; ADR - Agreement concerning the International Carriage of Dangerous Goods by Road; AIIC - Australian Inventory of Industrial Chemicals; ASTM - American Society for the Testing of Materials; bw - Body weight; CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008; CMR - Carcinogen, Mutagen or Reproductive Toxicant; DIN - Standard of the German Institute for Standardisation; DSL - Domestic Substances List (Canada); ECHA - European Chemicals Agency; EC-Number - European Community number; ECx - Concentration associated with x% response; EIGA - European Industrial Gases Association; ELx - Loading rate associated with x% response; EmS - Emergency Schedule; ENCS - Existing and New Chemical Substances (Japan); ErCx - Concentration associated with x% growth rate response; GHS - Globally Harmonized System; GLP - Good Laboratory Practice; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; IBC - International Code for the Construction and Equipment of Ships carrying Dangerous Chemicals in Bulk; IC50 - Half maximal inhibitory concentration; ICAO - International Civil Aviation Organization; IECSC - Inventory of Existing Chemical Substances in China; IMDG - International Maritime Dangerous Goods; IMO - International Maritime Organization; ISHL - Industrial Safety and Health Law (Japan); ISO - International Organisation for Standardization; KECI - Korea Existing Chemicals Inventory; LC50 - Lethal Concentration to 50 % of a test population; LD50 - Lethal Dose to 50% of a test population (Median Lethal Dose); MARPOL - International Convention for the Prevention of Pollution from Ships; n.o.s. - Not Otherwise Specified; NO(A)EC - No Observed (Adverse) Effect Concentration; NO(A)EL - No Observed (Adverse) Effect Level; NOELR - No Observable Effect Loading Rate; NZIoC - New Zealand Inventory of Chemicals; OECD - Organization for Economic Co-operation and Development; OPPTS - Office of Chemical Safety and Pollution Prevention; PBT - Persistent, Bioaccumulative and Toxic substance; PICCS - Philippines Inventory of Chemicals and Chemical Substances; (Q)SAR - (Quantitative) Structure Activity Relationship; REACH - Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals; RID - Regulations concerning the International Carriage of Dangerous Goods by Rail; SADT - Self-Accelerating Decomposition Temperature; SDS - Safety Data Sheet; SVHC - substance of very high concern; TCSI - Taiwan Chemical Substance Inventory; TECI - Thailand Existing Chemicals Inventory; TRGS - Technical Rule for Hazardous Substances; TSCA - Toxic Substances Control Act (United States); UN - United Nations; vPvB - Very Persistent and Very Bioaccumulative

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Key literature references and sources for data:

Various sources of data have been used in the compilation of this SDS, they include but are not exclusive to:
Agency for Toxic Substances and Diseases Registry (ATSDR) (http://www.atsdr.cdc.gov/).
European Chemical Agency: Guidance on the Compilation of Safety Data Sheets.
European Chemical Agency: Information on Registered Substances http://apps.echa.europa.eu/registered/registered-sub.aspx#search
European Industrial Gases Association (EIGA) Doc. 169 "Classification and Labelling guide", as amended.
International Programme on Chemical Safety (http://www.inchem.org/)
ISO 10156:2010 Gases and gas mixtures - Determination of fire potential and oxidizing ability for the selection of cylinder valve outlets.
Matheson Gas Data Book, 7th Edition.
National Institute for Standards and Technology (NIST) Standard Reference Database Number 69.
The ESIS (European chemical Substances 5 Information System) platform of the former European Chemicals Bureau (ECB) ESIS (http://ecb.jrc.ec.europa.eu/esis/).
The European Chemical Industry Council (CEFIC) ERICards.
United States of America's National Library of Medicine's toxicology data network TOXNET (http://toxnet.nlm.nih.gov/index.html)
Threshold Limit Values (TLV) from the American Conference of Governmental Industrial Hygienists (ACGIH).
Substance specific information from suppliers.
Details given in this document are believed to be correct at the time of publication.

Wording of the H-statements in section 2 and 3

H270	May cause or intensify fire; oxidizer.
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.
H410	Very toxic to aquatic life with long lasting effects.

Training information:

Users of breathing apparatus must be trained. Ensure operators understand the toxicity hazard. Ensure operators understand the hazards.

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Classification according to Regulation (EC) No 1272/2008 as amended.

Ox. Gas 1, H270
Press. Gas Liq. Gas, H280
Acute Tox. 2, H330
Skin Irrit. 2, H315
Eye Irrit. 2, H319
STOT SE 3, H335
Aquatic Acute 1, H400
Aquatic Chronic 1, H410

Other information: Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out. Ensure adequate air ventilation. Ensure all national/local regulations are observed. Whilst proper care has been taken in the preparation of this document, no liability for injury or damage resulting from its use can be accepted.

Last revised date: 21.11.2023

Disclaimer: This information is provided without warranty. The information is believed to be correct. This information should be used to make an independent determination of the methods to safeguard workers and the environment.

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Annex to the extended Safety Data Sheet (eSDS)

Content

Exposure Scenario 1.

Exposure scenario worker

1. Industrial:, Formulation & (re)packing of substances and mixtures, Manufacture of fine chemicals, Metal surface treatment products, Manufacture of computer, electronic and optical products, electrical equipment, Bleaching agent, Use as an Intermediate (transported, on-site isolated)., Water treatment.

List of use descriptors	
Sector(s) of use	SU6b: Manufacture of pulp, paper and paper products SU9: Manufacture of fine chemicals SU14: Manufacture of basic metals, including alloys SU15: Manufacture of fabricated metal products, except machinery and equipment SU16: Manufacture of computer, electronic and optical products, electrical equipment SU23: Electricity, steam, gas water supply and sewage treatment
Product categories [PC]:	PC14: Metal surface treatment products PC21: Laboratory chemicals PC26: Paper and board treatment products

	PC33: Semiconductors PC37: Water treatment chemicals

Name of contributing environmental scenario and corresponding ERC	Industrial use: ERC6a: Use of intermediate ERC6b: Use of reactive processing aid at industrial site (no inclusion into or onto article)

Contributing Scenarios	Industrial use: PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC22: Manufacturing and processing of minerals and/or metals at substantially elevated temperature

2.1. Contributing exposure scenario controlling environmental exposure for: Industrial use, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid., Using gas as feedstock in chemical processes., Using gas for metal treatment., Purification of molten aluminium, Use for electronic component manufacture., Paper bleaching, Manufacture of optical fibres, Water treatment.

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

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Physical form of the product	See section 9 of the SDS.

Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	0,013 mPa.s (68 °F/20 °C)

Amounts used

Regional use tonnage:	28611 tonnes/day

Frequency and duration of use

Batch process:	not relevant
Continuous process:	365 Emission days

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	Local freshwater dilution factor	Local marine water dilution factor	Other factors:	Remarks:
not relevant	10	100	not relevant	

Other given operational conditions affecting environmental exposure

type	Emission days	Emission factors			Remarks
		Air	Soil	Water	
Intermittent release	365	0,1 %	-	-	All waste product is assumed to be collected and returned for re-processing or use as a fuel.

Other relevant operational conditions	Release to air from process: 0 tonnes Negligible air emissions as process operates in a contained system. Release to waste water from process: 0 tonnes Negligible wastewater emissions as process operates without water contact.

Risk management measures (RMM)

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

See chapter 8 of the safety data sheet (Environmental exposure controls).

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

Technical and organisational measures	Handle substance within a closed system.
Air	Air - minimum efficiency of 99 %
Soil	not relevant
Water	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater. Soil emission controls are not applicable as there is no direct release to soil.

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	Onsite Sewage Treatment Plant
Discharge rate:	2.000 m3/d
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	not relevant

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste

		should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH CSA

Use appropriate abatement systems to ensure that the emission levels defined by local regulations are not exceeded. Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Industrial use, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid., Using gas as feedstock in chemical processes., Using gas for metal treatment., Purification of molten aluminium, Use for electronic component manufacture., Paper bleaching, Manufacture of optical fibres, Water treatment.

Process Categories:	PROC1: Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions PROC3: Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC22: Manufacturing and processing of minerals and/or metals at substantially elevated temperature

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	6780 hPa
Process temperature:	20 °C
Remarks	not relevant

Amounts used

Daily amount per site	The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	> 4 h	220 days per year	PROC1, PROC3, PROC8b, PROC22
Covers daily exposures up to 8 hours			

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature:	Ventilation rate	Remarks
Indoor or outdoor use				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions, Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition, Transfer of substance or mixture (charging and

				discharging) at dedicated facilities, Manufacturing and processing of minerals and/or metals at substantially elevated temperature

Other relevant operational conditions:	. See section 8 of the SDS.

Risk management measures (RMM)

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

See chapter 7 of the safety data sheet

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Chemical production or refinery in closed process without likelihood of exposure or processes with equivalent containment conditions
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition
Local exhaust ventilation				Manufacture or formulation in the chemical industry in closed batch processes with occasional controlled exposure or processes with equivalent containment condition

Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Local exhaust ventilation				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Manufacturing and processing of minerals and/or metals at substantially elevated temperature
Local exhaust ventilation				Manufacturing and processing of minerals and/or metals at substantially elevated temperature

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 7 of the SDS.
				Ensure operatives are trained to minimise exposures.
				Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks

				See chapter 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH CSA

See section 7 of the SDS. Handle product within a closed system. Drain down and flush system prior to equipment break-in or maintenance. Apply a good standard of general or controlled ventilation when maintenance activities are carried out.

3. Exposure estimation

Environment:
Industrial use, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid., Using gas as feedstock in chemical processes., Using gas for metal treatment., Purification of molten aluminium, Use for electronic component manufacture., Paper bleaching, Manufacture of optical fibres, Water treatment.:

none

Health:
Industrial use, Formulation of mixtures with gas in pressure receptacles, Transfilling gas or liquid., Using gas as feedstock in chemical processes., Using gas for metal treatment., Purification of molten aluminium, Use for electronic component manufacture., Paper bleaching, Manufacture of optical fibres, Water treatment.:

none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see http://www.ecetoc.org/tra

Exposure Scenario 2.

Exposure scenario worker

1. Professional:, Laboratory use, Water treatment.

List of use descriptors

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Sector(s) of use	SU23: Electricity, steam, gas water supply and sewage treatment SU24: Scientific research and development
Product categories [PC]:	PC21: Laboratory chemicals PC37: Water treatment chemicals

Name of contributing environmental scenario and corresponding ERC	Professional use: ERC8b: Widespread use of reactive processing aid (no inclusion into or onto article, indoor)

Contributing Scenarios	Professional use: PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC15: Use as laboratory reagent

2.1. Contributing exposure scenario controlling environmental exposure for: Professional use, Using gas alone or in mixtures for the calibration of analysis equipment., Water treatment.

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product	See section 9 of the SDS.

Viscosity:	
Kinematic viscosity:	No data available.
Dynamic viscosity:	0,013 mPa.s (68 °F/20 °C)

Amounts used

Regional use tonnage:	28611 tonnes/day

Frequency and duration of use

Batch process:	not relevant
Continuous process:	365 Emission days

Environment factors not influenced by risk management

Flow rate of receiving surface water (m^3/d):	Local freshwater dilution factor	Local marine water dilution factor	Other factors:	Remarks:
not relevant	10	100	not relevant	

Other given operational conditions affecting environmental exposure

type	Emission days	Emission factors			Remarks
		Air	Soil	Water	
Intermittent release	365	0,1 %	-	-	All waste product is assumed to be collected and returned for re-processing or use as a fuel.

Other relevant operational conditions	Release to air from process: 0 tonnes Negligible air emissions as process operates in a contained system. Release to waste water from process: 0 tonnes Negligible wastewater emissions as process operates without water contact.

Risk management measures (RMM)

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

See chapter 8 of the safety data sheet (Environmental exposure controls).

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

Technical and organisational measures	Handle substance within a closed system.
Air	Air - minimum efficiency of 99 %

Soil	not relevant
Water	not relevant
Remarks:	Wastewater emission controls are not applicable as there is no direct release to wastewater. Soil emission controls are not applicable as there is no direct release to soil.

Organisational measures to prevent/limit release from site:

none

Conditions and measures related to sewage treatment plant

type:	Onsite Sewage Treatment Plant
Discharge rate:	2.000 m3/d
Treatment effectiveness:	not relevant
Sludge treatment technique:	not relevant
Measures to limit air emissions:	not relevant
Remarks:	not relevant

Conditions and measures related to external treatment of waste for disposal

Fraction of used amount transferred to external waste treatment:

Suitable waste treatment	Treatment effectiveness	Remarks
See section 13 of the SDS		External treatment and disposal of waste should comply with applicable local and/or national regulations.

Conditions and measures related to external recovery of waste

Fraction of used amount transferred to external waste treatment:

Suitable recovery operations:	Treatment effectiveness	Remarks
See section 13 of the SDS		External recovery and recycling of waste should comply with applicable local and/or national regulations.

Additional good practice advice beyond the REACH CSA

Use appropriate abatement systems to ensure that the emission levels defined by local regulations are not exceeded. Ensure operatives are trained to minimise releases

2.2. Contributing exposure scenario controlling worker exposure for: Professional use, Using gas alone or in mixtures for the calibration of analysis equipment., Water treatment.

Process Categories:	PROC8b: Transfer of substance or mixture (charging and discharging) at dedicated facilities PROC15: Use as laboratory reagent

Product characteristics

Concentration of the substance in a mixture:	Covers percentage substance in the product up to 100 %.

Physical form of the product:	See section 9 of the SDS.
Vapour pressure:	6780 hPa
Process temperature:	20 °C
Remarks	not relevant

Amounts used

Daily amount per site	The actual tonnage handled per shift is not considered to influence the exposure as such for this scenario. Instead, the combination of the scale of operation (industrial vs. professional) and level of containment/automation (as reflected in the PROCs and technical conditions) is the main determinant of the process-intrinsic emission potential.

Frequency and duration of use

	Use duration:	Frequency of use:	Remarks
Hours per shift	> 4 h	220 days per year	PROC8b, PROC15
Covers daily exposures up to 8 hours			

Human factors not influenced by risk management

This information is not available.

Other given operational conditions affecting workers exposure

Area of use	Room size:	Temperature:	Ventilation rate	Remarks
Indoor or outdoor use				Transfer of substance or mixture (charging and discharging) at dedicated facilities, Use as laboratory reagent

Other relevant operational conditions:	. See section 8 of the SDS.

Risk management measures (RMM)

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

See chapter 7 of the safety data sheet

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
Provide a good standard of general ventilation (not less than 3 to 5 air changes per hour).				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Local exhaust ventilation				Transfer of substance or mixture (charging and discharging) at dedicated facilities
Provide a good standard of controlled ventilation (10 to 15				Use as laboratory reagent

air changes per hour).				
Local exhaust ventilation				Use as laboratory reagent

Organisational measures to prevent/limit releases, dispersion and exposure

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See section 7 of the SDS.
				Ensure operatives are trained to minimise exposures.
				Ensure supervision is in place to check that the RMMs are in place and are being used correctly and that the OCs are being followed

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

inhalation exposure	dermal exposure	eye exposure	oral exposure	Remarks
				See chapter 8 of the safety data sheet (Personal protection equipment)

Additional good practice advice beyond the REACH CSA

See section 7 of the SDS. Handle product within a closed system. Drain down and flush system prior to equipment break-in or maintenance. Apply a good standard of general or controlled ventilation when maintenance activities are carried out.

3. Exposure estimation

Environment:
Professional use, Using gas alone or in mixtures for the calibration of analysis equipment., Water treatment.:

none

Health:
Professional use, Using gas alone or in mixtures for the calibration of analysis equipment., Water treatment.:

none

4. Guidance to Downstream User to evaluate whether he works inside the boundaries set by the ES

Check that RMMs and OCs are as described above or of equivalent efficiency Guidance is based on assumed operating conditions which may not be applicable to all sites; thus, scaling may be necessary to define appropriate site-specific risk management measures. For scaling see http://www.ecetoc.org/tra