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

### 1.1. Product identifier
- **Trade name**: Chlorine, CHLORINE (N28, N40, N48, UHP)
- **SDS no**: 022
- **Chemical description**: Chlorine
  - CAS-No.: 7782-50-5
  - EC-No.: 231-959-5
  - EC Index-No.: 017-001-00-7
- **Registration-No.**
- **Chemical formula**: Cl₂

### 1.2. Relevant identified uses of the substance or mixture and uses advised against
- **Relevant identified uses**: Industrial and professional. Perform risk assessment prior to use. See the list of identified uses and exposure scenarios in the annex of the safety data sheet. Contact supplier for more information on uses.
- **Uses advised against**: Consumer use.

### 1.3. Details of the supplier of the safety data sheet
- **Company identification**
  - **Supplier**: AIR LIQUIDE Deutschland GmbH
    - Luise-Rainer-Straße 5
    - 40235 Düsseldorf - GERMANY
    - T +49 (0)211 6699-0 - F +49 (0)211 6699-222
    - info@airliquide.de
  - **E-Mail address (competent person)**: info.SDB@airliquide.de

### 1.4. Emergency telephone number
- **Emergency telephone number**
- **Availability** (24 / 7)

### SECTION 2: Hazards identification

#### 2.1. Classification of the substance or mixture
**Classification according to Regulation (EC) No. 1272/2008 [CLP]**
- **Physical hazards**: Oxidising Gases, Category 1
- **Health hazards**: Acute toxicity (inhalation:gas) Category 2
  - Skin corrosion/irritation, Category 2
  - Serious eye damage/eye irritation, Category 2
  - Specific target organ toxicity — Single exposure, Category 3, Respiratory tract irritation
- **Environmental hazards**: Hazardous to the aquatic environment — Acute Hazard, Category 1
  - Hazardous to the aquatic environment — Chronic Hazard, Category 1

#### 2.2. Label elements
**Labelling according to Regulation (EC) No. 1272/2008 [CLP]**
- **Hazard pictograms (CLP)**: [GHS03, GHS04, GHS06, GHS09]
Signal word (CLP) : Danger

Hazard statements (CLP) :
- 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..
- H410 - Very toxic to aquatic life with long lasting effects..
- EUH071 - Corrosive to the respiratory tract..

Precautionary statements (CLP) :

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

- Response :
  - P370+P376 - In case of fire: stop leak if safe to do so..
  - P332+P313 - If skin irritation occurs: Get medical advice/attention..
  - P304+P351+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.
  - P302+P352 - IF ON SKIN: Wash with plenty of soap and water..

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

2.3. Other hazards

: None.

SECTION 3: Composition/information on ingredients

3.1. Substances

<table>
<thead>
<tr>
<th>Name</th>
<th>Product identifier</th>
<th>Composition [V-%]:</th>
<th>Classification according to Regulation (EC) No. 1272/2008 [CLP]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorine</td>
<td>(CAS-No.) 7782-50-5 (EC-No.) 231-959-5 (EC Index-No.) 017-001-00-7 (Registration-No.) 01-2119486560-35</td>
<td>100</td>
<td>Ox. Gas 1, H270 Press. Gas (Liq.), H280 Acute Tox. 2 (Inhalation:gas), H330 Skin Irrit. 2, H315 Eye Irrit. 2, H319 STOT SE 3, H335 Aquatic Acute 1, H400 (M=100) Aquatic Chronic 1, H410</td>
</tr>
</tbody>
</table>

Contains no other components or impurities which will influence the classification of the product.

3.2. Mixtures: Not applicable.

SECTION 4: First aid measures

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. Perform cardiopulmonary resuscitation if breathing stopped.
- Skin contact : Remove contaminated clothing. Drench affected area with water for at least 15 minutes. In case of frostbite spray with water for at least 15 minutes. Apply a sterile dressing. Obtain medical assistance.
- Eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes.
- Ingestion : Ingestion is not considered a potential route of exposure.

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

May cause irritation to cornea (with temporary disturbance to vision).

May cause irritation to skin.

Material is destructive to tissue of the mucous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea. Refer to section 11.

4.3. Indication of any immediate medical attention and special treatment needed

Obtain medical assistance.

Treat with corticosteroid spray as soon as possible after inhalation.

SECTION 5: Firefighting measures

5.1. Extinguishing media

- Suitable extinguishing media: Water spray or fog.
  Foam.

- Unsuitable extinguishing media: Do not use water jet to extinguish.

5.2. Special hazards arising from the substance or mixture

Specific hazards: Supports combustion.

Exposure to fire may cause containers to rupture/explode.

Hazardous combustion products: None that are more hazardous than the product itself.

5.3. Advice for firefighters

Specific methods: Use fire control measures appropriate for the surrounding fire. Exposure to fire and heat radiation may cause gas receptacles to rupture. Cool endangered receptacles with water spray jet from a protected position. Prevent water used in emergency cases from entering sewers and drainage systems.

If possible, stop flow of product.

Use water spray or fog to knock down fire fumes if possible.

Move containers away from the fire area if this can be done without risk.

Special protective equipment for fire fighters: Wear gas tight chemically protective clothing in combination with self contained breathing apparatus.

Standard EN 943-2: Protective clothing against liquid and gaseous chemicals, aerosols and solid particles. Gas-tight chemical protective suits for emergency teams.

Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Try to stop release.

Evacuate area.

Monitor concentration of released product.

Wear self-contained breathing apparatus when entering area unless atmosphere is proved to be safe.

Eliminate ignition sources.

Ensure adequate air ventilation.

Prevent from entering sewers, basements and workpits, or any place where its accumulation can be dangerous.

Act in accordance with local emergency plan.

Stay upwind.

6.2. Environmental precautions

Try to stop release.

Reduce vapour with fog or fine water spray.

6.3. Methods and material for containment and cleaning up
6.4. Reference to other sections

: See also sections 8 and 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Safe use of the product

: The product must be handled in accordance with good industrial hygiene and safety procedures.
  Only experienced and properly instructed persons should handle gases under pressure.
  Consider pressure relief device(s) in gas installations.
  Ensure the complete gas system was (or is regularly) checked for leaks before use.
  Do not smoke while handling product.
  Avoid exposure, obtain special instructions before use.
  Avoid contact with aluminium.
  Keep equipment free from oil and grease.
  Use no oil or grease.
  Use only properly specified equipment which is suitable for this product, its supply pressure and temperature. Contact your gas supplier if in doubt.
  Installation of a cross purge assembly between the cylinder and the regulator is recommended.
  Purge system with dry inert gas (e.g. helium or nitrogen) before gas is introduced and when system is placed out of service.
  Avoid suck back of water, acid and alkalis.
  Do not breathe gas.
  Avoid release of product into atmosphere.

Safe handling of the gas receptacle

: Refer to supplier's container handling instructions.
  Do not allow backfeed into the container.
  Protect cylinders from physical damage; do not drag, roll, slide or drop.
  When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders.
  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.
  If user experiences any difficulty operating cylinder valve discontinue use and contact supplier.
  Never attempt to repair or modify container valves or safety relief devices.
  Damaged valves should be reported immediately to the supplier.
  Keep container valve outlets clean and free from contaminants particularly oil and water.
  Replace valve outlet caps or plugs and container caps where supplied as soon as container is disconnected from equipment.
  Close container valve after each use and when empty, even if still connected to equipment.
  Never attempt to transfer gases from one cylinder/container to another.
  Never use direct flame or electrical heating devices to raise the pressure of a container.
  Do not remove or deface labels provided by the supplier for the identification of the cylinder contents.
  Suck back of water into the container must be prevented.
  Open valve slowly to avoid pressure shock.

7.2. Conditions for safe storage, including any incompatibilities
Observe all regulations and local requirements regarding storage of containers. Containers should not be stored in conditions likely to encourage corrosion. Container valve guards or caps should be in place. Containers should be stored in the vertical position and properly secured to prevent them from falling over. Stored containers should be periodically checked for general condition and leakage. Keep container below 50°C in a well ventilated place. Segregate from flammable gases and other flammable materials in store. Store containers in location free from fire risk and away from sources of heat and ignition. Keep away from combustible materials.

7.3. Specific end use(s)

: None.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

<table>
<thead>
<tr>
<th>Chlorine (7782-50-5)</th>
<th>OEL : Occupational Exposure Limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>EU</td>
<td>STEL IOELV (EU) 15 min [mg/m³]</td>
</tr>
<tr>
<td></td>
<td>STEL IOELV (EU) 15 min [ppm]</td>
</tr>
<tr>
<td>Germany</td>
<td>TWA (DE) OEL 8h [mg/m3] TRGS 900</td>
</tr>
<tr>
<td></td>
<td>TWA (DE) OEL 8h [ppm] TRGS 900</td>
</tr>
<tr>
<td></td>
<td>Peak exposure limitation factor (DE) OEL TRGS 900</td>
</tr>
<tr>
<td></td>
<td>Remark (TRGS 900)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Chlorine (7782-50-5)</th>
<th>DNEL: Derived no effect level (Workers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute - local effects, inhalation</td>
<td>1.5 mg/m³</td>
</tr>
<tr>
<td>Acute - systemic effects, inhalation</td>
<td>1.5 mg/m³</td>
</tr>
<tr>
<td>Long-term - local effects, inhalation</td>
<td>0.75 mg/m³</td>
</tr>
<tr>
<td>Long-term - systemic effects, inhalation</td>
<td>0.75 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chlorine (7782-50-5)</th>
<th>PNEC: Predicted no effect concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aqua (freshwater)</td>
<td>0.00021 mg/l</td>
</tr>
<tr>
<td>Aqua (marine water)</td>
<td>0.000042 mg/l</td>
</tr>
<tr>
<td>Aquatic, intermittent releases</td>
<td>0.00026 mg/l</td>
</tr>
<tr>
<td>Micro-organisms in sewage treatment plant (STP)</td>
<td>0.03 mg/l</td>
</tr>
</tbody>
</table>

8.2. Exposure controls

8.2.1. Appropriate engineering controls

: Product to be handled in a closed system and under strictly controlled conditions. Provide adequate general and local exhaust ventilation. Preferably use permanent leak-tight installations (e.g. welded pipes). Systems under pressure should be regularly checked for leakages. Ensure exposure is below occupational exposure limits (where available). Gas detectors should be used when toxic gases may be released. Consider the use of a work permit system e.g. for maintenance activities.

8.2.2. Individual protection measures, e.g. personal protective equipment

: 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:
PPE compliant to the recommended EN/ISO standards should be selected.

- **Eye/face protection**
  : Wear goggles and a face shield when transfilling or breaking transfer connections.
  Standard EN 166 - Personal eye-protection - specifications.
  Provide readily accessible eye wash stations and safety showers.

- **Skin protection**
  : Wear working gloves when handling gas containers.
Chlorine

Standard EN 388 - Protective gloves against mechanical risk.
Wear cold insulating gloves when transfilling or breaking transfer connections.
Standard EN 511 - Cold insulating gloves.
Wear chemically resistant protective gloves.
Standard EN 374 - Protective gloves against chemicals.
Permeation time: minimum >30min short term exposure: material / thickness Chloroprene rubber (Neoprene®) (CR) / 0.4 [mm].
Permeation time: minimum >480min long term exposure : material / thickness Fluoroelastomer (Viton®) (FKM) / 0.7 [mm].
Consult glove manufacturer’s product information on material suitability and material thickness.
The breakthrough time of the selected gloves must be greater than the intended use period.

- Other

Keep suitable chemically resistant protective clothing readily available for emergency use.
Standard EN943-1 - Full protective suits against liquid, solid and gaseous chemicals.
Wear safety shoes while handling containers.
Standard EN ISO 20345 - Personal protective equipment - Safety footwear.

• Respiratory protection

Gas filters may be used if all surrounding conditions e.g. type and concentration of the contaminant(s) and duration of use are known.
Use gas filters with full face mask, where exposure limits may be exceeded for a short-term period, e.g. connecting or disconnecting containers.
Recommended: Filter B (grey).
Gas filters do not protect against oxygen deficiency.
Standard EN 14387 - Gas filter(s), combined filter(s) and standard EN136, full face masks.
Keep self contained breathing apparatus readily available for emergency use.
Self contained breathing apparatus is recommended, where unknown exposure may be expected, e.g. during maintenance activities on installation systems.
Standard EN 137 - Self-contained open-circuit compressed air breathing apparatus with full face mask.

• Thermal hazards

None in addition to the above sections.

8.2.3. Environmental exposure controls

Refer to local regulations for restriction of emissions to the atmosphere. See section 13 for specific methods for waste gas treatment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance

• Physical state at 20°C / 101.3kPa: Gas.
• Colour: Greenish gas.

Odour: Pungent.
Odour threshold: Odour threshold is subjective and inadequate to warn of overexposure.
Melting point: -101 °C
Boiling point: -34 °C
Flash point: Not applicable for gases and gas mixtures.

Flammability range: Non flammable.
Relative vapour density at 20 °C: Not applicable.
Evaporation rate (ether=1): Not applicable for gases and gas mixtures.
Vapour pressure [20°C]: 6.8 bar(a)
Vapour pressure [50°C]: 14.3 bar(a)
Relative density, gas (air=1): 2.5
Relative density, liquid (water=1): 1.6
Solubility in water: 8620 mg/l
pH value: If dissolved in water pH-value will be affected.
Partition coefficient n-octanol/water [log Kow]: Not applicable for inorganic products.
Decomposition point [°C] : Not applicable.
Auto-ignition temperature : Non flammable.
Viscosity [20°C] : No reliable data available.
Explosive Properties : Not applicable.
Oxidising Properties : Oxidiser.
- Coefficient of oxygen equivalency (Ci) : 0.7

9.2. Other information
Molar mass : 71 g/mol
Critical temperature [°C] : 144 °C
Other data : Gas/vapour heavier than air. May accumulate in confined spaces, particularly at or below
ground level.

SECTION 10: Stability and reactivity

10.1. Reactivity
: No reactivity hazard other than the effects described in sub-sections below.

10.2. Chemical stability
: Stable under normal conditions.

10.3. Possibility of hazardous reactions
: Violently oxidises organic material.

10.4. Conditions to avoid
: Avoid moisture in installation systems.

10.5. Incompatible materials
: May react violently with combustible materials.
May react violently with reducing agents.
Keep equipment free from oil and grease.
Reacts with water to form corrosive acids.
May react violently with alkalis.
With water causes rapid corrosion of some metals.
Moisture.
For additional information on compatibility refer to ISO 11114.

10.6. Hazardous decomposition products
: Under normal conditions of storage and use, hazardous decomposition products should not be
produced.

SECTION 11: Toxicological information

11.1. Information on toxicological effects
Acute toxicity : Fatal if inhaled.
Delayed fatal pulmonary oedema possible.

<table>
<thead>
<tr>
<th>LC50 inhalation rat (ppm)</th>
<th>146.5 ppm/4h</th>
</tr>
</thead>
</table>

Skin corrosion/irritation : Causes skin irritation.
Serious eye damage/irritation : Causes serious eye irritation.
Respiratory or skin sensitisation : No known effects from this product.
Germ cell mutagenicity : No known effects from this product.
Carcinogenicity : No known effects from this product.
Reproductive toxicity :
- Toxic for reproduction : Fertility : No known effects from this product.
- Toxic for reproduction : unborn child : No known effects from this product.
STOT-single exposure : Severe corrosion to the respiratory tract at high concentrations.
May cause inflammation of the respiratory system.
Chlorine

Target organ(s) : Respiratory tract.
STOT-repeated exposure : No known effects from this product.
Aspiration hazard : Not applicable for gases and gas mixtures.

SECTION 12: Ecological information

12.1. Toxicity
Assessment : Very toxic to aquatic life.  
Very toxic to aquatic life with long lasting effects.
EC50 48h - Daphnia magna [mg/l] : 0.141 mg/l
EC50 72h - Algae [mg/l] : 0.001 - 0.01
LC50 96 h - fish [mg/l] : 0.032 mg/l

12.2. Persistence and degradability
Assessment : Not applicable for inorganic products.

12.3. Bioaccumulative potential
Assessment : No data available.

12.4. Mobility in soil
Assessment : Because of its high volatility, the product is unlikely to cause ground or water pollution.  
Partition into soil is unlikely.

12.5. Results of PBT and vPvB assessment
Assessment : Not classified as PBT or vPvB.

12.6. Other adverse effects
Other adverse effects : May cause pH changes in aqueous ecological systems.
Effect on the ozone layer : None.
Effect on global warming : No known effects from this product.

SECTION 13: Disposal considerations

13.1. Waste treatment methods
Contact supplier if guidance is required.
Must not be discharged to atmosphere.
Ensure that the emission levels from local regulations or operating permits are not exceeded.
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.
Return unused product in original cylinder to supplier.
List of hazardous waste codes (from Commission Decision 2001/118/EC) : 16 05 04 *: Gases in pressure containers (including halons) containing hazardous substances.

13.2. Additional information
External treatment and disposal of waste should comply with applicable local and/or national regulations.

SECTION 14: Transport information

14.1. UN number
UN-No. : 1017
14.2. UN proper shipping name
Transport by road/rail (ADR/RID) : CHLORINE
Transport by air (ICAO-TI / IATA-DGR) : Chlorine
Transport by sea (IMDG) : CHLORINE

14.3. Transport hazard class(es)
Labelling:

- 2.3 : Toxic gases.
- 5.1 : Oxidizing substances.
- 8 : Corrosive substances.

Environmentally hazardous substances

14.4. Packing group

- Transport by road/rail (ADR/RID) : Not established.
- Transport by air (ICAO-TI / IATA-DGR) : Not established.
- Transport by sea (IMDG) : Not established.

14.5. Environmental hazards

- Transport by road/rail (ADR/RID) : Environmentally hazardous substance / mixture.
- Transport by air (ICAO-TI / IATA-DGR) : Environmentally hazardous substance / mixture.
- Transport by sea (IMDG) : Marine pollutant

14.6. Special precautions for user

- Packing Instruction(s)
  - Transport by road/rail (ADR/RID) : P200.
  - Transport by air (ICAO-TI / IATA-DGR)
    - Passenger and Cargo Aircraft : Forbidden.
    - Cargo Aircraft only : Forbidden.
  - Transport by sea (IMDG) : P200.
Special transport precautions: 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 there is adequate ventilation.
  - Ensure that containers are firmly secured.
  - Ensure cylinder valve is closed and not leaking.
  - Ensure valve outlet cap nut or plug (where provided) is correctly fitted.
  - Ensure valve protection device (where provided) is correctly fitted.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

Not applicable.

SECTION 15: Regulatory information

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

EU-Regulations
Restrictions on use: None.

National regulations
National legislation: Ensure all national/local regulations are observed.

Germany
Water hazard class (WGK): Water hazard class (WGK) 2, significant hazard to water (Classification according to VwVwS, Annex 1 or 2; ID No. 223)

Other information, restrictions and prohibition regulations:

15.2. Chemical safety assessment
A CSA has been carried out.

SECTION 16: Other information


Abbreviations and acronyms:
- ATE - Acute Toxicity Estimate
- CLP - Classification Labelling Packaging Regulation; Regulation (EC) No 1272/2008
- EINECS - European Inventory of Existing Commercial Chemical Substances
- CAS# - Chemical Abstract Service number
- PPE - Personal Protection Equipment
- LC50 - Lethal Concentration to 50% of a test population
- RMM - Risk Management Measures
- PBT - Persistent, Bioaccumulative and Toxic
- vPvB - Very Persistent and Very Bioaccumulative
- STOT- SE : Specific Target Organ Toxicity - Single Exposure
- CSA - Chemical Safety Assessment
- EN - European Standard
- UN - United Nations
- ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road
- IATA - International Air Transport Association
SAFETY DATA SHEET

Chlorine

IMDG code - International Maritime Dangerous Goods
RID - Regulations concerning the International Carriage of Dangerous Goods by Rail
WGK - Water Hazard Class

Training advice
- Users of breathing apparatus must be trained.
- Ensure operators understand the toxicity hazard.

Further information
- This Safety Data Sheet has been established in accordance with the applicable European Union legislation.

Full text of H- and EUH-statements

<table>
<thead>
<tr>
<th>Acute Tox. 2 (Inhalation:gas)</th>
<th>Acute toxicity (inhalation:gas) Category 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquatic Acute 1</td>
<td>Hazardous to the aquatic environment — Acute Hazard, Category 1</td>
</tr>
<tr>
<td>Aquatic Chronic 1</td>
<td>Hazardous to the aquatic environment — Chronic Hazard, Category 1</td>
</tr>
<tr>
<td>Eye Irrit. 2</td>
<td>Serious eye damage/eye irritation, Category 2</td>
</tr>
<tr>
<td>Ox. Gas 1</td>
<td>Oxidising Gases, Category 1</td>
</tr>
<tr>
<td>Press. Gas (Liq.)</td>
<td>Gases under pressure : Liquefied gas</td>
</tr>
<tr>
<td>Skin Irrit. 2</td>
<td>Skin corrosion/irritation, Category 2</td>
</tr>
<tr>
<td>STOT SE 3</td>
<td>Specific target organ toxicity — Single exposure, Category 3, Respiratory tract irritation</td>
</tr>
<tr>
<td>H270</td>
<td>May cause or intensify fire; oxidiser.</td>
</tr>
<tr>
<td>H280</td>
<td>Contains gas under pressure; may explode if heated.</td>
</tr>
<tr>
<td>H315</td>
<td>Causes skin irritation.</td>
</tr>
<tr>
<td>H319</td>
<td>Causes serious eye irritation.</td>
</tr>
<tr>
<td>H330</td>
<td>Fatal if inhaled.</td>
</tr>
<tr>
<td>H335</td>
<td>May cause respiratory irritation.</td>
</tr>
<tr>
<td>H400</td>
<td>Very toxic to aquatic life.</td>
</tr>
<tr>
<td>H410</td>
<td>Very toxic to aquatic life with long lasting effects.</td>
</tr>
<tr>
<td>EUH071</td>
<td>Corrosive to the respiratory tract.</td>
</tr>
</tbody>
</table>

DISCLAIMER OF LIABILITY
- Before using this product in any new process or experiment, a thorough material compatibility and safety study should be carried out.
- Details given in this document are believed to be correct at the time of going to press.
- 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.
**Annex to the safety data sheet**

This Annex documents the Exposure Scenarios (ESs) related to the identified uses of the registered substance. The ESs detail protective measures for workers and the environment in addition to those described in sections 7, 8, 11, 12 and 13 of the SDS that are required to ensure that the potential exposure to workers and the environment remains within acceptable levels for each of the identified uses.

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<th>Es N°</th>
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<td>022-1</td>
<td>Industrial uses, closed contained conditions</td>
<td>13</td>
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<tr>
<td>Electronic component manufacture</td>
<td>022-1</td>
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<td>Calibration of analysis equipment</td>
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<td>Transfiling in pressure receptacles</td>
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<td>Purification of molten aluminium</td>
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<td>Industrial uses, closed contained conditions</td>
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<tr>
<td>Metal treatment</td>
<td>022-1</td>
<td>Industrial uses, closed contained conditions</td>
<td>13</td>
</tr>
<tr>
<td>Intermediate (transported, on-site isolated)</td>
<td>022-1</td>
<td>Industrial uses, closed contained conditions</td>
<td>13</td>
</tr>
<tr>
<td>Oxidant to dissolve metals</td>
<td>022-1</td>
<td>Industrial uses, closed contained conditions</td>
<td>13</td>
</tr>
<tr>
<td>Manufacture of pharmaceutical products</td>
<td>022-1</td>
<td>Industrial uses, closed contained conditions</td>
<td>13</td>
</tr>
</tbody>
</table>
### 1.022-1: Industrial uses, closed contained conditions

#### 1.1. Title section

**Industrial uses, closed contained conditions**

<table>
<thead>
<tr>
<th>Processes, tasks, activities covered</th>
<th>Industrial uses, including product transfers and associated laboratory activities within different closed or contained systems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environment</td>
<td>Use descriptors</td>
</tr>
<tr>
<td>CS01</td>
<td>ERC2, ERC4, ERC6b</td>
</tr>
<tr>
<td>Worker</td>
<td>Use descriptors</td>
</tr>
<tr>
<td>CS02</td>
<td>PROC1</td>
</tr>
<tr>
<td>CS03</td>
<td>PROC2, PROC3, PROC4, PROC8b, PROC9</td>
</tr>
</tbody>
</table>

#### 1.2. Conditions of use affecting exposure

##### 1.2.1. Control of environmental exposure: ERC2, ERC4, ERC6b

<table>
<thead>
<tr>
<th>ERC2</th>
<th>Formulation of preparations</th>
</tr>
</thead>
<tbody>
<tr>
<td>ERC4</td>
<td>Industrial use of processing aids in processes and products, not becoming part of articles</td>
</tr>
<tr>
<td>ERC6b</td>
<td>Industrial use of reactive processing aids</td>
</tr>
</tbody>
</table>

**Product (article) characteristics**

<table>
<thead>
<tr>
<th>Physical form of product</th>
<th>See section 9 of the SDS, No additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration of substance in product</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

**Amount used, frequency and duration of use (or from service life)**

The actual tonnage handled per site is not considered to influence the immissions as such for this scenario as there is practically no release.

<table>
<thead>
<tr>
<th>Emission Days (days/year)</th>
<th>365</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covers frequency up to:</td>
<td>Continuous release</td>
</tr>
</tbody>
</table>

**Technical and organisational conditions and measures**

| Soil emission controls are not applicable as there is no direct release to soil |
| Wastewater emission controls are not applicable as there is no direct release to wastewater |
| Ensure operatives are trained to minimise releases |

**Conditions and measures related to sewage treatment plant**

| Size of the sewage treatment plant (STP) | 2000 m³/d |

**Conditions and measures related to treatment of waste (including article waste)**

| No additional information |

**Other conditions affecting environmental exposure**

| Dilution of STP emissions at least: | 10 Rivers |
| Dilution of STP emissions at least: | 100 Coastal zones |

##### 1.2.2. Control of worker exposure: PROC1

**PROC1**

Use in closed process, no likelihood of exposure

**Product (article) characteristics**

<table>
<thead>
<tr>
<th>Physical form of product</th>
<th>See section 9 of the SDS, No additional information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concentration of substance in product</td>
<td>&lt;= 100 %</td>
</tr>
</tbody>
</table>

**Amount used (or contained in articles), frequency and duration of use/exposure**

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
### Chlorine

#### Technical and organisational conditions and measures

<table>
<thead>
<tr>
<th>Handle product within a closed system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply a good standard of general or controlled ventilation when maintenance activities are carried out.</td>
</tr>
<tr>
<td>Ensure operatives are trained to minimise exposure</td>
</tr>
<tr>
<td>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</td>
</tr>
</tbody>
</table>

#### Other conditions affecting workers exposure

<table>
<thead>
<tr>
<th>Indoor or outdoor use</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3. Exposure estimation and reference to its source</td>
</tr>
</tbody>
</table>

### Exposure duration

| <= 8 h/day |
| Covers frequency up to: |
| 5 days/week |

### Technical and organisational conditions and measures

<table>
<thead>
<tr>
<th>Handle product within a closed system</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fill containers at dedicated fill points supplied with local extract ventilation.</td>
</tr>
<tr>
<td>Ensure samples are obtained under containment or extract ventilation.</td>
</tr>
<tr>
<td>Drain and flush system prior to equipment break-in or maintenance.</td>
</tr>
<tr>
<td>During indoor processes or in cases where natural ventilation is not sufficient, LEV should be in place at points were emissions could occur. Outdoor, LEV is not generally required.</td>
</tr>
<tr>
<td>Apply a good standard of general or controlled ventilation when maintenance activities are carried out.</td>
</tr>
<tr>
<td>Ensure operatives are trained to minimise exposure.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

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

| Face mask with type B filter. Self-contained breathing apparatus should be worn in case of medium confinement/insufficient oxygen/in case of large uncontrolled emissions/in all circumstances when the mask and cartridge do not give adequate protection. Wear suitable gloves tested to EN374. Neoprene rubber (HNBR) |
| Wear suitable coveralls to prevent exposure to the skin |

### Other conditions affecting workers exposure

<table>
<thead>
<tr>
<th>Indoor or outdoor use</th>
</tr>
</thead>
</table>

#### 1.2.3. Control of worker exposure: PROC2, PROC3, PROC4, PROC8b, PROC9

| PROC2 | Use in closed, continuous process with occasional controlled exposure |
| PROC3 | Use in closed batch process (synthesis or formulation) |
| PROC4 | Use in batch and other process (synthesis) where opportunity for exposure arises |
| PROC8b | Transfer of substance or preparation (charging/discharging) from/to vessels/large containers at dedicated facilities |
| PROC9 | Transfer of substance or preparation into small containers (dedicated filling line, including weighing) |

#### Product (article) characteristics

<table>
<thead>
<tr>
<th>Physical form of product</th>
</tr>
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<tbody>
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<tr>
<td>Concentration of substance in product</td>
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</tbody>
</table>

#### Amount used (or contained in articles), frequency and duration of use/exposure

| 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. |
| Exposure duration |
| <= 8 h/day |
| Covers frequency up to: |
| 5 days/week |

#### Other conditions affecting workers exposure

<table>
<thead>
<tr>
<th>Indoor or outdoor use</th>
</tr>
</thead>
</table>

#### 1.3. Exposure estimation and reference to its source
1.3.1. Environmental release and exposure: ERC2, ERC4, ERC6b

The exposure of aquatic, terrestrial, sediment and sewage treatment microorganisms is considered to be negligible because the substance partitions primarily to air when released to the environment.

1.3.2. Worker exposure: PROC1

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposure of workers and indirect human exposure via the environment is not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

1.3.3. Worker exposure: PROC2, PROC3, PROC4, PROC8b, PROC9

When the recommended risk management measures (RMMs) and operational conditions (OCs) are observed, exposure of workers and indirect human exposure via the environment is not expected to exceed the predicted DNELs and the resulting risk characterisation ratios are expected to be less than 1.

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

1.4.1. Environment

| Guidance - Environment | Check that RMMs and OCs are as described above or of equivalent efficiency |

1.4.2. Health

| Guidance - Health | Check that RMMs and OCs are as described above or of equivalent efficiency |